Alcatel-Lucent

Service Router | Release 12.0 R4

7750 SR-OS Router Configuration Guide

93-0073-11-02 Edition 1

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Preface

About This Guide

This guide describes logical IP routing interfaces, virtual routers, IP and MAC-based filtering, and cflowd support and presents configuration and implementation examples.

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 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:

- IP router configuration
- Virtual routers
- IP-based filters
- Cflowd

List of Technical Publications

The 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
- 7750 SR OS Router Configuration Guide

  This guide describes logical IP routing interfaces and associated attributes such as an IP address, as well as IP and MAC-based filtering, and 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, 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 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 OS Quality of Service Guide

  This guide describes how to configure Quality of Service (QoS) policy management.
- OS Multi-Service ISA Guide

  This guide describes services provided by integrated service adapters such as Application Assurance, IPSec, ad insertion (ADI) and Network Address Translation (NAT).
- 7750 SR OS RADIUS Attributes Reference Guide

This guide describes all supported RADIUS Authentication, Authorization and Accounting attributes.

- 7750 SR OS Gx AVPs Reference Guide
  This guide describes Gx Attribute Value Pairs (AVP).

Technical Support

If you purchased a service agreement for your 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 at:

Web: http://www.alcatel-lucent.com/wps/portal/support

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Include document name, version, part number and page(s) affected.

Getting Started

In This Chapter

This chapter provides process flow information to configure routing entities, virtual routers, IP and MAC filters, and Cflowd.

Alcatel-Lucent 7750 SR-Series Router Configuration Process

Table 1 lists the tasks necessary to configure logical IP routing interfaces, virtual routers, IP and MAC-based filtering, and Cflowd.

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
Router configuration	Configure router parameters, including router interfaces and addresses, router IDs, autonomous systems, and confederations.	IP Router Configuration on page 19
Protocol configuration	VRRP	VRRP on page 313
	IP and MAC filters	Filter Policies on page 421
	Cflowd	Cflowd on page 603
Reference	List of IEEE, IETF, and other proprietary entities.	Standards and Protocol Support on page 671

Note: In SR OS 12.0.R4 any function that displays an IPv6 address or prefix changes to reflect rules described in RFC 5952, *A Recommendation for IPv6 Address Text Representation*. Specifically, hexadecimal letters in IPv6 addresses are now represented in lowercase, and the correct compression of all leading zeros is displayed. This changes visible display output compared to previous SR OS releases. Previous SR OS behavior can cause issues with operator scripts that use standard IPv6 address expressions and with libraries that have standard IPv6 parsing as per RFC 5952 rules. See the section on IPv6 Addresses in this guide for more information.

IP Router Configuration

In This Chapter

This chapter provides information about commands required to configure basic router parameters.

Topics in this chapter include:

Configuring IP Router Parameters

In order to provision services on an Alcatel-Lucent router, logical IP routing interfaces must be configured to associate attributes such as an IP address, port or the system with the IP interface.

A special type of IP interface is the system interface. A system interface must have an IP address with a 32-bit subnet mask. The system interface is used as the router identifier by higher-level protocols such as OSPF and BGP, unless overwritten by an explicit router ID.

The following router features can be configured:

- Interfaces on page 20
- Creating an IP Address Range on page 24
- Autonomous Systems (AS) on page 37
- Confederations on page 38
- Proxy ARP on page 40

Refer to 7750 SR OS Triple Play Guide for information about DHCP and support as well as configuration examples. on page 33

Interfaces

Alcatel-Lucent routers use different types of interfaces for various functions. Interfaces must be configured with parameters such as the interface type (network and system) and address. A port is not associated with a system interface. An interface can be associated with the system (loopback address).

Network Interface

A network interface (a logical IP routing interface) can be configured on one of the following entities:

- A physical or logical port
- A SONET/SDH channel

Network Domains

In order to determine which network ports (and hence which network complexes) are eligible to transport traffic of individual SDPs, network-domain is introduced. This information is then used for the sap-ingress queue allocation algorithm applied to VPLS SAPs. This algorithm is optimized in such a way that no sap-ingress queues are allocated if the given port does not belong to the network-domain used in the given VPLS. In addition, sap-ingress queues will not be allocated towards network ports (regardless of the network-domain membership) if the given VPLS does not contain any SDPs.

Sap-ingress queue allocation takes into account the following aspects:

- SHG membership of individual SDPs
- Network-domain definition under SDP to restrict the topology the given SDP can be set-up in

The implementation supports four network-domains within any given VPLS.

Network-domain configuration at the SDP level is ignored when the given SDP is used for Epipe, Ipipe, or Apipe bindings.

Network-domain configuration is irrelevant for Layer 3 services (Layer 3 VPN and/or IES service). It can be defined in the base routing context and associated only with network interfaces in this context. Network domains are not applicable to loopback and system interfaces.

The network-domain information will only be used for ingress VPLS sap queue-allocation. It will not be taken into account by routing during SDP setup. As a consequence, if the given SDP is routed through network interfaces that are not part of the configured network domain, the packets will be still forwarded, but their QoS and queuing behavior will be based on default settings. In addition, the packet will not appear in SAP stats.

There will be always one network-domain that exists with reserved name default. The interfaces will always belong to a default network-domain. It will be possible to assign given interface to different user-defined network-domains. The loopback and system interface will be also associated with the default network-domain at the creation. However, any attempt to associate such interfaces with any explicitly defined network-domain will be blocked at the CLI level as there is no benefit for that association.

Any SDP can be assigned only to one network domain. If none is specified, the system will assign the default network-domain. This means that all SAPs in VPLS will have queue reaching all fwd-complexes serving interfaces that belong to the same network-domains as the SDPs.

It is possible to assign/remove network-domain association of the interface/SDP without requiring deletion of the respective object.

System Interface

The system interface is associated with the network entity (such as a specific router or switch), not a specific interface. The system interface is also referred to as the loopback address. The system interface is associated during the configuration of the following entities:

- The termination point of service tunnels
- The hops when configuring MPLS paths and LSPs
- The addresses on a target router for BGP and LDP peering

The system interface is used to preserve connectivity (when routing reconvergence is possible) when an interface fails or is removed. The system interface is also referred to as the loopback address and is used as the router identifier. A system interface must have an IP address with a 32-bit subnet mask.

Unicast Reverse Path Forwarding Check (uRPF)

This section applies to the 7750-SR, 7710-SR, 7950-SR and the 7450-ESS.
uRPF helps to mitigate problems that are caused by the introduction of malformed or forged (spoofed) IP source addresses into a network by discarding IP packets that lack a verifiable IP source address. For example, a number of common types of denial-of-service (DoS) attacks, including smurf and tribe flood network (TFN), can take advantage of forged or rapidly changing source IP addresses to allow attackers to thwart efforts to locate or filter the attacks. For Internet service providers (ISPs) that provide public access, Unicast RPF deflects such attacks by forwarding only packets that have source addresses that are valid and consistent with the IP routing table. This action protects the network of the ISP, its customer, and the rest of the Internet.

uRPF is supported for both IPv4 and IPv6 on network and access. It is supported on any IP interface, including base router, IES, VPRN and subscriber group interfaces.

In strict mode, uRPF checks whether the incoming packet has a source address that matches a prefix in the routing table, and whether the interface expects to receive a packet with this source address prefix.

In loose mode, uRPF checks whether the packet has a source address with a corresponding prefix in the routing table; loose mode does not check whether the interface expects to receive a packet with a specific source address prefix.

Loose uRPF check is supported for ECMP, IGP shortcuts and VPRN MP-BGP routes. Packets coming from a source that matches any ECMP, IGP shortcut or VPRN MP-BGP route will pass the uRPF check even when the uRPF mode is set to strict mode on the incoming interface.

In the case of ECMP, this allows a packet received on an IP interface configured in strict URPF mode to be forwarded if the source address of the packet matches an ECMP route, even if the IP interface is not a next-hop of the ECMP route and even if the interface is not a member of any ECMP routes. The strict-no-ecmp uRPF mode may be configured on any interface which is known to not be a next-hop of any ECMP route. When a packet is received on this interface and the source address matches an ECMP route the packet is dropped by uRPF.

If there is a default route then this is included in the uRPF check, as follows:

If there is a default route:

- A loose mode uRPF check always succeeds.
- A strict mode uRPF check only succeeds if the SA matches any route (including the default route) where the next-hop is on the incoming interface for the packet.

Otherwise the uRPF check fails.

If the source IP address matches a discard/blackhole route, the packet is treated as if it failed uRPF check.

Creating an IP Address Range

An IP address range can be reserved for exclusive use for services by defining the **config>router>service-prefix** command. When the service is configured, the IP address must be in the range specified as a service prefix. If no service prefix command is configured, then no limitation exists.

Addresses in the range of a service prefix can be allocated to a network port unless the *exclusive* parameter is used. Then, the address range is exclusively reserved for services.

When defining a range that is a superset of a previously defined service prefix, the subset will be replaced with the superset definition. For example, if a service prefix exists for 10.10.10.0/24, and a new service prefix is configured as 10.10.0.0/16, then the old address (10.10.10.0/24) will be replaced with the new address (10.10.0.0/16).

When defining a range that is a subset of a previously defined service prefix, the subset will replace the existing superset, providing addresses used by services are not affected; for example, if a service prefix exists for 10.10.0.0/16, and a new service prefix is configured as 10.10.10.0/24, then the 10.10.0.0/16 entry will be removed, provided that no services are configured that use 10.10.x.x addresses other than 10.10.10.x.

QoS Policy Propagation Using BGP (QPPB)

This section discusses QPPB as it applies to VPRN, IES, and router interfaces. Refer to the Internet Enhanced Service section in the Services Guide and the IP Router Configuration section in the 7x50 SR OS Router Configuration Guide.

QoS policy propagation using BGP (QPPB) is a feature that allows a route to be installed in the routing table with a forwarding-class and priority so that packets matching the route can receive the associated QoS. The forwarding-class and priority associated with a BGP route are set using BGP import route policies. In the industry this feature is called QPPB, and even though the feature name refers to BGP specifically. On SR routers, QPPB is supported for BGP (IPv4, IPv6, VPN-IPv4, VPN-IPv6), RIP and static routes.

While SAP ingress and network QoS policies can achieve the same end result as QPPB, assigning a packet arriving on a particular IP interface to a specific forwarding-class and priority/profile based on the source IP address or destination IP address of the packet □the effort involved in creating the QoS policies, keeping them up-to-date, and applying them across many nodes is much greater than with QPPB. In a typical application of QPPB, a BGP route is advertised with a BGP community attribute that conveys a particular QoS. Routers that receive the advertisement accept the route into their routing table and set the forwarding-class and priority of the route from the community attribute.

QPPB Applications

There are two typical applications of QPPB:

1. Coordination of QoS policies between different administrative domains.
2. Traffic differentiation within a single domain, based on route characteristics.

Inter-AS Coordination of QoS Policies

The operator of an administrative domain A can use QPPB to signal to a peer administrative domain B that traffic sent to certain prefixes advertised by domain A should receive a particular QoS treatment in domain B. More specifically, an ASBR of domain A can advertise a prefix XYZ to domain B and include a BGP community attribute with the route. The community value implies a particular QoS treatment, as agreed by the two domains (in their peering agreement or service level agreement, for example). When the ASBR and other routers in domain B accept and install the route for XYZ into their routing table, they apply a QoS policy on selected interfaces that classifies traffic towards network XYZ into the QoS class implied by the BGP community value.

QPPB may also be used to request that traffic sourced from certain networks receive appropriate QoS handling in downstream nodes that may span different administrative domains. This can be achieved by advertising the source prefix with a BGP community, as discussed above. However, in this case other approaches are equally valid, such as marking the DSCP or other CoS fields based on source IP address so that downstream domains can take action based on a common understanding of the QoS treatment implied by different DSCP values.

In the above examples, coordination of QoS policies using QPPB could be between a business customer and its IP VPN service provider, or between one service provider and another.

Traffic Differentiation Based on Route Characteristics

There may be times when a network operator wants to provide differentiated service to certain traffic flows within its network, and these traffic flows can be identified with known routes. For example, the operator of an ISP network may want to give priority to traffic originating in a particular ASN (the ASN of a content provider offering over-the-top services to the ISP's customers), following a certain AS_PATH, or destined for a particular next-hop (remaining on-net vs. off-net).

Figure 1 shows an example of an ISP that has an agreement with the content provider managing AS300 to provide traffic sourced and terminating within AS300 with differentiated service appropriate to the content being transported. In this example we presume that ASBR1 and ASBR2 mark the DSCP of packets terminating and sourced, respectively, in AS300 so that other nodes within the ISP's network do not need to rely on QPPB to determine the correct forwarding-class to use for the traffic. Note however, that the DSCP or other COS markings could be left unchanged in the ISP's network and QPPB used on every node.

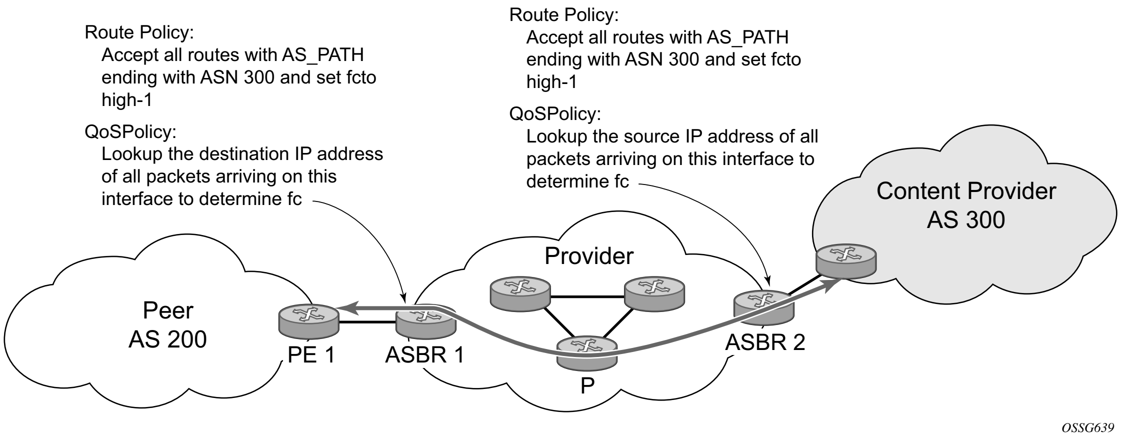

Route Policy:
Accept all routes with AS_PATH ending with ASN 300 and set fcto high-1
QoSPolicy:
Lookup the destination IP address of all packets arriving on this interface to determine fc
Route Policy:
Accept all routes with AS_PATH ending with ASN 300 and set fcto high-1
QoSPolicy:
Lookup the source IP address of all packets arriving on this interface to determine fc
Content Provider
AS 300
Provider
Peer
AS 200
PE 1
ASBR 1
P
ASBR 2
OSSG639

Figure 1: Use of QPPB to Differentiate Traffic in an ISP Network

QPPB

There are two main aspects of the QPPB feature:

- The ability to associate a forwarding-class and priority with certain routes in the routing table.
- The ability to classify an IP packet arriving on a particular IP interface to the forwarding-class and priority associated with the route that best matches the packet.

Associating an FC and Priority with a Route

This feature uses a command in the route-policy hierarchy to set the forwarding class and optionally the priority associated with routes accepted by a route-policy entry. The command has the following structure:

```
fc fc-name [priority {low | high}]
```

The use of this command is illustrated by the following example:

```
config>router>policy-options
     begin
     community gold members 300:100
     policy-statement qppb_policy
          entry 10
               from
                    protocol bgp
                    community gold
               exit
               action accept
                    fc h1 priority high
               exit
          exit
     exit
     commit
```

The **fc** command is supported with all existing from and to match conditions in a route policy entry and with any action other than reject, it is supported with next-entry, next-policy and accept actions. If a next-entry or next-policy action results in multiple matching entries then the last entry with a QPPB action determines the forwarding class and priority.

A route policy that includes the **fc** command in one or more entries can be used in any import or export policy but the **fc** command has no effect except in the following types of policies:

- VRF import policies:
  → config>service>vprn>vrf-import

- BGP import policies:
  - → config>router>bgp>import
  - → config>router>bgp>group>import
  - → config>router>bgp>group>neighbor>import
  - → config>service>vprn>bgp>import
  - → config>service>vprn>bgp>group>import
  - → config>service>vprn>bgp>group>neighbor>import
- RIP import policies:
  - → config>router>rip>import
  - → config>router>rip>group>import
  - → config>router>rip>group>neighbor>import
  - → config>service>vprn>rip>import
  - → config>service>vprn>rip>group>import
  - → config>service>vprn>rip>group>neighbor>import

As evident from above, QPPB route policies support routes learned from RIP and BGP neighbors of a VPRN as well as for routes learned from RIP and BGP neighbors of the base/global routing instance.

QPPB is supported for BGP routes belonging to any of the address families listed below:

- IPv4 (AFI=1, SAFI=1)
- IPv6 (AFI=2, SAFI=1)
- VPN-IPv4 (AFI=1, SAFI=128)
- VPN-IPv6 (AFI=2, SAFI=128)

Note that a VPN-IP route may match both a VRF import policy entry and a BGP import policy entry (if vpn-apply-import is configured in the base router BGP instance). In this case the VRF import policy is applied first and then the BGP import policy, so the QPPB QoS is based on the BGP import policy entry.

This feature also introduces the ability to associate a forwarding-class and optionally priority with IPv4 and IPv6 static routes. This is achieved using the following modified versions of the static-route commands:

- static-route {*ip-prefix*/*prefix-length*|*ip-prefix netmask*} [fc *fc-name* [priority {low | high}]] next-hop *ip-int-name*|*ip-address*
- static-route {*ip-prefix*/*prefix-length*|*ip-prefix netmask*} [fc *fc-name* [priority {low | high}]] indirect *ip-address*

Priority is optional when specifying the forwarding class of a static route, but once configured it can only be deleted and returned to unspecified by deleting the entire static route.

Displaying QoS Information Associated with Routes

The following commands are enhanced to show the forwarding-class and priority associated with the displayed routes:

- show router route-table
- show router fib
- show router bgp routes
- show router rip database
- show router static-route

This feature uses a **qos** keyword to the **show>router>route-table** command. When this option is specified the output includes an additional line per route entry that displays the forwarding class and priority of the route. If a route has no fc and priority information then the third line is blank. The following CLI shows an example:

show router route-table [**family**] [*ip-prefix*[/*prefix-length*]] [**longer** | **exact**] [**protocol** *protocol-name*] **qos**

An example output of this command is shown below:

```
A:Dut-A# show router route-table 10.1.5.0/24 qos
===============================================================================
Route Table (Router: Base)
===============================================================================
Dest Prefix                                   Type    Proto    Age         Pref
       Next Hop[Interface Name]                                     Metric
       QoS
-------------------------------------------------------------------------------
10.1.5.0/24                                   Remote  BGP      15h32m52s   0
       PE1_to_PE2                                                   0
       h1, high
-------------------------------------------------------------------------------
No. of Routes: 1
===============================================================================
A:Dut-A#
```

Enabling QPPB on an IP interface

To enable QoS classification of ingress IP packets on an interface based on the QoS information associated with the routes that best match the packets the **qos-route-lookup** command is necessary in the configuration of the IP interface. The **qos-route-lookup** command has parameters to indicate whether the QoS result is based on lookup of the source or destination IP address in every packet. There are separate qos-route-lookup commands for the IPv4 and IPv6 packets on an interface, which allows QPPB to enabled for IPv4 only, IPv6 only, or both IPv4 and IPv6. Note however, current QPPB based on a source IP address is not supported for IPv6 packets nor is it supported for ingress subscriber management traffic on a group interface.

The qos-route-lookup command is supported on the following types of IP interfaces:

- base router network interfaces (config>router>interface)
- VPRN SAP and spoke SDP interfaces (config>service>vprn>interface)
- VPRN group-interfaces (config>service>vprn>sub-if>grp-if)
- IES SAP and spoke SDP interfaces (config>service>ies>interface)
- IES group-interfaces (config>service>ies>sub-if>grp-if)

When the qos-route-lookup command with the destination parameter is applied to an IP interface and the destination address of an incoming IP packet matches a route with QoS information the packet is classified to the fc and priority associated with that route, overriding the fc and priority/profile determined from the sap-ingress or network qos policy associated with the IP interface (see section 5.7 for further details). If the destination address of the incoming packet matches a route with no QoS information the fc and priority of the packet remain as determined by the sap-ingress or network qos policy.

Similarly, when the qos-route-lookup command with the source parameter is applied to an IP interface and the source address of an incoming IP packet matches a route with QoS information the packet is classified to the fc and priority associated with that route, overriding the fc and priority/profile determined from the sap-ingress or network qos policy associated with the IP interface. If the source address of the incoming packet matches a route with no QoS information the fc and priority of the packet remain as determined by the sap-ingress or network qos policy.

Currently, QPPB is not supported for ingress MPLS traffic on network interfaces or on CsC PE'-CE' interfaces (config>service>vprn>nw-if).

Note: QPPB based on a source IP address is not supported for ingress subscriber management traffic on a group interface.

QPPB When Next-Hops are Resolved by QPPB Routes

In some circumstances (IP VPN inter-AS model C, Carrier Supporting Carrier, indirect static routes, etc.) an IPv4 or IPv6 packet may arrive on a QPPB-enabled interface and match a route A1 whose next-hop N1 is resolved by a route A2 with next-hop N2 and perhaps N2 is resolved by a route A3 with next-hop N3, etc. In release 9.0 the QPPB result is based only on the forwarding-class and priority of route A1. If A1 does not have a forwarding-class and priority association then the QoS classification is not based on QPPB, even if routes A2, A3, etc. have forwarding-class and priority associations.

QPPB and Multiple Paths to a Destination

When ECMP is enabled some routes may have multiple equal-cost next-hops in the forwarding table. When an IP packet matches such a route the next-hop selection is typically based on a hash algorithm that tries to load balance traffic across all the next-hops while keeping all packets of a given flow on the same path. The QPPB configuration model described in Associating an FC and Priority with a Route on page 28 allows different QoS information to be associated with the different ECMP next-hops of a route. The forwarding-class and priority of a packet matching an ECMP route is based on the particular next-hop used to forward the packet.

When Edge PIC [1] is enabled some BGP routes may have a backup next-hop in the forwarding table in addition to the one or more primary next-hops representing the equal-cost best paths allowed by the ECMP/multipath configuration. When an IP packet matches such a route a reachable primary next-hop is selected (based on the hash result) but if all the primary next-hops are unreachable then the backup next-hop is used. The QPPB configuration model described in Associating an FC and Priority with a Route on page 28 allows the forwarding-class and priority associated with the backup path to be different from the QoS characteristics of the equal-cost best paths. The forwarding class and priority of a packet forwarded on the backup path is based on the **fc** and priority of the backup route.

QPPB and Policy-Based Routing

When an IPv4 or IPv6 packet with destination address X arrives on an interface with both QPPB and policy-based-routing enabled:

- There is no QPPB classification if the IP filter action redirects the packet to a directly connected interface, even if X is matched by a route with a forwarding-class and priority
- QPPB classification is based on the forwarding-class and priority of the route matching IP address Y if the IP filter action redirects the packet to the indirect next-hop IP address Y, even if X is matched by a route with a forwarding-class and priority

QPPB and GRT Lookup

Source-address based QPPB is not supported on any SAP or spoke SDP interface of a VPRN configured with the **grt-lookup** command.

QPPB Interaction with SAP Ingress QoS Policy

When QPPB is enabled on a SAP IP interface the forwarding class of a packet may change from **fc1**, the original **fc** determined by the SAP ingress QoS policy to fc2, the new fc determined by QPPB. In the ingress datapath SAP ingress QoS policies are applied in the first P chip and route lookup/QPPB occurs in the second P chip. This has the implications listed below:

- Ingress remarking (based on profile state) is always based on the original fc (fc1) and sub-class (if defined).
- The profile state of a SAP ingress packet that matches a QPPB route depends on the configuration of **fc2** only. If the de-1-out-profile flag is enabled in **fc2** and **fc2** is not mapped to a priority mode queue then the packet will be marked out of profile if its DE bit = 1. If the profile state of **fc2** is explicitly configured (in or out) and **fc2** is not mapped to a priority mode queue then the packet is assigned this profile state. In both cases there is no consideration of whether or not **fc1** was mapped to a priority mode queue.
- The priority of a SAP ingress packet that matches a QPPB route depends on several factors. If the de-1-out-profile flag is enabled in **fc2** and the DE bit is set in the packet then priority will be low regardless of the QPPB priority or **fc2** mapping to profile mode queue, priority mode queue or policer. If **fc2** is associated with a profile mode queue then the packet priority will be based on the explicitly configured profile state of **fc2** (in profile = high, out profile = low, undefined = high), regardless of the QPPB priority or **fc1** configuration. If **fc2** is associated with a priority mode queue or policer then the packet priority will be based on QPPB (unless DE=1), but if no priority information is associated with the route then the packet priority will be based on the configuration of **fc1** (if **fc1** mapped to a priority mode queue then it is based on DSCP/IP prec/802.1p and if **fc1** mapped to a profile mode queue then it is based on the profile state of **fc1**).

Table 2 summarizes these interactions.

Table 2: QPPB Interactions with SAP Ingress QoS

Original FC object mapping	New FC object mapping	Profile	Priority (drop preference)	DE=1 override	In/out of profile marking
Profile mode queue	Profile mode queue	From new base FC unless overridden by DE=1	From QPPB, unless packet is marked in or out of profile in which case follows profile. Default is high priority	From new base FC	From original FC and sub-class
Priority mode queue	Priority mode queue	Ignored	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then from original dot1p/exp/DSCP mapping or policy default.	From new base FC	From original FC and sub-class
Policer	Policer	From new base FC unless overridden by DE=1	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then from original dot1p/exp/DSCP mapping or policy default.	From new base FC	From original FC and sub-class
Priority mode queue	Policer	From new base FC unless overridden by DE=1	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then from original dot1p/exp/DSCP mapping or policy default.	From new base FC	From original FC and sub-class
Policer	Priority mode queue	Ignored	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then from original dot1p/exp/DSCP mapping or policy default.	From new base FC	From original FC and sub-class

Table 2: QPPB Interactions with SAP Ingress QoS (Continued)

Original FC object mapping	New FC object mapping	Profile	Priority (drop preference)	DE=1 override	In/out of profile marking
Profile mode queue	Priority mode queue	Ignored	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then follows original FC's profile mode rules.	From new base FC	From original FC and sub-class
Priority mode queue	Profile mode queue	From new base FC unless overridden by DE=1	From QPPB, unless packet is marked in or out of profile in which case follows profile. Default is high priority	From new base FC	From original FC and sub-class
Profile mode queue	Policer	From new base FC unless overridden by DE=1	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then follows original FC's profile mode rules.	From new base FC	From original FC and sub-class
Policer	Profile mode queue	From new base FC unless overridden by DE=1	From QPPB, unless packet is marked in or out of profile in which case follows profile. Default is high priority	From new base FC	From original FC and sub-class

Router ID

The router ID, a 32-bit number, uniquely identifies the router within an autonomous system (AS) (see Autonomous Systems (AS) on page 37). In protocols such as OSPF, routing information is exchanged between areas, groups of networks that share routing information. It can be set to be the same as the loopback address. The router ID is used by both OSPF and BGP routing protocols in the routing table manager instance.

There are several ways to obtain the router ID. On each router, the router ID can be derived in the following ways.

- Define the value in the **config>router** *router-id* context. The value becomes the router ID.
- Configure the system interface with an IP address in the **config>router>interface** *ip-int-name* context. If the router ID is not manually configured in the **config>router** *router-id* context, then the system interface acts as the router ID.
- If neither the system interface or router ID are implicitly specified, then the router ID is inherited from the last four bytes of the MAC address.
- The router can be derived on the protocol level; for example, BGP.

Autonomous Systems (AS)

Networks can be grouped into areas. An area is a collection of network segments within an AS that have been administratively assigned to the same group. An area's topology is concealed from the rest of the AS, which results in a significant reduction in routing traffic.

Routing in the AS takes place on two levels, depending on whether the source and destination of a packet reside in the same area (intra-area routing) or different areas (inter-area routing). In intra-area routing, the packet is routed solely on information obtained within the area; no routing information obtained from outside the area can be used. This protects intra-area routing from the injection of bad routing information.

Routers that belong to more than one area are called area border routers. All routers in an AS do not have an identical topological database. An area border router has a separate topological database for each area it is connected to. Two routers, which are not area border routers, belonging to the same area, have identical area topological databases.

Autonomous systems share routing information, such as routes to each destination and information about the route or AS path, with other ASs using BGP. Routing tables contain lists of next hops, reachable addresses, and associated path cost metrics to each router. BGP uses the information and path attributes to compile a network topology.

Confederations

Configuring confederations is optional and should only be implemented to reduce the IBGP mesh inside an AS. An AS can be logically divided into smaller groupings called sub-confederations and then assigned a confederation ID (similar to an autonomous system number). Each sub-confederation has fully meshed IBGP and connections to other ASs outside of the confederation.

The sub-confederations have EBGP-type peers to other sub-confederations within the confederation. They exchange routing information as if they were using IBGP. Parameter values such as next hop, metric, and local preference settings are preserved. The confederation appears and behaves like a single AS.

Confederations have the following characteristics.

- A large AS can be sub-divided into sub-confederations.
- Routing *within* each sub-confederation is accomplished via IBGP.
- EBGP is used to communicate *between* sub-confederations.
- BGP speakers within a sub-confederation must be fully meshed.
- Each sub-confederation (member) of the confederation has a different AS number. The AS numbers used are typically in the private AS range of 64512 — 65535.

To migrate from a non-confederation configuration to a confederation configuration requires a major topology change and configuration modifications on each participating router. Setting BGP policies to select an optimal path through a confederation requires other BGP modifications.

There are no default confederations. Router confederations must be explicitly created. Figure 2 depicts a confederation configuration example.

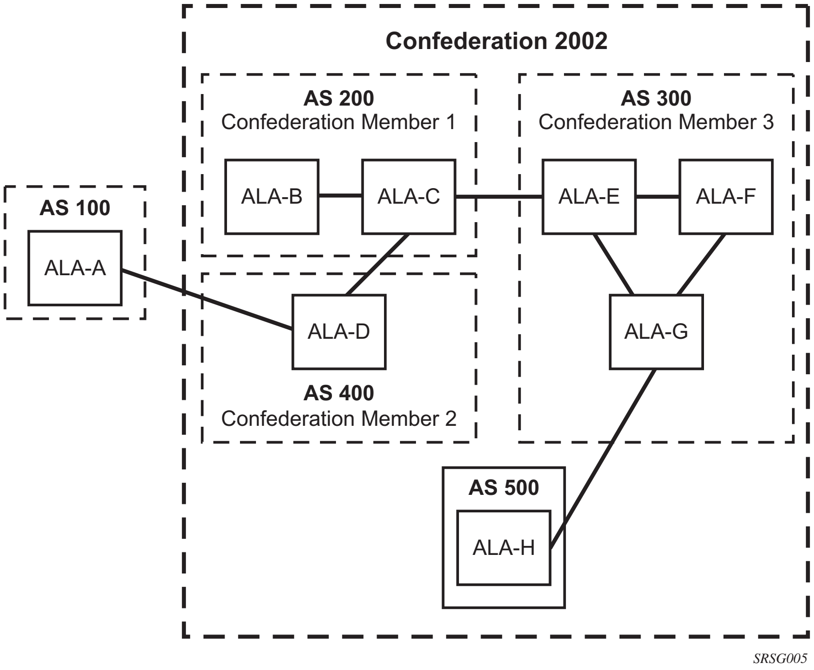


Figure 2: Confederation Configuration

Proxy ARP

Proxy ARP is the technique in which a router answers ARP requests intended for another node. The router appears to be present on the same network as the “real” node that is the target of the ARP and takes responsibility for routing packets to the “real” destination. Proxy ARP can help nodes on a subnet reach remote subnets without configuring routing or a default gateway.

Typical routers only support proxy ARP for directly attached networks; the router is targeted to support proxy ARP for all known networks in the routing instance where the virtual interface proxy ARP is configured.

In order to support DSLAM and other edge like environments, proxy ARP supports policies that allow the provider to configure prefix lists that determine for which target networks proxy ARP will be attempted and prefix lists that determine for which source hosts proxy ARP will be attempted.

In addition, the proxy ARP implementation will support the ability to respond for other hosts within the local subnet domain. This is needed in environments such as DSL where multiple hosts are in the same subnet but can not reach each other directly.

Static ARP is used when an Alcatel-Lucent router needs to know about a device on an interface that cannot or does not respond to ARP requests. Thus, the configuration can state that if it has a packet with a certain IP address to send it to the corresponding ARP address. Use proxy ARP so the router responds to ARP requests on behalf of another device.

Exporting an Inactive BGP Route from a VPRN

The **export-inactive-bgp** command under config>service>vprn introduces an IP VPN configuration option that allows the best BGP route learned by a VPRN to be exported as a VPN-IP route even when that BGP route is inactive due to the presence of a more preferred BGP-VPN route from another PE. This “best-external” type of route advertisement is useful in active/standby multi-homing scenarios because it can ensure that all PEs have knowledge of the backup path provided by the standby PE.

DHCP Relay

Refer to 7750 SROS Triple Play Guide for information about DHCP and support provided by the 7750 SR as well as configuration examples.

Internet Protocol Versions

The TiMOS implements IP routing functionality, providing support for IP version 4 (IPv4) and IP version 6 (IPv6). IP version 6 (RFC 1883, *Internet Protocol, Version 6 (IPv6)*) is a newer version of the Internet Protocol designed as a successor to IP version 4 (IPv4) (RFC-791, *Internet Protocol*). The changes from IPv4 to IPv6 effect the following categories:

- Expanded addressing capabilities — IPv6 increases the IP address size from 32 bits (IPv4) to 128 bits, to support more levels of addressing hierarchy, a much greater number of addressable nodes, and simpler auto-configuration of addresses. The scalability of multicast routing is improved by adding a scope field to multicast addresses. Also, a new type of address called an anycast address is defined that is used to send a packet to any one of a group of nodes.
- Header format simplification — Some IPv4 header fields have been dropped or made optional to reduce the common-case processing cost of packet handling and to limit the bandwidth cost of the IPv6 header.
- Improved support for extensions and options — Changes in the way IP header options are encoded allows for more efficient forwarding, less stringent limits on the length of options, and greater flexibility for introducing new options in the future.
- Flow labeling capability — The capability to enable the labeling of packets belonging to particular traffic flows for which the sender requests special handling, such as non-default quality of service or "real-time" service was added in IPv6.
- Authentication and privacy capabilities — Extensions to support authentication, data integrity, and (optional) data confidentiality are specified for IPv6.

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Version| Prio. |                   Flow Label                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Payload Length        |  Next Header  |   Hop Limit   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
+                                                               +
|                                                               |
+                         Source Address                        +
|                                                               |
+                                                               +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
+                                                               +
|                                                               |
+                      Destination Address                      +
|                                                               |
+                                                               +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 3: IPv6 Header Format

Table 3: IPv6 Header Field Descriptions

Field	Description
Version	4-bit Internet Protocol version number = 6.
Prio.	4-bit priority value.
Flow Label	24-bit flow label.
Payload Length	16-bit unsigned integer. The length of payload, for example, the rest of the packet following the IPv6 header, in octets. If the value is zero, the payload length is carried in a jumbo payload hop-by-hop option.
Next Header	8-bit selector. Identifies the type of header immediately following the IPv6 header. This field uses the same values as the IPv4 protocol field.
Hop Limit	8-bit unsigned integer. Decremented by 1 by each node that forwards the packet. The packet is discarded if the hop limit is decremented to zero.
Source Address	128-bit address of the originator of the packet.
Destination Address	128-bit address of the intended recipient of the packet (possibly not the ultimate recipient if a routing header is present).

IPv6 Address Format

IPv6 uses a 128-bit address, as opposed to the IPv4 32-bit address. Unlike IPv4 addresses, which use the dotted-decimal format, with each octet assigned a decimal value from 0 to 255, IPv6 addresses use the colon-hexadecimal format X:X:X:X:X:X:X:X, where each X is a 16-bit section of the 128-bit address. For example:

2001:0DB8:0000:0000:0000:0000:0000:0000

Leading zeros must be omitted from each block in the address. A series of zeros can be replaced with a double colon. For example:

2001:DB8::

The double colon can only be used once in an address.

The IPv6 prefix is the part of the IPv6 address that represents the network identifier. The network identifier appears at the beginning of the IP address. The IPv6 prefix length, which begins with a forward slash (/), shows how many bits of the address make up the network identifier. For example, the address 1080:6809:8086:6502::1/64 means that the first 64 bits of the address represent the network identifier; the remaining 64 bits represent the node identifier.

Note: In SR OS 12.0.R4 any function that displays an IPv6 address or prefix changes to reflect rules described in RFC 5952, *A Recommendation for IPv6 Address Text Representation*. Specifically, hexadecimal letters in IPv6 addresses are now represented in lowercase, and the correct compression of all leading zeros is displayed. This changes visible display output compared to previous SR OS releases. Previous SR OS behavior can cause issues with operator scripts that use standard IPv6 address expressions and with libraries that have standard IPv6 parsing as per RFC 5952 rules.

IPv6 Applications

Examples of the IPv6 applications supported by the TiMOS include:

- IPv6 Internet exchange peering — Figure 4 shows an IPv6 Internet exchange where multiple ISPs peer over native IPv6.

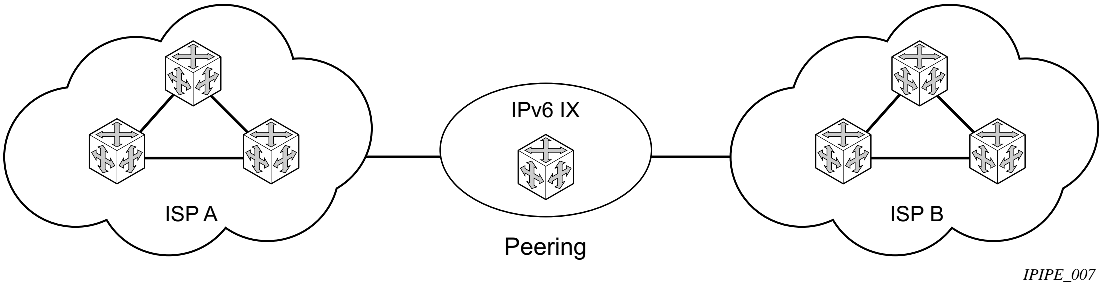


Figure 4: IPv6 Internet Exchange

- IPv6 transit services — Figure 5 shows IPv6 transit provided by an ISP.

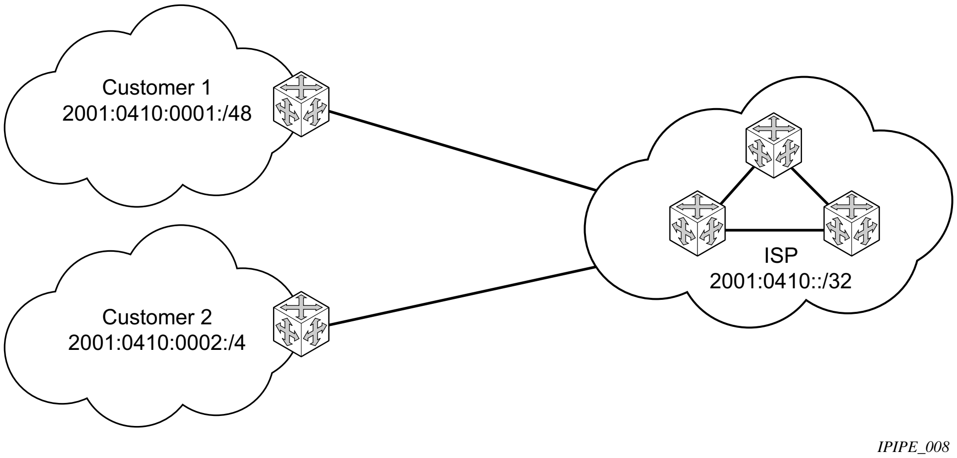


Figure 5: IPv6 Transit Services

- IPv6 services to enterprise customers and home users — Figure 6 shows IPv6 connectivity to enterprise and home broadband users.

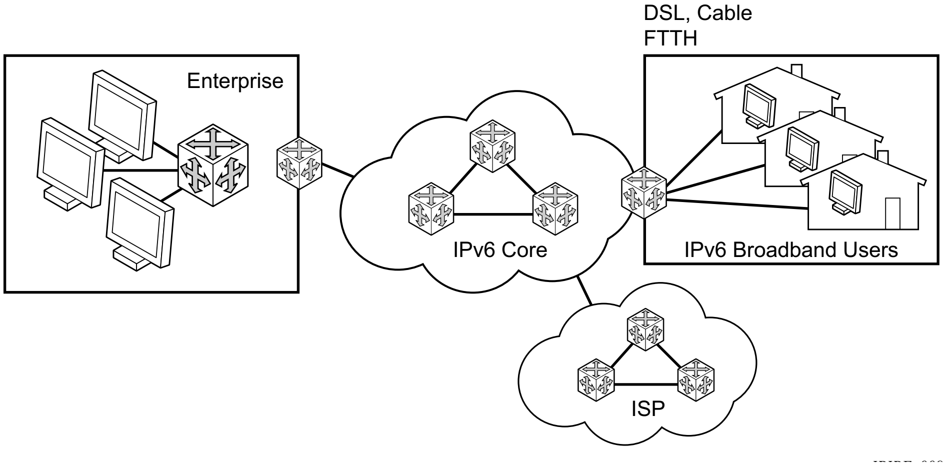


Figure 6: IPv6 Services to Enterprise Customers and Home Users

- IPv6 over IPv4 relay services — IPv6 over IPv4 tunnels are one of many IPv6 transition methods to support IPv6 in an environment where not only IPv4 exists but native IPv6 networks depend on IPv4 for greater IPv6 connectivity. Alcatel-Lucent router supports dynamic IPv6 over IPv4 tunneling. The ipv4 source and destination address are taken from configuration, the source address is the ipv4 system address and the ipv4 destination is the next hop from the configured 6over4 tunnel.

  IPv6 over IPv4 is an automatic tunnel method that gives a prefix to the attached IPv6 network. Figure 7 shows IPv6 over IPv4 tunneling to transition from IPv4 to IPv6.

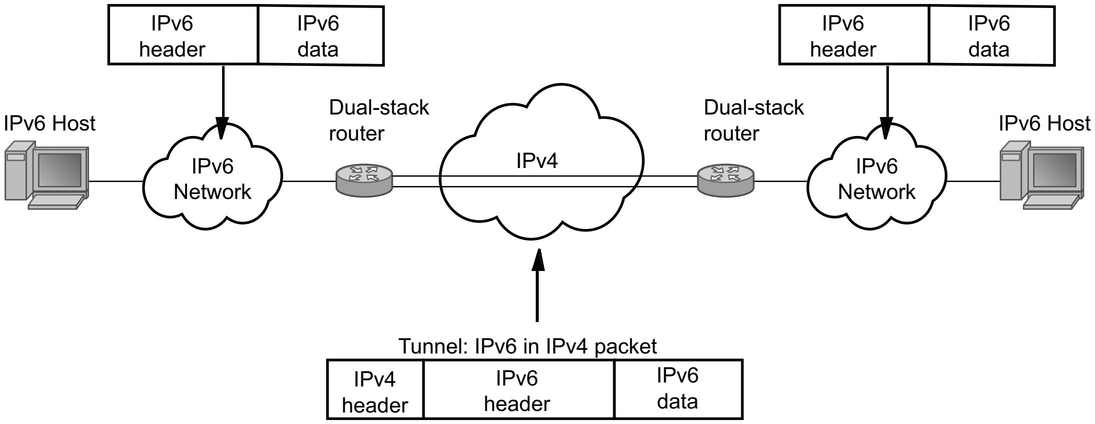


Figure 7: IPv6 over IPv4 Tunnels

DNS

The DNS client is extended to use IPv6 as transport and to handle the IPv6 address in the DNS AAAA resource record from an IPv4 or IPv6 DNS server. An assigned name can be used instead of an IPv6 address since IPv6 addresses are more difficult to remember than IPv4 addresses.

IPv6 Provider Edge Router over MPLS (6PE)

6PE allows IPv6 domains to communicate with each other over an IPv4 MPLS core network. This architecture requires no backbone infrastructure upgrades and no re-configuration of core routers, because forwarding is purely based on MPLS labels. 6PE is a cost effective solution for IPv6 deployment.

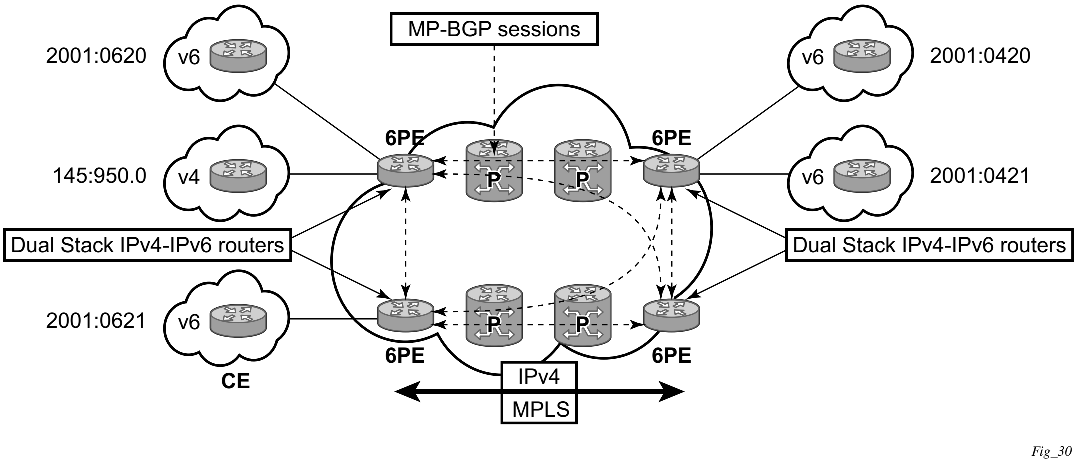


Figure 8: Example of a 6PE Topology within One AS

6PE Control Plane Support

The 6PE MP-BGP routers support:

- IPv4/IPv6 dual-stack
- MP-BGP can be used between 6PE routers to exchange IPv6 reachability information.
  - → The 6PE routers exchange IPv6 prefixes over MP-BGP sessions running over IPv4 transport. The MP-BGP AFI used is IPv6 (value 2).
  - → An IPv4 address of the 6PE router is encoded as an IPv4-mapped IPv6 address in the BGP next-hop field of the IPv6 NLRI. By default, the IPv4 address that is used for peering is used. It is configurable through the route policies.
  - → The 6PE router binds MPLS labels to the IPv6 prefixes it advertises. The SAFI used in MP-BGP is the SAFI (value 4) label. The router uses the IPv6 explicit null (value 2) label for all the IPv6 prefixes that it advertises and can accept an arbitrary label from its peers.
- LDP is used to create the MPLS full mesh between the 6PE routers and the IPv4 addresses that are embedded in the next-hop field are reachable by LDP LSPs. The ingress 6PE router uses the LDP LSPs to reach remote 6PE routers.

6PE Data Plane Support

The ingress 6PE router can push two MPLS labels to send the packets to the egress 6PE router. The top label is an LDP label used to reach the egress 6PE router. The bottom label is advertised in MP-BGP by the remote 6PE router. Typically, the IPv6 explicit null (value 2) label is used but an arbitrary value can be used when the remote 6PE router is from a vendor other than Alcatel-Lucent.

The egress 6PE router pops the top LDP tunnel label. It sees the IPv6 explicit null label, which indicates an IPv6 packet is encapsulated. It also pops the IPv6 explicit null label and performs an IPv6 route lookup to find out the next hop for the IPv6 packet.

Bi-directional Forwarding Detection

Bi-directional Forwarding Detection (BFD) is a light-weight, low-overhead, short-duration detection of failures in the path between two systems. If a system stops receiving BFD messages for a long enough period (based on configuration) it is assumed that a failure along the path has occurred and the associated protocol or service is notified of the failure.

BFD can provide a mechanism used for liveness detection over any media, at any protocol layer, with a wide range of detection times and overhead, to avoid a proliferation of different methods.

SR OS supports asynchronous and on deman modes of BFD in which BFD messages are set to test the path between systems.

If multiple protocols are running between the same two BFD endpoints then only a single BFD session is established, and all associated protocols will share the single BFD session.

In addition to the typical asynchronous mode, there is also an echo function defined within RFC 5880, *Bi-directional Forwarding Detection*, that allows either of the two systems to send a sequence of BFD echo packets to the other system, which loops them back within that system's forwarding plane. If a number of these echo packets are lost then the BFD session is declared down.

BFD Control Packet

The base BFD specification does not specify the encapsulation type to be used for sending BFD control packets. Instead it is left to the implementers to use the appropriate encapsulation type for the medium and network. The encapsulation for BFD over IPv4 and IPv6 networks is specified in draft-ietf-bfd-v4v6-1hop-04.txt, *BFD for IPv4 and IPv6 (Single Hop)*. This specification requires that BFD control packets be sent over UDP with a destination port number of 3784 and the source port number must be within the range 49152 to 65535.

In addition, the TTL of all transmitted BFD packets must have an IP TTL of 255. All BFD packets received must have an IP TTL of 255 if authentication is not enabled. If authentication is enabled, the IP TTL should be 255 but can still be processed if it is not (assuming the packet passes the enabled authentication mechanism).

If multiple BFD sessions exist between two nodes, the BFD discriminator is used to de-multiplex the BFD control packet to the appropriate BFD session.

Control Packet Format

The BFD control packet has 2 sections, a mandatory section and an optional authentication section.

```
0                   1                   2                   3
     0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |Vers |  Diag   |Sta|P|F|C|A|D|R|  Detect Mult  |    Length     |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                       My Discriminator                        |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                      Your Discriminator                       |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                    Desired Min TX Interval                    |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                   Required Min RX Interval                    |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                 Required Min Echo RX Interval                 |
```

Figure 9: Mandatory Frame Format

Table 4: BFD Control Packet Field Descriptions

Field	Description
Vers	The version number of the protocol. The initial protocol version is 0.
Diag	A diagnostic code specifying the local system's reason for the last transition of the session from Up to some other state. Possible values are: 0-No diagnostic 1-Control detection time expired 2-Echo function failed 3-Neighbor signaled session down 4-Forwarding plane reset 5-Path down 6-Concatenated path down 7-Administratively down
D Bit	The "demand mode" bit. (Not supported)
P Bit	The poll bit. If set, the transmitting system is requesting verification of connectivity, or of a parameter change.
F Bit	The final bit. If set, the transmitting system is responding to a received BFD control packet that had the poll (P) bit set.
Rsvd	Reserved bits. These bits must be zero on transmit and ignored on receipt.

Table 4: BFD Control Packet Field Descriptions (Continued)

Field	Description (Continued)
Length	Length of the BFD control packet, in bytes.
My Discriminator	A unique, nonzero discriminator value generated by the transmitting system, used to demultiplex multiple BFD sessions between the same pair of systems.
Your Discriminator	The discriminator received from the corresponding remote system. This field reflects back the received value of my discriminator, or is zero if that value is unknown.
Desired Min TX Interval	This is the minimum interval, in microseconds, that the local system would like to use when transmitting BFD control packets.
Required Min RX Interval	This is the minimum interval, in microseconds, between received BFD control packets that this system is capable of supporting.
Required Min Echo RX Interval	This is the minimum interval, in microseconds, between received BFD echo packets that this system is capable of supporting. If this value is zero, the transmitting system does not support the receipt of BFD echo packets.

BFD for RSVP-TE

BFD will notify RSVP-TE if the BFD session goes down, in addition to notifying other configured BFD enabled protocols (for example, OSPF, IS-IS and PIM). This notification will then be used by RSVP-TE to begin the reconvergence process. This greatly accelerates the overall RSVP-TE response to network failures.

All encapsulation types supporting IPv4 and IPv6 is supported as all BFD packets are carried in IPv4 and IPv6 packets; this includes Frame Relay and ATM.

BFD is supported on the following interfaces:

- Ethernet (Null, Dot1Q & QinQ)
- POS interfaces (including APS)
- Channelized interfaces (PPP, HDLC, FR and ATM) on ASAP (priority 1) and channelized MDAs (Priority 2) including link bundles and IMA
- Spoke SDPs
- LAG interfaces
- VSM interfaces

Echo Support

Echo support for BFD calls for the support of the echo function within BFD. By supporting BFD echo, the router loops back received BFD echo messages to the original sender based on the destination IP address in the packet.

The echo function is useful when the local router does not have sufficient CPU power to handle a periodic polling rate at a high frequency. As a result, it relies on the echo sender to send a high rate of BFD echo messages through the receiver node, which is only processed by the receiver's forwarding path. This allows the echo sender to send BFD echo packets at any rate.

Note that the SR-OS router does not support the sending of echo requests, only the response to echo requests.

BFD Support for BGP

This feature enhancement allows BGP peers to be associated with the BFD session. If the BFD session failed, then BGP peering will also be torn down.

Centralized BFD

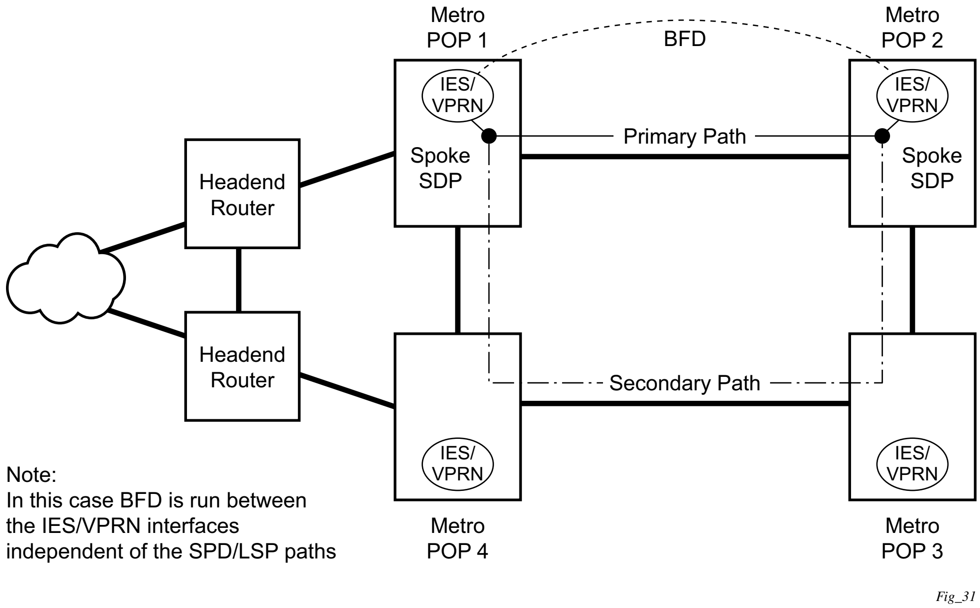
The following applications of centralized BFD require BFD to run on the SF/CPM.

- IES Over Spoke SDP
- BFD Over LAG and VSM Interfaces

IES Over Spoke SDP

One application for a central BFD implementation is so BFD can be supported over spoke SDPs used to inter-connection IES or VPRN interfaces. When there are spoke SDPs for inter-connections over an MPLS network between two routers, BFD is used to speed up failure detections between nodes so re-convergence of unicast and multicast routing information can begin as quickly as possible.

The MPLS LSP associated with the spoke SDP can enter or egress from multiple interfaces on the box. BFD for these types of interfaces can not exist on the IOM itself.

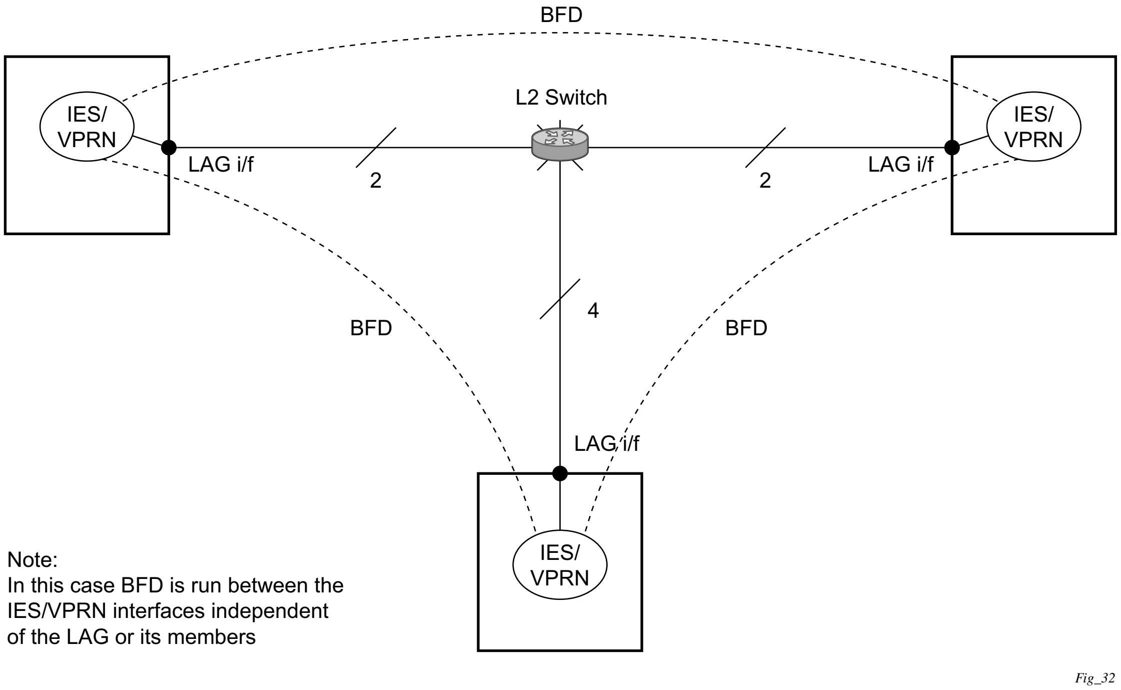


Note:
In this case BFD is run between
the IES/VPRN interfaces
independent of the SPD/LSP paths

Figure 10: BFD for IES/VPRN over Spoke SDP

BFD Over LAG and VSM Interfaces

A second application for a central BFD implementation is so BFD can be supported over LAG or VSM interface. This is useful where BFD is not used for link failure detection but instead for node failure detection. In this application, the BFD session can run between the IP interfaces associated with the LAG or VSM interface, but there is only one session between the two nodes. There is no requirement for the message flow to across a certain link, or VSM, to get to the remote node.



Note:
In this case BFD is run between the IES/VPRN interfaces independent of the LAG or its members

Figure 11: BFD over LAG

Aggregate Next Hop

This feature adds the ability to configure an indirect next-hop for aggregate routes. The indirect next-hop specifies where packets will be forwarded if they match the aggregate route but not a more-specific route in the IP forwarding table.

Invalidate Next-Hop Based on ARP/Neighbor Cache State

This feature invalidates next-hop entries for static-routes when the next-hop is no longer reachable on directly connected interfaces. This invalidation is based on ARP and Neighbor Cache state information.

When a next-hop is detected as no longer reachable due to ARP/Neighbor Cache expiry, the route's next-hop is set as unreachable to prevent the SR from sending continuous ARPs/Neighbor Solicitations triggered by traffic destined for the static-route prefix. When the next-hop is detected as reachable via ARP or Neighbor Advertisements, the state of the next-hop is set back to valid.

Invalidate Next-Hop Based on IPV4 ARP

This feature invalidates a static route based on the reachability of the next-hop in the ARP cache when a specific flag is added to the static route.

static-route {*ip-prefix/prefix-length***|** *ip-prefix netmask* **} next-hop** *ip-int-name|ip-address* **validate-next-hop**

In this case, when the ARP entry for the next-hop is INVALID or not populated, the static route must remain invalid/inactive. When an ARP entry for the next-hop is populated based on a gratuitous ARP received or periodic traffic destined for it and the normal ARP who-has procedure, the static route becomes valid/active and is installed.

Invalidate Next-Hop Based on Neighbor Cache State

This feature invalidates a static route based on the reachability of the next-hop in the neighbor cache when a specific flag is added to the static route.

configure router static-route 2001:db8::/64 next-hop 2001:db8:abba::2 validate-next-hop

In this case, when the Neighbor Cache entry for next-hop is INVALID or not populated, the static route must remain invalid/inactive. When an NC entry for next-hop is populated based on a neighbor advertisement received, or periodic traffic destined for it and the normal NS/NA procedure, the static route becomes valid/active and is installed.

Process Overview

The following items are components to configure basic router parameters.

- Interface — A logical IP routing interface. Once created, attributes like an IP address, port, link aggregation group or the system can be associated with the IP interface.
- Address — The address associates the device’s system name with the IP system address. An IP address must be assigned to each IP interface.
- System interface — This creates an association between the logical IP interface and the system (loopback) address. The system interface address is the circuitless address (loopback) and is used by default as the router ID for protocols such as OSPF and BGP.
- Router ID — (Optional) The router ID specifies the router's IP address.
- Autonomous system — (Optional) An autonomous system (AS) is a collection of networks that are subdivided into smaller, more manageable areas.
- Confederation — (Optional) Creates confederation autonomous systems within an AS to reduce the number of IBGP sessions required within an AS.

Configuration Notes

The following information describes router configuration caveats.

- A system interface and associated IP address should be specified.
- Boot options file (BOF) parameters must be configured prior to configuring router parameters.
- Confederations can be configured before protocol connections (such as BGP) and peering parameters are configured.
- IPv6 interfaces and associated routing protocols may only be configured on the following systems:
  - → Chassis systems running in chassis mode c or d.
  - → Chassis systems running in mixed-mode with IPv6 functionality limited to those interface on slots with IOM3-XPs/IMMs or later line cards.
  - → 7750 SR-c4/12.
- An iom2-20g and a SFM2 card are required to enable the IPv6 CPM filter and per-peer queuing functionality.

Configuring an IP Router with CLI

This section provides information to configure an IP router.

Topics in this section include:

Router Configuration Overview

In an Alcatel-Lucent router, an interface is a logical named entity. An interface is created by specifying an interface name under the `configure>router` context. This is the global router configuration context where objects like static routes are defined. An IP interface name can be up to 32 alphanumeric characters long, must start with a letter, and is case-sensitive; for example, the interface name "1.1.1.1" is not allowed, but "int-1.1.1.1" is allowed.

To create an interface, the basic configuration tasks that must be performed are:

- Assign a name to the interface.
- Associate an IP address with the interface.
- Associate the interface with a network interface or the system interface.
- Configure appropriate routing protocols.

A system interface and network interface should be configured.

System Interface

The system interface is associated with the network entity (such as a specific Alcatel-Lucent router), not a specific interface. The system interface is also referred to as the loopback address. The system interface is associated during the configuration of the following entities:

- The termination point of service tunnels
- The hops when configuring MPLS paths and LSPs
- The addresses on a target router for BGP and LDP peering.

The system interface is used to preserve connectivity (when routing reconvergence is possible) when an interface fails or is removed. The system interface is used as the router identifier. A system interface must have an IP address with a 32-bit subnet mask.

Network Interface

A network interface can be configured on one of the following entities a physical port or LAG:

- A physical or logical port
- A SONET/SDH channel

Basic Configuration

NOTE: Refer to each specific chapter for specific routing protocol information and command syntax to configure protocols such as OSPF and BGP.

The most basic router configuration must have the following:

- System name
- System address

The following example displays a router configuration:

```
A:ALA-A> config# info
. . .
#------------------------------------------
# Router Configuration
#------------------------------------------
    router
        interface "system"
            address 10.10.10.103/32
        exit
        interface "to-104"
            address 10.0.0.103/24
            port 1/1/1
            exit
        exit
        autonomous-system 100
        confederation 1000 members 100 200 300
   router-id 10.10.10.103
...
     exit
     isis
     exit
...
#------------------------------------------
A:ALA-A> config#
```

Common Configuration Tasks

The following sections describe basic system tasks.

- Configuring a System Name on page 66
- Configuring Interfaces on page 67
  - → Configuring a System Interface on page 67
  - → Configuring a Network Interface on page 67
- Configuring Proxy ARP on page 82
- Creating an IP Address Range on page 84
- Configuring an Autonomous System on page 90
- Configuring Overload State on a Single SFM on page 91

Configuring a System Name

Use the `system` command to configure a name for the device. The name is used in the prompt string. Only one system name can be configured. If multiple system names are configured, the last one configured will overwrite the previous entry.

If special characters are included in the system name string, such as spaces, #, or ?, the entire string must be enclosed in double quotes. Use the following CLI syntax to configure the system name:

CLI Syntax:

```
config# system
  name system-name
```

Example:

```
config# system
config>system# name ALA-A
ALA-A>config>system# exit all
ALA-A#
```

The following example displays the system name output.

```
A:ALA-A>config>system# info
#------------------------------------------
# System Configuration
#------------------------------------------
        name "ALA-A"
        location "Mt.View, CA, NE corner of FERG 1 Building"
        coordinates "37.390, -122.05500 degrees lat."
        snmp
        exit
```

Configuring Interfaces

The following command sequences create a system and a logical IP interface. The system interface assigns an IP address to the interface, and then associates the IP interface with a physical port. The logical interface can associate attributes like an IP address or port.

Note that the system interface cannot be deleted.

Configuring a System Interface

To configure a system interface:

CLI Syntax:

```
config>router
     interface interface-name
        address {[ip-address/mask]|[ip-address] [netmask]}
           [broadcast {all-ones|host-ones]
        secondary {[address/mask|ip-address][netmask]}
           [broadcast {all-ones|host-ones}] [igp-inhibit]
```

Configuring a Network Interface

To configure a network interface:

CLI Syntax:

```
config>router
     interface interface-name
        address ip-addr{/mask-length | mask} [broadcast {all-
           ones | host-ones}]
        cflowd {acl | interface}
        egress
           filter ip ip-filter-id
           filter ipv6 ipv6-filter-id
        ingress
           filter ip ip-filter-id
           filter ipv6 ipv6-filter-id
        port port-name
```

The following displays an IP configuration output showing interface information.

```
A:ALA-A>config>router# info
#------------------------------------------
# IP Configuration
#------------------------------------------
        interface "system"
            address 10.10.0.4/32
        exit
        interface "to-ALA-2"
            address 10.10.24.4/24
            port 1/1/1
            egress
                filter ip 10
            exit
        exit
...
#------------------------------------------
A:ALA-A>config>router#
```

To enable CPU protection:

CLI Syntax:
```
config>router
     interface interface-name
        cpu-protection policy-id
```

CPU protection policies are configured in the **config>sys>security>cpu-protection** context. See the OS System Management Guide.

Configuring IPv6 Parameters

IPv6 interfaces and associated routing protocols may only be configured on the following systems:

- Chassis systems running in chassis mode c or d.
- Chassis systems running in mixed-mode, with IPv6 functionality limited to those interface on slots with IOM3-XPs/IMMs or later line cards.
- 7750 SR-c4/12.

The following displays the interface configuration showing the IPv6 default configuration when IPv6 is enabled on the interface.

```
A:ALA-49>config>router>if>ipv6# info detail
----------------------------------------------
  ‘ port 1/2/37
   ipv6
      packet-too-big 100 10
      param-problem 100 10
      redirects 100 10
      time-exceeded 100 10
      unreachables 100 10
   exit
----------------------------------------------
A:ALA-49>config>router>if>ipv6# exit all
```

Use the following CLI syntax to configure IPv6 parameters on a router interface.

CLI Syntax:
```
config>router# interface interface-name
  port port-name
  ipv6
     address {ipv6-address/prefix-length} [eui-64]
     icmp6
        packet-too-big [number seconds]
        param-problem [number seconds]
        redirects [number seconds]
        time-exceeded [number seconds]
        unreachables [number seconds]
     neighbor ipv6-address mac-address
```

The following displays a configuration example showing interface information.

```
A:ALA-49>config>router>if# info
----------------------------------------------
            address 10.11.10.1/24
            port 1/2/37
            ipv6
                address 10::1/24
            exit
----------------------------------------------
A:ALA-49>config>router>if#
```

Configuring IPv6 Over IPv4 Parameters

This section provides several examples of the features that must be configured in order to implement IPv6 over IPv4 relay services.

- Tunnel Ingress Node on page 70
  - → Learning the Tunnel Endpoint IPv4 System Address on page 72
  - → Configuring an IPv4 BGP Peer on page 73
  - → An Example of a IPv6 Over IPv4 Tunnel Configuration on page 74
- Tunnel Egress Node on page 75
  - → Learning the Tunnel Endpoint IPv4 System Address on page 76
  - → Configuring an IPv4 BGP Peer on page 77
  - → An Example of a IPv6 Over IPv4 Tunnel Configuration on page 78

Tunnel Ingress Node

This configuration shows how the interface through which the IPv6 over IPv4 traffic leaves the node. This must be configured on a network interface.

CLI Syntax:

```
config>router
 static-route ::C8C8:C802/128 indirect 200.200.200.2
 interface ip-int-name
    address {ip-address/mask|ip-address netmask} [broadcast
    all-ones|host-ones]
    port port-name
```

The following displays configuration output showing interface configuration.

```
A:ALA-49>configure>router# info
----------------------------------------------
...
        interface "ip-1.1.1.1"
            address 1.1.1.1/30
            port 1/1/1
        exit
...
----------------------------------------------
A:ALA-49>configure>router#
```

Both the IPv4 and IPv6 system addresses must to configured

CLI Syntax:

```
config>router
    interface ip-int-name
        address {ip-address/mask|ip-address netmask} [broadcast all-ones|host-ones]
        ipv6
            address ipv6-address/prefix-length [eui-64]
```

The following displays configuration output showing interface information.

```
A:ALA-49>configure>router# info
----------------------------------------------
...
        interface "system"
            address 200.200.200.1/32
            ipv6
                address 3FFE::C8C8:C801/128
            exit
        exit
...
----------------------------------------------
A:ALA-49>configure>router#
```

Learning the Tunnel Endpoint IPv4 System Address

This configuration displays the OSPF configuration to learn the IPv4 system address of the tunnel endpoint.

CLI Syntax:
```
config>router
  ospf
     area area-id
        interface ip-int-name
```

The following displays a configuration showing OSPF output.

```
A:ALA-49>configure>router# info
----------------------------------------------
...
        ospf
            area 0.0.0.0
                interface "system"
                exit
                interface "ip-1.1.1.1"
                exit
            exit
        exit
----------------------------------------------
A:ALA-49>configure>router#
```

Configuring an IPv4 BGP Peer

This configuration display the commands to configure an IPv4 BGP peer with (IPv4 and) IPv6 protocol families.

CLI Syntax:

```
config>router
 bgp
    export policy-name [policy-name...(upto 5 max)]
    router-id ip-address
    group name
       family [ipv4][vpn-ipv4] [ipv6] [mcast-ipv4]
       type {internal|external}
       neighbor ip-address
          local-as as-number [private]
          peer-as as-number
```

The following displays a configuration showing BGP output.

```
A:ALA-49>configure>router# info
----------------------------------------------
...
        bgp
            export "ospf3"
            router-id 200.200.200.1
            group "main"
                family ipv4 ipv6
                type internal
                neighbor 200.200.200.2
                    local-as 1
                    peer-as 1
                exit
            exit
        exit
...
----------------------------------------------
A:ALA-49>configure>router#
```

An Example of a IPv6 Over IPv4 Tunnel Configuration

The IPv6 address is the next-hop as it is received through BGP. The IPv4 address is the system address of the tunnel's endpoint static-route ::C8C8:C802/128 indirect 200.200.200.2.

This configuration displays an example to configure a policy to export IPv6 routes into BGP.

CLI Syntax:

```
config>router
 bgp
    export policy-name [policy-name...(upto 5 max)]
    router-id ip-address
    group name
       family [ipv4] [vpn-ipv4] [ipv6] [mcast-ipv4]
       type {internal|external}
       neighbor ip-address
          local-as as-number [private]
          peer-as as-number
```

The following displays the configuration output.

```
A:ALA-49>configure>router# info
----------------------------------------------
...
         policy-options
            policy-statement "ospf3"
                description "Plcy Stmnt For 'From ospf3 To bgp'"
                entry 10
                    description "Entry From Protocol ospf3 To bgp"
                    from
                        protocol ospf3
                    exit
                    to
                        protocol bgp
                    exit
                    action accept
                    exit
                exit
            exit
        exit
...
----------------------------------------------
A:ALA-49>configure>router#
```

Tunnel Egress Node

This configuration shows how the interface through which the IPv6 over IPv4 traffic leaves the node. It must be configured on a network interface. Both the IPv4 and IPv6 system addresses must be configured.

CLI Syntax:

```
config>router
  configure router static-route ::C8C8:C801/128 indirect
  200.200.200.1
       interface ip-int-name
            address {ip-address/mask>|ip-address netmask} [broad-
                 cast all-ones|host-ones]
            ipv6
                 address ipv6-address/prefix-length [eui-64]
            port port-name
```

The following displays interface configuration.

```
A:ALA-49>configure>router# info
----------------------------------------------
...
        interface "ip-1.1.1.2"
            address 1.1.1.2/30
            port 1/1/1
        exit
        interface "system"
            address 200.200.200.2/32
            ipv6
                address 3FFE::C8C8:C802/128
            exit
        exit
----------------------------------------------
```

Learning the Tunnel Endpoint IPv4 System Address

This configuration displays the OSPF configuration to learn the IPv4 system address of the tunnel endpoint.

CLI Syntax:

```
config>router
 ospf
    area area-id
       interface ip-int-name
```

The following displays OSPF configuration information.

```
A:ALA-49>configure>router# info
----------------------------------------------
...
        ospf
            area 0.0.0.0
                interface "system"
                exit
                interface "ip-1.1.1.2"
                exit
            exit
        exit
----------------------------------------------
A:ALA-49>configure>router#
```

Configuring an IPv4 BGP Peer

This configuration display the commands to configure an IPv4 BGP peer with (IPv4 and) IPv6 protocol families.

CLI Syntax:

```
config>router
 bgp
    export policy-name [policy-name...(upto 5 max)]
    router-id ip-address
    group name
       family [ipv4] [vpn-ipv4] [ipv6] [mcast-ipv4]
       type {internal|external}
       neighbor ip-address
          local-as as-number [private]
          peer-as as-number
```

The following displays the IPv4 BGP peer configuration example.

```
A:ALA-49>configure>router# info
----------------------------------------------
...
        bgp
            export "ospf3"
            router-id 200.200.200.2
            group "main"
                family ipv4 ipv6
                type internal
                neighbor 200.200.200.1
                    local-as 1
                    peer-as 1
                exit
            exit
        exit
...
----------------------------------------------
A:ALA-49>configure>router#
```

An Example of a IPv6 Over IPv4 Tunnel Configuration

The IPv6 address is the next-hop as it is received through BGP. The IPv4 address is the system address of the tunnel's endpoint static-route ::C8C8:C802/128 indirect 200.200.200.2

This configuration displays an example to configure a policy to export IPv6 routes into BGP.

CLI Syntax:

```
config>router
 bgp
    export policy-name [policy-name...(upto 5 max)]
    router-id ip-address
    group name
       family [ipv4] [vpn-ipv4] [ipv6] [mcast-ipv4]
       type {internal|external}
       neighbor ip-address
          local-as as-number [private]
          peer-as as-number
```

The following displays an IPv6 over IPv4 tunnel configuration

```
A:ALA-49>configure>router# info
----------------------------------------------
...
        policy-options
            policy-statement "ospf3"
                description "Plcy Stmnt For 'From ospf3 To bgp'"
                entry 10
                    description "Entry From Protocol ospf3 To bgp"
                    from
                        protocol ospf3
                    exit
                    to
                        protocol bgp
                    exit
                    action accept
                    exit
                exit
            exit
        exit
----------------------------------------------
A:ALA-49>configure>router#
```

Router Advertisement

To configure the router to originate router advertisement messages on an interface, the interface must be configured under the router-advertisement context and be enabled (no shutdown). All other router advertisement configuration parameters are optional.

Use the following CLI syntax to enable router advertisement and configure router advertisement parameters:

CLI Syntax:

```
config>router# router-advertisement
 interface ip-int-name
    current-hop-limit number
    managed-configuration
    max-advertisement-interval seconds
    min-advertisement-interval seconds
    mtu mtu-bytes
    other-stateful-configuration
    prefix ipv6-prefix/prefix-length
       autonomous
       on-link
       preferred-lifetime {seconds | infinite}
       valid-lifetime {seconds | infinite}
    reachable-time milli-seconds
    retransmit-time milli-seconds
    router-lifetime seconds
    no shutdown
    use-virtual-mac
```

The following displays a router advertisement configuration example.

```
*A:sim131>config>router>router-advert# info
----------------------------------------------
            interface "n1"
                prefix 3::/64
                exit
                use-virtual-mac
                no shutdown
            exit
----------------------------------------------
*A:sim131>config>router>router-advert# interface n1
*A:sim131>config>router>router-advert>if# prefix 3::/64
*A:sim131>config>router>router-advert>if>prefix# info detail
----------------------------------------------
                    autonomous
                    on-link
                    preferred-lifetime 604800
                    valid-lifetime 2592000
----------------------------------------------
*A:tahi>config>router>router-advert>if>prefix#
```

Configuring IPv6 Parameters

The following displays the interface configuration showing the IPv6 default configuration when IPv6 is enabled on the interface.

```
A:ALA-49>config>router>if>ipv6# info detail
----------------------------------------------
  port 1/3/37
   ipv6
      packet-too-big 100 10
      param-problem 100 10
      redirects 100 10
      time-exceeded 100 10
      unreachables 100 10
   exit
----------------------------------------------
A:ALA-49>config>router>if>ipv6# exit all
```

The following displays an IPv6 configuration example.

```
A:ALA-49>config>router>if# info
----------------------------------------------
            address 10.11.10.1/24
            port 1/3/37
            ipv6
                address 10::1/24
            exit
----------------------------------------------
A:ALA-49>config>router>if#
```

An Example of a IPv6 Over IPv4 Tunnel Configuration

The IPv6 address is the next-hop as it is received through BGP. The IPv4 address is the system address of the tunnel's endpoint static-route ::C8C8:C802/128 indirect 200.200.200.2

This configuration displays an example to configure a policy to export IPv6 routes into BGP.

CLI Syntax:

```
config>router
 bgp
    export policy-name [policy-name...(upto 5 max)]
    router-id ip-address
    group name
       family [ipv4] [vpn-ipv4] [ipv6] [mcast-ipv4]
       type {internal|external}
       neighbor ip-address
          local-as as-number [private]
          peer-as as-number
```

The following displays the configuration showing the policy output.

```
A:ALA-49>configure>router# info
----------------------------------------------
...
        policy-options
            policy-statement "ospf3"
                description "Plcy Stmnt For 'From ospf3 To bgp'"
                entry 10
                    description "Entry From Protocol ospf3 To bgp"
                    from
                        protocol ospf3
                    exit
                    to
                        protocol bgp
                    exit
                    action accept
                    exit
                exit
            exit
        exit
----------------------------------------------
A:ALA-49>configure>router#
```

Configuring Proxy ARP

To configure proxy ARP, you can configure:

- A prefix list in the **config>router>policy-options>prefix-list** context.
- A route policy statement in the **config>router>policy-options>policy-statement** context and apply the specified prefix list.
  - → In the policy statement **entry>to** context, specify the host source address(es) for which ARP requests can or cannot be forwarded to non-local networks, depending on the specified action.
  - → In the policy statement **entry>from** context, specify network prefixes that ARP requests will or will not be forwarded to depending on the action if a match is found. For more information about route policies, refer to the OS Routing Protocols Guide.
- Apply the policy statement to the **proxy-arp** configuration in the **config>router>interface** context.

CLI Syntax:
```
config>router# policy-options
 begin
 commit
 prefix-list name
    prefix ip-prefix/mask [exact|longer|through
    length|prefix-length-range length1-length2]
```

Use the following CLI syntax to configure the policy statement specified in the **proxy-arp-policy** *policy-statement* command.

CLI Syntax:
```
config>router# policy-options
 begin
 commit
 policy-statement name
    default-action {accept | next-entry | next-policy | re-
    ject}
    entry entry-id
       action {accept | next-entry | next-policy | reject}
       to
          prefix-list name [name...(upto 5 max)]
       from
          prefix-list name [name...(upto 5 max)]
```

The following displays prefix list and policy statement configuration examples:

```
A:ALA-49>config>router>policy-options# info
----------------------------------------------
            prefix-list "prefixlist1"
                    prefix 10.20.30.0/24 through 32
            exit
            prefix-list "prefixlist2"
                    prefix 10.10.10.0/24 through 32
            exit
...
            policy-statement "ProxyARPpolicy"
                entry 10
                    from
                        prefix-list "prefixlist1"
                    exit
                    to
                        prefix-list "prefixlist2"
                    exit
                    action reject
                exit
                default-action accept
                exit
            exit
...
----------------------------------------------
A:ALA-49>config>router>policy-options#
```

Use the following CLI to configure proxy ARP:

CLI Syntax:

```
config>router>interface interface-name
  local-proxy-arp
  proxy-arp-policy policy-name [policy-name...(upto 5 max)]
  remote-proxy-arp
```

The following displays a proxy ARP configuration example:

```
A:ALA-49>config>router>if# info
----------------------------------------------
            address 128.251.10.59/24
            local-proxy-arp
            proxy-arp
                policy-statement "ProxyARPpolicy"
            exit
----------------------------------------------
A:ALA-49>config>router>if#
```

Creating an IP Address Range

An IP address range can be reserved for exclusive use for services by defining the `config>router>service-prefix` command. When the service is configured, the IP address must be in the range specified as a service prefix. If no service prefix command is configured, then no limitation exists.

The `no service-prefix ip-prefix/mask` command removes all address reservations. A service prefix cannot be removed while one or more services use address(es) in the range to be removed.

CLI Syntax:

```
config>router
  service-prefix ip-prefix/mask [exclusive]
```

Configuring an LDP Shortcut

This command enables you to forward user IP packets and specified control IP packets using LDP shortcuts over all network interfaces in the system that participate in the IS-IS and OSPF routing protocols. The default is to disable the LDP shortcut across all interfaces in the system.

IGP Route Resolution

When LDP shortcut is enabled, LDP populates the RTM with next-hop entries corresponding to all prefixes for which it activated an LDP FEC. For a given prefix, two route entries are populated in RTM. One corresponds to the LDP shortcut next-hop and has an owner of LDP. The other one is the regular IP next-hop. The LDP shortcut next-hop always has preference over the regular IP next-hop for forwarding user packets and specified control packets over a given outgoing interface to the route next-hop.

The prior activation of the FEC by LDP is done by performing an exact match with an IGP route prefix in RTM. It can also be done by performing a longest prefix-match with an IGP route in RTM if the aggregate-prefix-match option is enabled globally in LDP *ldp-interarea-prd*.

Note that the LDP next-hop entry is not exported to LDP control plane or to any other control plane protocols except OSPF, IS-IS, and specific OAM control plane as specified in Handling of Control Packets on page 86.

This feature is not restricted to /32 FEC prefixes. However only /32 FEC prefixes will be populated in the Tunnel Table for use as a tunnel by services.

All user and specified control packets for which the longest prefix match in RTM yields the FEC prefix will be forwarded over the LDP LSP. The following is an example of the resolution process.

Assume the egress LER advertised a FEC for some /24 prefix using the fec-originate command. At the ingress LER, LDP resolves the FEC by checking in RTM that an exact match exists for this prefix. Once LDP activated the FEC, it programs the NHLFE in the egress data path and the LDP tunnel information in the ingress data path tunnel table.

Next, LDP provides the shortcut route to RTM which will associate it with the same /24 prefix. There will be two entries for this /24 prefix, the LDP shortcut next-hop and the regular IP next-hop. The latter was used by LDP to validate and activate the FEC. RTM then resolves all user prefixes which succeed a longest prefix match against the /24 route entry to use the LDP LSP.

Assume now the aggregate-prefix-match was enabled and that LDP found a /16 prefix in RTM to activate the FEC for the /24 FEC prefix. In this case, RTM adds a new more specific route entry of /24 and has the next-hop as the LDP LSP but it will still not have a specific /24 IP route entry. RTM then resolves all user prefixes which succeed a longest prefix match against the /24 route entry to use the LDP LSP while all other prefixes which succeed a longest prefix-match against the /16 route entry will use the IP next-hop. LDP shortcut will also work when using RIP for routing.

LDP Shortcut Forwarding Plane

Once LDP activated a FEC for a given prefix and programmed RTM, it also programs the ingress Tunnel Table in IOM with the LDP tunnel information.

When an IPv4 packet is received on an ingress network interface, a subscriber IES interface, or a regular IES interface, the lookup of the packet by the ingress IOM will result in the packet being sent labeled with the label stack corresponding to the NHLFE of the LDP LSP when the preferred RTM entry corresponds to an LDP shortcut.

If the preferred RTM entry corresponds to an IP next-hop, the IPv4 packet is forwarded unlabelled.

The switching from the LDP shortcut next-hop to the regular IP next-hop when the LDP FEC becomes unavailable depends on whether the next-hop is still available. If it is (for example, the LDP FEC was withdrawn due to LDP control plane issues) the switchover should be faster. If the next-hop determination requires IGP to re-converge, this will take longer. However no target is set.

The switching from a regular IP next-hop to an LDP shortcut next-hop will normally occur only when both are available. However, the programming of the NHLFE by LDP and the programming of the LDP tunnel information in the ingress IOM tunnel table are asynchronous. If Tunnel Table is configured first, it is possible that traffic will be black holed for some time .

ECMP Considerations

When ECMP is enabled and multiple equal-cost next-hops exit for the IGP route, the ingress IOM will spray the packets for this route based on hashing routine currently supported for IPv4 packets.

When the preferred RTM entry corresponds to an LDP shortcut route, spraying will be performed across the multiple next-hops for the LDP FEC. The FEC next-hops can either be direct link LDP neighbors or T-LDP neighbors reachable over RSVP LSPs in the case of LDP-over-RSVP but not both. This is as per ECMP for LDP in existing implementation.

When the preferred RTM entry corresponds to a regular IP route, spraying will be performed across regular IP next-hops for the prefix.

Spraying across regular IP next-hops and LDP-shortcut next-hops concurrently is not supported.

Handling of Control Packets

All control plane packets will not see the LDP shortcut route entry in RTM with the exception of the following control packets which will be forwarded over an LDP shortcut when enabled:

- A locally generated or in transit ICMP Ping and trace route of an IGP route. The transit message appears as a user packet to the ingress LER node.
- A locally generated response to a received ICMP ping or trace route message.

All other control plane packets that require an RTM lookup and knowledge of which destination is reachable over the LDP shortcut will continue to be forwarded over the IP next-hop route in RTM.

Handling of Multicast Packets

Multicast packets cannot be forwarded or received from an LDP LSP. This is because there is no support for the configuration of such an LSP as a tunnel interfaces in PIM. Only an RSVP P2MP LSP is currently allowed.

If a multicast packet is received over the physical interface, the RPF check will not resolve to the LDP shortcut as the LDP shortcut route in RTM is not made available to multicast application.

Interaction with LDP Shortcut for BGP Route Resolution

There is no interaction between an LDP shortcut for BGP next-hop resolution and the LDP shortcut for IGP route resolution. BGP will continue to resolve a BGP next-hop to an LDP shortcut if the user enabled the LDP shortcut option in BGP *BGP-Shortcut*:

CLI Syntax:
```
config>router>bgp>igp-shortcut ldp
```

Interaction with LDP Shortcut for Static Route Resolution

There is no interaction between LDP shortcut for static route resolution and the LDP shortcut for IGP route resolution. A static route will continue to be resolved by searching an LDP LSP which FEC prefix matches the specified indirect next-hop for the route. In contrast, the LDP shortcut for IGP route resolution uses the LDP LSP as a route.

LDP Control Plane

In order for the LDP shortcut to be usable, an SR-OS router must originate a <FEC, label> binding for each IGP route it learns of even if it did not receive a binding from the next-hop for that route. In other words, it must assume it is an egress LER for the FEC until the route disappears from the routing table or the next-hop advertised a binding for the FEC prefix. In the latter case, the SR-OS router becomes a transit LSR for the FEC.

An SR-OS router will originate a <FEC, label> binding for its system interface address only by default. The only way to originate a binding for local interfaces and routes which are not local to the system is by using the fec-originate capability.

You must use the **fec-originate** command to generate bindings for all non-local routes for which this node acts as an egress LER for the corresponding LDP FEC. Specifically, this feature must support the FEC origination of IGP learned routes and subscriber/host routes statically configured or dynamically learned over subscriber IES interfaces.

An LDP LSP used as a shortcut by IPv4 packets may also be tunneled using the LDP-over-RSVP feature.

Deriving the Router ID

The router ID defaults to the address specified in the system interface command. If the system interface is not configured with an IP address, then the router ID inherits the last four bytes of the MAC address. The router ID can also be manually configured in the `config>router router-id` context. On the BGP protocol level, a BGP router ID can be defined in the `config>router>bgp router-id` context and is only used within BGP.

Note that if a new router ID is configured, protocols are not automatically restarted with the new router ID. The next time a protocol is initialized the new router ID is used. An interim period of time can occur when different protocols use different router IDs. To force the new router ID, issue the `shutdown` and `no shutdown` commands for each protocol that uses the router ID, or restart the entire router.

It is possible to configure an SR OS node to operate with an IPv6 only BOF and no IPv4 system interface address. When configured in this manner, the operator must explicitly define IPv4 router IDs for protocols such as OSPF and BGP as there is no mechanism to derive the router ID from an IPv6 system interface address.

Use the following CLI syntax to configure the router ID:

CLI Syntax:
```
config>router
  router-id router-id
  interface ip-int-name
        address {ip-address/mask | ip-address netmask} [broad-
           cast all-ones | host-ones]
```

The following example displays a router ID configuration:

```
A:ALA-4>config>router# info
#------------------------------------------
# IP Configuration
#------------------------------------------
        interface "system"
            address 10.10.0.4/32
        exit
     . . .
        router-id 10.10.0.4
#------------------------------------------
A:ALA-4>config>router#
```

Configuring a Confederation

Configuring a confederation is optional. The AS and confederation topology design should be carefully planned. Autonomous system (AS), confederation, and BGP connection and peering parameters must be explicitly created on each participating router. Identify AS numbers, confederation numbers, and members participating in the confederation.

Refer to the BGP section for CLI syntax and command descriptions.

Use the following CLI syntax to configure a confederation:

CLI Syntax:

```
config>router
 confederation confed-as-num members member-as-num
```

The following example displays the commands to configure the confederation topology diagram displayed in Figure 2 on page 39.

NOTES:

- Confederations can be preconfigured prior to configuring BGP connections and peering.
- Each confederation can have up to 15 members.

The following displays a confederation example.

```
A:ALA-B>config>router# info
#------------------------------------------
# IP Configuration
#------------------------------------------
        interface "system"
            address 10.10.10.103/32
        exit
        interface "to-104"
            shutdown
            address 10.0.0.103/24
            port 1/1/1
        exit
        autonomous-system 100
        confederation 2002 members 200 300 400
        router-id 10.10.10.103

#------------------------------------------
A:ALA-B>config>router#
```

Configuring an Autonomous System

Configuring an autonomous system is optional. Use the following CLI syntax to configure an autonomous system:

CLI Syntax:

```
config>router
     autonomous-system as-number
```

The following displays an autonomous system configuration example:

```
A;ALA-A>config>router# info
#------------------------------------------
# IP Configuration
#------------------------------------------
        interface "system"
            address 10.10.10.103/32
        exit
   interface "to-104"
            address 10.0.0.103/24
            port 1/1/1
            exit
        exit
        autonomous-system 100
        router-id 10.10.10.103
#------------------------------------------
A:ALA-A>config>router#
```

Configuring Overload State on a Single SFM

A 7x50 system with a single SFM installed has a system multicast throughput that is only a half of a 7x50 system with dual SFMs installed. For example, in a mixed environment in which IOM1s, IOM2s, and IOM3s are installed in the same system (chassis mode B or C), system multicast throughput doubles when redundant SFMs are used instead of a single SFM. If the required system multicast throughput is between 16G and 32G (which means both SFMs are being actively used), when there is an SFM failure, multicast traffic needs to be rerouted around the node.

Some scenarios include:

- There is only one SFM installed in the system
- One SFM (active or standby) failed in a dual SFM configuration
- The system is in the ISSU process

You can use an overload state in IGP to trigger the traffic reroute by setting the overload bit in IS-IS or setting the metric to maximum in OSPF. Since PIM uses IGP to find out the upstream router, a next-hop change in IGP will cause PIM to join the new path and prune the old path, which effectively reroutes the multicast traffic downstream. When the problem is resolved, the overload condition is cleared, which will cause the traffic to be routed back to the router.

Service Management Tasks

This section discusses the following service management tasks:

- Changing the System Name on page 92
- Modifying Interface Parameters on page 93
- Deleting a Logical IP Interface on page 94

Changing the System Name

The `system` command sets the name of the device and is used in the prompt string. Only one system name can be configured. If multiple system names are configured, the last one configured will overwrite the previous entry.

Use the following CLI syntax to change the system name:

CLI Syntax:

```
config# system
   name system-name
```

The following example displays the command usage to change the system name:

Example:

```
A:ALA-A>config>system# name tgif
A:TGIF>config>system#
```

The following example displays the system name change:

```
A:ALA-A>config>system# name TGIF
A:TGIF>config>system# info
#------------------------------------------
# System Configuration
#------------------------------------------
        name "TGIF"
     location "Mt.View, CA, NE corner of FERG 1 Building"
     coordinates "37.390, -122.05500 degrees lat."
     synchronize
     snmp
        exit
        security
            snmp
                community "private" rwa version both
            exit
        exit
        . . .
----------------------------------------------
A:TGIF>config>system#
```

Modifying Interface Parameters

Starting at the `config>router` level, navigate down to the router interface context.

To modify an IP address, perform the following steps:

Example:
```
A:ALA-A>config>router# interface “to-sr1”
A:ALA-A>config>router>if# shutdown
A:ALA-A>config>router>if# no address
A:ALA-A>config>router>if# address 10.0.0.25/24
A:ALA-A>config>router>if# no shutdown
```

To modify a port, perform the following steps:

Example:
```
A:ALA-A>config>router# interface “to-sr1”
A:ALA-A>config>router>if# shutdown
A:ALA-A>config>router>if# no port
A:ALA-A>config>router>if# port 1/1/2
A:ALA-A>config>router>if# no shutdown
```

The following example displays the interface configuration:

```
A:ALA-A>config>router# info
#------------------------------------------
# IP Configuration
#------------------------------------------
        interface "system"
            address 10.0.0.103/32
        exit
        interface "to-sr1"
            address 10.0.0.25/24
            port 1/1/2
        exit
        router-id 10.10.0.3
#------------------------------------------
A:ALA-A>config>router#
```

Deleting a Logical IP Interface

The no form of the `interface` command typically removes the entry, but all entity associations must be shut down and/or deleted before an interface can be deleted.

1. Before an IP interface can be deleted, it must first be administratively disabled with the `shutdown` command.
2. After the interface has been shut down, it can then be deleted with the **no interface** command.

CLI Syntax:

```
config>router
   no interface ip-int-name
```

Example:

```
config>router# interface test-interface
config>router>if# shutdown
config>router>if# exit
config>router# no interface test-interface
config>router#
```

IP Router Command Reference

Command Hierarchies

Configuration Commands

Router Commands

```
config
     — router [router-name]
               — aggregate ip-prefix/ip-prefix-length [summary-only] [as-set] [aggregator as-number:ip-
                 address] [black-hole] [community comm-id] [description description]
               —  aggregate ip-prefix/ip-prefix-length [summary-only] [as-set] [aggregator as-number:ip-
                 address] [community comm-id] [indirect ip-address] [description description]
               — no aggregate ip-prefix/ip-prefix-length
               — autonomous-system autonomous-system
               — no autonomous-system
               — confederation confed-as-num members as-number [as-number...(up to 15 max)]
               — no confederation [confed-as-num members as-number....(up to 15 max)]
               — ecmp max-ecmp-routes
               — no ecmp
               — fib-priority {high | standard}
               — [no] icmp-tunneling
               — [no] ignore-icmp-redirect
               — [no] ip-fast-reroute
               — [no] ldp-shortcut
               — mc-maximum-routes number [log-only] [threshold threshold]
               — no mc-maximum-routes
               — mpls-labels
                         — static-label max-lsp-labels number static-svc-labels number
                         — no static-label
               — multicast-info policy-name
               — no multicast-info
               — multicast-info
                         — description description-string
                         — no description
               — origin-validation
                         — [no] rpki-session ip-address
                                   — [no] connect-retryseconds
                                   — [no] description string
                                   — [no] local-address ip-address
                                   — [no] port number
                                   — [no] refresh-time seconds hold-time seconds
                                   — [no] shutdown
                                   — [no] stale-time seconds
                                   — static-entry ip-prefix/prefix-length1-prefix-length2 origin-as as-number
                                     [valid | invalid]
                                   — no static-entry ip-prefix/prefix-length1-prefix-length2
               — router-id ip-address
               — no router-id
               — service-prefix {ip-prefix/mask | ip-prefix netmask}[exclusive]
               — no service-prefix ip-prefix/mask | ip-prefix netmask}
               — sgt-qos
                         — application dscp-app-name dscp {dscp-value | dscp-name}
                         — application dot1p-app-name dot1p dot1p-priority
                         — no application {dscp-app-name | dot1p-app-name}
                         — dscp dscp-name fc fc-name
                         — [no] dscp dscp-name
               — single-sfm-overload [holdoff-time holdoff-time]
               — no single-sfm-overload
```

```
                    — [no] static-route {ip-prefix/prefix-length| ip-prefix netmask} [preference preference] [metric metric] [tag tag] [enable|disable] next-hop ip-int-name|ip-address [validate-next-hop] [mcast-family] [community comm-id][bfd-enable|{cpe-check cpe-ip-address [interval seconds] [drop-count count] [padding-size padding-size] [log]}| {prefix-list prefix-list-name [all|none]}][fc fc-name [priority {low|high}]] [source-class source-index][dest-class dest-index][ldp-sync][description description]
                    — [no] static-route {ip-prefix/prefix-length | ip-prefix netmask} [preference preference] [metric metric] [tag tag] [community comm-id] [enable | disable] indirect ip-address [ldp | rsvp-te [disallow-igp]] [cpe-check cpe-ip-address [interval seconds] [drop-count count] [log]]
                    — [no] static-route {ip-prefix/prefix-length | ip-prefix netmask} [preference preference] [metric metric] [tag tag] [community comm-id] [enable | disable] black-hole [mcast-family]
                    — [no] triggered-policy
                    — ttl-propagate
                              — label-route-local [none | all]
                              — label-route-transit [none | all]
                              — lsr-label-route [none | all]
                              — vprn-local [none | vc-only | all]
                              — vprn-transit [none | vc-only | all]
```

```
config
          — router management
                    — origin-validation
                              — [no] rpki-session ip-address
                                        — [no] connect-retryseconds
                                        — [no] description string
                                        — [no] local-address ip-address
                                        — [no] port number
                                        — [no] refresh-time seconds hold-time seconds
                                        — [no] shutdown
                                        — [no] stale-time seconds
```

Router BFD commands

```
config
    — router
        — bfd
        — bfd-template name [create]
        — bfd-template name
            — transmit-interval transmit-interval
            — no transmit-interval
            — receive-interval receive-interval
            — no receive-interval
            — cv-tx transmit-interval
            — no cv-tx
            — echo-receive echo-interval
            — no echo-receive
            — multiplier multiplier
            — no multiplier
            — [no] type cpm-np
```

Router L2TP Commands

```
config
    — router [router-name]
        — l2tp
            — calling-number-format ascii-spec
            — no calling-number-format
            — challenge {always}
            — no challenge
            — df-bit-lac {always|never}
            — no df-bit-lac
            — destruct-timeout destruct-timeout
            — no destruct-timeout
            — exclude-avps calling-number
            — no exclude-avps
            — group tunnel-group-name [create]
            — no group tunnel-group-name
                — avp-hiding sensitive | always
                — no avp-hiding
                — challenge always
                — no challenge
                — description description-string
                — no description
                — df-bit-lac {always|never|default}
                — no df-bit-lac
                — destruct-timeout destruct-timeout
                — no destruct-timeout
                — hello-interval hello-interval
                — no hello-interval
                — idle-timeout idle-timeout
                — no idle-timeout
                — lns-group lns-group-id
                — no lns-group
                — load-balance-method {per-session|per-tunnel}
                — no load-balance-method
                — local-address ip-address
                — no local-address
                — local-name host-name
                — no local-name
                — max-retries-estab max-retries
                — no max-retries-estab
                — max-retries-not-estab max-retries
                — no max-retries-not-estab
                — password password [hash | hash2]
                — no password
                — ppp
                    — authentication {chap|pap|pref-chap}
                    — authentication-policy auth-policy-name
                    — no authentication-policy
                    — default-group-interface ip-int-name service-id service-id
                    — no default-group-interface
                    — keepalive seconds [hold-up-multiplier multiplier]
                    — no keepalive
                    — mtu mtu-bytes
                    — no mtu
                    — [no] proxy-authentication
                    — [no] proxy-lcp
                    — user-db local-user-db-name
                    — no user-db
          — session-assign-method weighted
          — no session-assign-method
          — session-limit session-limit
          — no session-limit
          — tunnel tunnel-name [create]
          — no tunnel tunnel-name
                    — [no] auto-establish
                    — avp-hiding {never | sensitive | always}
                    — no avp-hiding
                    — challenge challenge-mode
                    — no challenge
                    — description description-string
                    — no description
                    — df-bit-lac {always|never|default}
                    — no df-bit-lac
                    — destruct-timeout destruct-timeout
                    — no destruct-timeout
                    — hello-interval hello-interval
                    — hello-interval infinite
                    — no hello-interval
                    — idle-timeout idle-timeout
                    — idle-timeout infinite
                    — no idle-timeout
                    — load-balance-method {per-session|per-tunnel}
                    — no load-balance-method
                    — local-address ip-address
                    — no local-address
                    — local-name host-name
                    — no local-name
                    — max-retries-estab max-retries
                    — no max-retries-estab
                    — max-retries-not-estab max-retries
                    — no max-retries-not-estab
                    — password password [hash | hash2]
                    — no password
                    — peer ip-address
                    — no peer
                    — preference preference
                    — no preference
                    — remote-name host-name
                    — no remote-name
                    — session-limit session-limit
                    — no session-limit
                    — [no] shutdown
— next-attempt {same-preference-level | next-preference-level}
— no next-attempt
— replace-result-code code [code...(upto 3 max)]
— no replace-result-code
— peer-address-change-policy {accept | ignore | reject}
— receive-window-size [4..1024]
— no receive-window-size
```

```
                    — [no] shutdown
configure
    — router
        — l2tp
            — tunnel-selection-blacklist
                — add-tunnel never
                — add-tunnel on reason>[reason...(upto 8 max)]
                — no add-tunnel
                — add-tunnel
                — max-list-length count
                — no max-list-length
                — max-time minutes
                — no max-time
                — timeout-action action
                — no timeout-action
```

Router Interface Commands

```
config
    — router [router-name]
        — if-attribute
            — admin-group group-name value group-value
            — no admin-group group-name
            — srlg-group group-name value group-value
            — no srlg-group group-name
        — [no] interface ip-int-name [unnumbered-mpls-tp]
            — address {ip-address/mask | ip-address netmask} [broadcast all-ones | host-ones]
              [track-srrp srrp-instance]
            — no address
            — [no] allow-directed-broadcasts
            — arp-timeout seconds
            — no arp-timeout
            — bfd transmit-interval [receive receive-interval] [multiplier multiplier] [echo-
              receive echo-interval [type cpm-np]
            — no bfd
            — cflowd {acl | interface} [direction]
            — no cflowd
            — cpu-protection policy-id
            — no cpu-protection
            — delayed-enable seconds
            — no delayed-enable
            — description description-string
            — no description
            — dist-cpu-protection policy-name
            — no dist-cpu-protection
            — egr-ip-load-balancing {src-if | dst-ip}
            — egress
                — filter ip ip-filter-id
                — filter ipv6 ipv6-filter-id
                — no filter [ip ip-filter-id] [ipv6 ipv6-filter-id]
            — [no] enable-ingress-stats
            — [no] enable-mac-accounting
            — icmp
                — [no] mask-reply
                — redirects [number seconds]
                — no redirects
                — ttl-expired [number seconds]
                — no ttl-expired
                — unreachables [number seconds]
                — no unreachables
            — if-attribute
                — [no] admin-group group-name [group-name...(up to 5 max)]
                — no admin-group
                — [no] srlg-group group-name [group-name...(up to 5 max)]
                — no srlg-group
            — ingress
                — filter ip ip-filter-id
                — filter ipv6 ipv6-filter-id
                — no filter [ip ip-filter-id][ipv6 ipv6-filter-id]
                — [no] flowspec
                — [no] flowspec-ipv6
```

```
          — ip-load-balancing {source|destination}
          — no ip-load-balancing
          — lag-link-map-profile lnk-map-profile-id
          — no lag-link-map-profile
          — ldp-sync-timer seconds
          — no ldp-sync-timer
          — [no] local-proxy-arp
          — [no] loopback
          — lsr-load-balancing hashing-algorithm
          — no lsr-load-balancing
          — mac ieee-mac-addr
          — no mac
          — [no] multihoming primary|secondary [hold-time holdover-time]
          — network-domain network-domain-name
          — no network-domain
          — [no] ntp-broadcast
          — port port-name
          — no port
          — [no] proxy-arp-policy
          — [no] ptp-hw-assist
          — qos-route-lookup [source | destination]
          — no qos-route-lookup
          — qos network-policy-id [egress-port-redirect-group queue-group-name] [egress-
            instance instance-id]] [ingress-fp- redirect-group queue-group-name ingress-
            instance instance-id]
          — no qos
          — [no] remote-proxy-arp
          — secondary {[ip-addr/mask | ip-addr][netmask]} [broadcast {all-ones | host-
            ones}] [igp-inhibit]
          — no secondary [ip-addr/mask | ip-addr][netmask ]
          — [no] shutdown
          — static-arp  ip-addr ieee-mac-addr unnumbered
          — no static-arp unnumbered
          — [no] strip-label
          — tcp-mss mss-value
          — no tcp-mss
          — [no] teid-load-balancing
          — tos-marking-state {trusted | untrusted}
          — no tos-marking-state
          — unnumbered [ip-addr | ip-int-name]
          — no unnumbered
          — [no] urpf-check
                    — mode {strict|loose|strict-no-ecmp}
                    — no mode
— [no] mh-primary-interface
          — address {ip-address/mask | ip-address netmask}
          — no address
          — description description-string
          — no description
          — [no] shutdown
— [no] mh-secondary-interface
          — hold-time holdover-time
          — no hold-time
          — address {ip-address/mask | ip-address netmask}
          — no address
          — description description-string
          — no description
          — [no] shutdown
     — route-next-hop-policy
          — [no] template template-name
                    — include-group group-name [pref pref]
                    — no include-group group-name
                    — [no] exclude-group group-name
                    — [no] srlg-enable
                    — protection-type {link | node}
                    — no protection-type
                    — nh-type {ip | tunnel}
                    — no nh-type
```

For router interface VRRP commands, see VRRP Command Reference on page 355.

Router Interface IPv6 Commands

```
config
     — router [router-name]
          — [no] interface ip-int-name
               — [no] ipv6
                    — address ipv6-address/prefix-length [eui-64]
                    — no address ipv6-address/prefix-length
                    — bfd transmit-interval [receive receive-interval] [multiplier multiplier]
                      [echo-receive echo-interval [type cpm-np]
                    — no bfd
                    — [no] dad-disable
                    — icmp6
                         — packet-too-big [number seconds]
                         — no packet-too-big
                         — param-problem [number seconds]
                         — no param-problem
                         — redirects [number seconds]
                         — no redirects
                         — time-exceeded [number seconds]
                         — no time-exceeded
                         — unreachables [number seconds]
                         — no unreachables
                    — [no] local-proxy-nd
                    — neighbor ipv6-address [mac-address]
                    — no neighbor ipv6-address
                    — proxy-nd-policy policy-name [ policy-name...(up to 5 max)]
                    — no proxy-nd-policy
                    — [no] qos-route-lookup
                    — tcp-mss mss-value
                    — no tcp-mss
                    — [no] urpf-check
                         — mode {strict | loose | strict-no-ecmp}
                         — no mode
               — [no] qos-route-lookup
               — [no] urpf-check
                    — mode {strict | loose}
                    — no mode
```

Router Advertisement Commands

```
config
    — router
        — [no] router-advertisement
            — [no] interface ip-int-name
                — current-hop-limit number
                — no current-hop-limit
                — [no] managed-configuration
                — max-advertisement-interval seconds
                — no max-advertisement-interval
                — min-advertisement-interval seconds
                — no min-advertisement-interval
                — mtu mtu-bytes
                — no mtu
                — [no] other-stateful-configuration
                — prefix [ipv6-prefix/prefix-length]
                    — [no] autonomous
                    — [no] on-link
                    — preferred-lifetime {seconds | infinite}
                    — no preferred-lifetime
                    — valid-lifetime {seconds | infinite}
                    — no valid-lifetime
                — reachable-time milli-seconds
                — no reachable-time
                — retransmit-time milli-seconds
                — no retransmit-time
                — router-lifetime seconds
                — no router-lifetime
                — [no] shutdown
                — [no] use-virtual-mac
```

Show Commands

```
show
     — router router-instance
     — router service-name service-name
          — aggregate [family] [active]
          — arp [ ip-int-name | ip-address/mask | mac ieee-mac-address | summary] [local | dynamic | static | managed]
          — authentication
               — statistics
               — statistics interface [ip-int-name | ip-address]
               — statistics policy name
          — bfd
               — bfd-template template-name
               — interface [interface-name]
               — session [src ip-address [dst ip-address] | [detail]]
               — session [type type]
               — session [summary]
          — dhcp
               — statistics [ip-int-name | ip-address]
               — summary
          — dhcp6
               — statistics [ip-int-name | ip-address]
               — summary
          — ecmp
          — fib slot-number [family] [ip-prefix/prefix-length [longer]] [secondary]
          — fib slot-number [family] summary
          — fib slot-number nh-table-usage
          — fp-tunnel-table slot-number [ip-prefix/prefix-length]
          — icmp6
          — interface [{[ip-address|ip-int-name][detail] [family]}|summary| exclude-services]
          — interface ip-address|ip-int-name eth-cfm [detail]
          — interface ip-address|ip-int-name mac [ieee-address]
          — interface ip-address|ip-int-name statistics
          — interface dist-cpu-protection [detail]
          — interface policy-accounting [class [index]]
          — l2tp
               — group [tunnel-group-name [statistics]]
               — group connection-id connection-id [detail]|
               — group [detail] [session-id session-id (v2)] [state session-state][peer ip-address] [group group-name] [assignment-id assignment-id] [local-namelocal-host-name] [remote-name remote-host-name] [tunnel-id tunnel-id (v2)]|
               — session [detail] [state session-state] [peer ip-address] [group group-name] [assignment-id assignment-id] [local-name local-host-name] [remote-name remote-host-name] [control-connection-id connection-id (v3)]
               — statistics
               — tunnel [statistics] [detail] [peer ip-address] [state tunnel-state] [remote-connection-id remote-connection-id (v3)] [group group-name] [assignment-id assignment-id] [local-name host-name] [remote-name host-name]|  tunnel  [statistics] [detail] [peer ip-address] [state tunnel-state] [remote-tunnel-id remote-tunnel-id (v2)] [group group-name] [assignment-id assignment-id] [local-name host-name] [remote-name host-name]
               — tunnel tunnel-id tunnel-id (v2) [statistics] [detail]
               — tunnel connection-id connection-id (v3) [statistics] [detail]
          — ldp
```

```
                — bindings active
        — mvpn
        — neighbor [ip-address | ip-int-name | mac ieee-mac-address | summary]
        — network-domains  [detail] [network-domain-name]
        — policy [name | damping |  prefix-list name | as-path name | community name | admin]
        — policy-edits
        — route-table [family] [ip-prefix[/prefix-length] [longer|exact|protocol protocol-name] [all]]
          [next-hop-type type][qos][alternative]
        — route-table [family] summary
        — route-table tunnel-endpoints [ip-prefix[/prefix-length]] [longer|exact] [detail]
        — rtr-advertisement [interface interface-name] [prefix ipv6-prefix[/prefix-length] [conflicts]
        — service-prefix
        — sgt-qos
                — application [app-name] [dscp-dot1p]
                — dscp-map [dscp-name]
        — static-arp [ip-address | ip-int-name | mac ieee-mac-addr]
        — static-route [family] [[ip-prefix /mask]| [preference preference] | [next-hop ip-address] |
          [tag tag] [detail]
        — status
        — tms routes
        — tunnel-table [ip-address[/mask]] | [protocol protocol | sdp sdp-id] [summary]
        — neighbor [interface-name]
```

Clear Commands

```
clear
     — router [router-instance]
               — arp {all | ip-addr | interface {ip-int-name | ip-addr}}
               — bfd
                         — session src-ip ip-address dst-ip ip-address
                         — statistics src-ip ip-address dst-ip ip-address
                         — statistics all
               — dhcp
                         — statistics [ip-int-name | ip-address]
               — dhcp6
                         — statistics [ip-int-name | ip-address]
               — forwarding-table [slot-number]
               — grt-lookup
               — icmp-redirect-route {all | ip-address}
               — icmp6 all
               — icmp6 global
               — icmp6 interface interface-name
               — interface [ip-int-name | ip-addr] [icmp] [urpf-stats] [statistics]
               — l2tp
                         — group tunnel-group-name
                                   — statistics
                         — statistics
                         — tunnel tunnel-id
                                   — statistics
               — neighbor {all | ip-address}
               — neighbor [interface ip-int-name | ip-address]
               — router-advertisement all
               — router-advertisement [interface interface-name]
               — forwarding-table [slot-number]
               — interface [ip-int-name | ip-addr] [icmp]
```

Debug Commands

```
debug
    — trace
            — destination trace-destination
            — enable
            — [no] trace-point [module module-name] [type event-type] [class event-class] [task task-
              name] [function function-name]
    — router router-instance
            — ip
                    — [no] arp
                    — icmp
                    — no icmp
                    — icmp6 [ip-int-name]
                    — no icmp6
                    — [no] interface [ip-int-name | ip-address]
                    — [no] neighbor
                    — packet [ip-int-name | ip-address] [headers] [protocol-id]
                    — no packet [ip-int-name | ip-address]
                    — route-table [ip-prefix/prefix-length] [longer]
                    — no route-table
                    — tunnel-table [ip-address] [ldp | rsvp [tunnel-id tunnel-id]| sdp [sdp-id sdp-id]]
            — mtrace
                    — [no] misc
                    — [no] packet [query | request | response]
            — tms [interface tms-interface] api [detail] tms-interface
```

Configuration Commands

Generic Commands

shutdown

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

Context config>router>interface

Description The **shutdown** command administratively disables the 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 no shutdown

description

Syntax **description** *description-string*
no description

Context config>router>if
config>router>if>dhcp
config>router>if>vrrp
config>router>l2tp>group
config>router>l2tp>group>tunnel

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

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

Default No description is associated with the configuration context.

Parameters *description-string* — The description character string. Allowed values are any string up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

Router Global Commands

router

Syntax **router** *router-name*

Context config

Description This command enables the context to configure router parameters, and interfaces, route policies, and protocols.

Parameters *router-name* — Specify the router-name.

Values	router-name:	Base, management
Default	Base	

aggregate

Syntax **aggregate** *ip-prefix/ip-prefix-length* [**summary-only**] [**as-set**] [**aggregator** *as-number:ip-address*] [**black-hole**] [**community** *comm-id*] [**description** *description*]

aggregate *ip-prefix/ip-prefix-length* [**summary-only**] [**as-set**] [**aggregator** *as-number:ip-address*] [**community** *comm-id*] [**indirect** *ip-address*] [**description** *description*]

no aggregate *ip-prefix/ip-prefix-length*

Context config>router

Description This command creates an aggregate route.

Use this command to automatically install an aggregate in the routing table when there are one or more component routes. A component route is any route used for forwarding that is a more-specific match of the aggregate.

The use of aggregate routes can reduce the number of routes that need to be advertised to neighbor routers, leading to smaller routing table sizes.

Overlapping aggregate routes may be configured; in this case a route becomes a component of only the one aggregate route with the longest prefix match. For example if one aggregate is configured as 10.0.0.0/16 and another as 10.0.0.0/24, then route 10.0.128/17 would be aggregated into 10.0.0.0/16, and route 10.0.0.128/25 would be aggregated into 10.0.0.0/24. If multiple entries are made with the same prefix and the same mask the previous entry is overwritten.

A standard 4-byte BGP community may be associated with an aggregate route in order to facilitate route policy matching.

By default aggregate routes are not installed in the forwarding table, however there are configuration options that allow an aggregate route to be installed with a black-hole next hop or with an indirect IP address as next hop.

The **no** form of the command removes the aggregate.

Default No aggregate routes are defined.

Parameters *ip-prefix* — The destination address of the aggregate route in dotted decimal notation.

Values	ipv4-prefix	a.b.c.d (host bits must be 0)	
	ipv4-prefix-length	0 — 32	
	ipv6-prefix	x:x:x:x:x:x:x:x (eight 16-bit pieces)	
		x:x:x:x:x:x:d.d.d.d	
		x:	[0 — FFFF]H
		d:	[0 — 255]D
	ipv6-prefix-length	0 — 128	

The mask associated with the network address expressed as a mask length.

Values	0 — 32

summary-only — This optional parameter suppresses advertisement of more specific component routes for the aggregate.

To remove the **summary-only** option, enter the same aggregate command without the **summary-only** parameter.

as-set — This optional parameter is only applicable to BGP and creates an aggregate where the path advertised for this route will be an AS_SET consisting of all elements contained in all paths that are being summarized. Use this feature carefully as it can increase the amount of route churn due to best path changes.

aggregator *as-number***:***ip-address* **—** This optional parameter specifies the BGP aggregator path attribute to the aggregate route. When configuring the aggregator, a two-octet AS number used to form the aggregate route must be entered, followed by the IP address of the BGP system that created the aggregate route.

community *comm-id* **—** This configuration option associates a BGP community with the aggregate route. The community can be matched in route policies and is automatically added to BGP routes exported from the aggregate route.

Values	comm-id	asn:comm-val | well-known-comm
	asn	0 — 65535
	comm-val	0 — 65535
	well-known-comm	no-advertise, no-export, no-export-subconfed

black-hole — This optional parameter installs the aggregate route, when activated, in the FIB with a black-hole next-hop; where packets matching this route are discarded.

indirect *ip-address* **—** This configuration option specifies that the aggregate route should be installed in the FIB with a next-hop taken from the route used to forward packets to ip-address.

Values	ipv4-prefix	a.b.c.d
	ipv6-prefix	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

description *description-text* **—** Specifies a text description stored in the configuration file for a configuration context.

autonomous-system

Syntax **autonomous-system** *autonomous-system*
no autonomous-system

Context config>router

Description This command configures the autonomous system (AS) number for the router. A router can only belong to one AS. An AS number is a globally unique number with an AS. This number is used to exchange exterior routing information with neighboring ASs and as an identifier of the AS itself.

If the AS number is changed on a router with an active BGP instance, the new AS number is not used until the BGP instance is restarted either by administratively disabling/enabling (**shutdown**/ **no shutdown**) the BGP instance or rebooting the system with the new configuration.

Default No autonomous system number is defined.

Parameters *autonomous-system* — The autonomous system number expressed as a decimal integer.

Values 1 — 4294967295

confederation

Syntax **confederation** *confed-as-num* **members** *as-number* [*as-number...*up to 15 max]
no confederation [*confed-as-num* **members** *as-number...*up to 15 max]

Context config>router

Description This command creates confederation autonomous systems within an AS.

This technique is used to reduce the number of IBGP sessions required within an AS. Route reflection is another technique that is commonly deployed to reduce the number of IBGP sessions.

The **no** form of the command deletes the specified member AS from the confederation.

When no members are specified in the **no** statement, the entire list is removed and **confederation** is disabled.

When the last member of the list is removed, **confederation** is disabled.

Default no confederation - no confederations are defined.

Parameters *confed-as-num* — The confederation AS number expressed as a decimal integer.

Values 1 — 65535

members *member-as-num* **—** The AS number(s) of members that are part of the confederation, expressed as a decimal integer. Up to 15 members per *confed-as-num* can be configured.

Values 1 — 65535

ecmp

Syntax **ecmp** *max-ecmp-routes*
no ecmp

Context config>router

Description This command enables ECMP and configures the number of routes for path sharing; for example, the value 2 means two equal cost routes will be used for cost sharing.

ECMP can only be used for routes learned with the same preference and same protocol. See the discussion on preferences in the **static-route** command.

When more ECMP routes are available at the best preference than configured in *max-ecmp-routes*, then the lowest next-hop IP address algorithm is used to select the number of routes configured in *max-ecmp-routes*.

The **no** form of the command disables ECMP path sharing. If ECMP is disabled and multiple routes are available at the best preference and equal cost, then the route with the lowest next-hop IP address is used.

Default no ecmp

Parameters *max-ecmp-routes* — The maximum number of equal cost routes allowed on this routing table instance, expressed as a decimal integer. Setting ECMP *max-ecmp-routes* to 1 yields the same result as entering **no ecmp**.

Values 0 — 32

fib-priority

Syntax **fib-priority** {**high** | **standard**}

Context config>router

Description This command specifies the FIB priority for VPRN.

icmp-tunneling

Syntax **icmp-tunneling**
no icmp-tunneling

Context config>router

Description This command enables the tunneling of ICMP reply packets over MPLS LSP at a LSR node as per RFC 3032.

The LSR part of this feature consists of crafting the reply ICMP packet of type=11- 'time exceeded', with a source address set to a local address of the LSR node, and appending the IP header and leading payload octets of the original datagram. The system skips the lookup of the source address of the sender of the label TTL expiry packet, which becomes the destination address of the ICMP reply packet. Instead, CPM injects the ICMP reply packet in the forward direction of the MPLS LSP the label TTL expiry packet was received from. The TTL of pushed labels should be set to 255.

The source address of the ICMP reply packet is determined as follows. The LSR uses the address of the outgoing interface for the MPLS LSP. Note that with LDP LSP or BGP LSP multiple ECMP next-hops can exist and in such a case the first outgoing interface is selected. If that interface does not have an address of the same family (IPv4 or IPv6) as the ICMP packet, then the system address of the same family is selected. If one is not configured, the packet is dropped.

When the packet is received by the egress LER, it performs a regular user packet lookup in the data path in the GRT context for BGP shortcut, 6PE, and BGP label route prefixes, or in VPRN context for VPRN and 6VPE prefixes. It then forwards it to the destination, which is the sender of the original packet which TTL expired at the LSR.

If the egress LER does not have a route to the destination of the ICMP packet, it drops the packets.

The rate of the tunneled ICMP replies at the LSR can be directly or indirectly controlled by the existing IOM level and CPM levels mechanisms. Specifically, the rate of the incoming UDP traceroute packets received with a label stack can be controlled at ingress IOM using the distributed CPU protection feature. The rate of the ICMP replies by CPM can also be directly controlled by configuring a system wide rate limit for packets ICMP replies to MPLS expired packets which are successfully forwarded to CPM using the command 'configure system security vprn-network-exceptions'. Note that while this command's name refers to VPRN service, this feature rate limits ICMP replies for packets received with any label stack, including VPRN and shortcuts.

The 7x50 implementation supports appending to the ICMP reply of type Time Exceeded the MPLS label stack object defined in RFC 4950. It does not include it in the ICMP reply type of Destination unreachable.

The new MPLS Label Stack object permits an LSR to include label stack information including label value, EXP, and TTL field values, from the encapsulation header of the packet that expired at the LSR node. The ICMP message continues to include the IP header and leading payload octets of the original datagram.

In order to include the MPLS Label Stack object, the SROS implementation adds support of RFC 4884 which defines extensions for a multi-part ICMPv4/v6 message of type Time Exceeded.

The **no** form of command disables the tunneling of ICMP reply packets over MPLS LSP at a LSR node.

Default no icmp-tunneling

ignore-icmp-redirect

Syntax [**no**] **ignore-icmp-redirect**

Context config>router

Description This command drops ICMP redirects received on the management interface.

The no form of the command accepts ICMP redirects received on the management interface.

ip-fast-reroute

Syntax [**no**] **ip-fast-reroute**

Context config>router

Description This command enables IP Fast-Reroute (FRR) feature on the system.

This feature provides for the use of a Loop-Free Alternate (LFA) backup next-hop for forwarding in-transit and CPM generated IP packets when the primary next-hop is not available. IP FRR is supported on IPv4 and IPv6 OSPF/IS-IS prefixes forwarded in the base router instance to a network IP interface or to an IES SAP interface or spoke interface. It is also supported for VPRN VPN-IPv4 OSPF prefixes and VPN-IPv6 OSPF prefixes forwarded to a VPRN SAP interface or spoke interface.

IP FRR also provides a LFA backup next-hop for the destination prefix of a GRE tunnel used in an SDP or in VPRN auto-bind.

When any of the following events occurs, IGP instructs in the fast path on the IOMs to enable the LFA backup next-hop:

a. OSPF/IS-IS interface goes operationally down: physical or local admin shutdown.

b. Timeout of a BFD session to a next-hop when BFD is enabled on the OSPF/IS-IS interface

When the SPF computation determines there is more than one primary next-hop for a prefix, it will not program any LFA next-hop in RTM. Thus, the IP prefix will resolve to the multiple equal-cost primary next-hops that provide the required protection.

The **no** form of this command disables the IP FRR feature on the system

Default no ip-fast-reroute

mc-maximum-routes

Syntax **mc-maximum-routes** *number* [**log-only**] [**threshold** *threshold*]
no mc-maximum-routes

Context config>router

Description This command specifies the maximum number of multicast routes that can be held within a VPN routing/forwarding (VRF) context. When this limit is reached, a log and SNMP trap are sent. If the **log-only** parameter is not specified and the maximum-routes value is set below the existing number of routes in a VRF, then no new joins will be processed.

The **no** form of the command disables the limit of multicast routes within a VRF context. Issue the **no** form of the command only when the VPRN instance is shutdown.

Default no mc-maximum-routes

Parameters *number* — Specifies the maximum number of routes to be held in a VRF context.

Values 1 — 2147483647

log-only — Specifies that if the maximum limit is reached, only log the event. **log-only** does not disable the learning of new routes.

threshold *threshold* **—** The percentage at which a warning log message and SNMP trap should be sent.

Values 0 — 100

Default 10

mpls-labels

Syntax **mpls-labels**

Context config>router

Description This command creates a context for the configuration of glocal parameters related to MPLS labels.

static-label

Syntax **static-label max-lsp-labels** *number* **static-svc-labels** *number*
no static-label

Context config>router>mpls-labels

Description This command enables the range of MPLS static label values reserved for LSPs and for VCs (pseudowires) to be configured. For LSPs, these ranges only apply to static MPLS-TP paths configured under config>router>mpls>lsp.

Default no static-label

Parameters **max-lsp-labels** *number* **—** The number of static label values that are reserved for use by statically configured LSPs. THe range is configured as follows: The minimum value of label is always 32. The maximum value in the range is then 32 + *number*. The allowed values of *number* are as follows for max-lsp-labels:

Values 0 — 131071 for chassis mode C (128k)

Values 0 — 261143 for chassis mode D (256k)

Default 992

static-svc-labels *number* **—** The number of static label values that are reserved for use by statically configured VCs (pseudowires). The range is configured as follows: The minimum value of static VC label is always [32 + max-lsp-labels + 1]. The maximum VC label value in the range is then [32 + max-lsp-labels + 1+ *number*]. The allowed values of *number* are as follows for static-svc-labels:

Values 0 — 131071 for chassis mode C (128k)

Values 0 — 261143 for chassis mode D (256k)

Default 16384

multicast-info

Syntax **multicast-info-policy** *policy-name*
no multicast-info-policy

Context configure>router

Description This command configures multicast information policy.

Parameters *policy-name* — Specifies the policy name.

Values 32 chars max

network-domains

Syntax **network-domains**

Context config>router

Description This command opens context for defining network-domains. This command is applicable only in the base routing context.

description

Syntax [**no**] **description** *string*

Context config>router>network-domains>network-domain

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

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

Default no description

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 character (#, $, space, etc.), the entire string must be enclosed within double quotes.

network-domain

Syntax **network-domain** *network-domain-name* [**create**]
no network-domain *network-domain-name*

Context config>router>network-domains

Description This command creates network-domains that can be associated with individual interfaces and SDPs.

Default **network-domain** “default”

Parameters *network-domain-name* — Network domain name character string.

rpki-session

Syntax **rpki-session** *ip-address*
no rpki-session *ip-address*

Context config>router>origin-validation

Description This command configures a session with an RPKI local cache server by using the RPKI-Router protocol. It is over these sessions that the router learns dynamic VRP entries expressing valid origin AS and prefix associations. SR-OS supports the RPKI-Router protocol over TCP/IPv4 or TCP/IPv6 transport. A 7x50 router can setup an RPKI-Router session using the base routing table or the management router.

Default **no rpki-session**

Parameters *ip-address* — An IPv4 address or an IPv6 address. If the IPv6 address is link-local then the interface name must be appended to the IPv6 address after a hyphen (-).

connect-retry

Syntax **connect-retry** *seconds*
no connect-retry

Context config>router>origin-validation>rpki-session

Description This command configures the time in seconds to wait between one TCP connection attempt that fails and the next attempt. The default (with no connect-retry) is 120 seconds.

Default **no connect-retry**

Parameters *seconds* — Specifies time in seconds.

Values 1-65535

description

Syntax **description** *description-string*
no description

Context config>router>origin-validation>rpki-session

Description This command configures a description for an RPKI-Router session.

Default **no description**

Parameters *description-string* — Specifies a text string up to 80 characters in length.

local-address

Syntax **local-address** *ip-address*
no local-address

Context config>router>origin-validation>rpki-session

Description This command configures the local address to use for setting up the TCP connection used by an RPKI-Router session. The default local-address is the outgoing interface IPv4 or IPv6 address. The local-address cannot be changed without first shutting down the session.

Default **no local-address**

Parameters *ip-address* — Specifies an IPv4 address or an IPv6 address.

port

Syntax **port** *port-id*
no port

Context config>router>origin-validation>rpki-session

Description This command configures the destination port number to use when contacting the cache server. The default port number is 323. The port cannot be changed without first shutting down the session.

Default **no port**

Parameters *port-id* — Specifies a port-id.

Values 0-65535

refresh-time

Syntax **refresh-time** *seconds1* **hold-time** *seconds2*
no refresh-time

Context config>router>origin-validation>rpki-session

Description This command is used to configure the **refresh-time** and **hold-time** intervals that are used for liveness detection of the RPKI-Router session. The **refresh-time** defaults to 300 seconds and is reset whenever a Reset Query PDU or Serial Query PDU is sent to the cache server. When the timer expires, a new Serial Query PDU is sent with the last known serial number.

The **hold-time** specifies the length of time in seconds that the session is to be considered UP without any indication that the cache server is alive and reachable. The timer defaults to 600 seconds and must be at least 2x the refresh-time (otherwise the CLI command is not accepted). Reception of any PDU from the cache server resets the hold timer. When the **hold-time** expires, the session is considered to be DOWN and the stale timer is started.

Default **no referesh-time**

Parameters *seconds1* — Specifies a time in seconds.

Values 30-32767

seconds2 — Specifies a time in seconds.

Values 60-65535

shutdown

Syntax **shutdown**
no shutdown

Context config>router>origin-validation>rpki-session

Description This command administratively disables an RPKI-Router session. The no form of the command enables the RPKI-Router session.

Default **no shutdown**

stale-time

Syntax **stale-time** *seconds*
no stale-time

Context config>router>origin-validation>rpki-session

Description This command configures the maximum length of time that prefix origin validation records learned from the cache server remain useable after the RPKI-Router session goes down. The default stale-time is 3600 seconds (1 hour). When the timer expires all remaining stale entries associated with the session are deleted.

Default **no stale-time**

Parameters *seconds* — Specifies a time in seconds.

Values 60-3600

static-entry

Syntax **static-entry** *ip-prefix/ip-prefix-length* **upto** *prefix-length2* **origin-as** *as-number* [**valid | invalid**]
no static-entry *ip-prefix/ip-prefix-length* **upto** *prefix-length2* **origin-as** *as-number*

Context config>router>origin-validation

Description This command configures a static VRP entry indicating that a particular origin AS is either valid or invalid for a particular IP prefix range. Static VRP entries are stored along with dynamic VRP entries (learned from local cache servers using the RPKI-Router protocol) in the origin validation database of the router. This database is used for determining the **origin-validation** state of IPv4 and/or IPv6 BGP routes received over sessions with the **enable-origin-validatio**n command configured.

Note that static entries can only be configured under the **config>router>origin-validation** context of the base router.

Default **no static entries**

Parameters *ip-prefix/ip-prefix-length* — Specifies an IPv4 or IPv6 address with a minimum prefix length value.

Values 60-3600

prefix-length2 — Specifies the maximum prefix length.

as-number — Specifies as-number.

Values 0-4294967295

valid **—** Specifies a keyword meaning the static entry expresses a valid combination of origin AS and prefix range.

invalid **—** Specifies a keyword meaning the static entry expresses an invalid combination of origin AS and prefix range.

router-id

Syntax **router-id** *ip-address*
no router-id

Context config>router

Description This command configures the router ID for the router instance.

The router ID is used by both OSPF and BGP routing protocols in this instance of the routing table manager. IS-IS uses the router ID value as its system ID.

When configuring a new router ID, protocols are not automatically restarted with the new router ID. The next time a protocol is initialized, the new router ID is used. This can result in an interim period of time when different protocols use different router IDs.

It is possible to configure an SR OS node to operate with an IPv6 only BOF and no IPv4 system interface address. When configured in this manner, the operator must explicitly define IPv4 router IDs for protocols such as OSPF and BGP as there is no mechanism to derive the router ID from an IPv6 system interface address.

To force the new router ID to be used, issue the **shutdown** and **no shutdown** commands for each protocol that uses the router ID, or restart the entire router.

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

Default The system uses the system interface address (which is also the loopback address).
If a system interface address is not configured, use the last 32 bits of the chassis MAC address.

Parameters *router-id* — The 32 bit router ID expressed in dotted decimal notation or as a decimal value.

service-prefix

Syntax **service-prefix** *ip-prefix/mask* **|** *ip-prefix netmask* [**exclusive**]
no service-prefix *ip-prefix/mask* | *ip-prefix netmask*

Context config>router

Description This command creates an IP address range reserved for IES or VPLS services.

The purpose of reserving IP addresses using **service-prefix** is to provide a mechanism to reserve one or more address ranges for services.

When services are defined, the address must be in the range specified as a service prefix. If a service prefix is defined, then IP addresses assigned for services must be within one of the ranges defined in the **service-prefix** command. If the **service-prefix** command is not configured, then no limitations exist.

Addresses in the range of a service prefix can be allocated to a network port unless the exclusive parameter is used. Then, the address range is exclusively reserved for services.

When a range that is a superset of a previously defined service prefix is defined, the subset is replaced with the superset definition; for example, if a service prefix exists for 10.10.10.0/24, and a service prefix is configured as 10.10.0.0/16, then 10.10.10.0/24 is replaced by the new 10.10.0.0/16 configuration.

When a range that is a subset of a previously defined service prefix is defined, the subset replaces the existing superset, providing addresses used by services are not affected; for example, if a service prefix exists for 10.10.0.0/16, and a service prefix is configured as 10.10.10.0/24, then the 10.10.0.0/16 entry is removed as long as no services are configured that use 10.10.x.x addresses other than 10.10.10.x.

The **no** form of the command removes all address reservations. A service prefix cannot be removed while one or more service uses an address or addresses in the range.

Default no service-prefix - no IP addresses are reserved for services.

Parameters *ip-prefix/mask* — The IP address prefix to include in the service prefix allocation in dotted decimal notation.

Values	ipv4-prefix:	a.b.c.d (host bits must be 0)
	ipv4-prefix-length:	0 — 32
	ipv6-prefix:	x:x:x:x:x:x:x:x (eight 16-bit pieces)
		x:x:x:x:x:x:d.d.d.d
		x: [0 — FFFF]H
		d: [0 — 255]D
	ipv6-prefix-length:	0 — 128

Values exclusive

When this option is specified, the addresses configured are exclusively used for services and cannot be assigned to network ports.

sgt-qos

Syntax **sgt-qos**

Context config>router

Description This command configures DSCP/Dot1p re-marking for self-generated traffic.

application

Syntax **application** *dscp-app-name* **dscp** {*dscp-value* |*dscp-name*}
application *dot1p-app-name* **dot1p** *dot1p-priority*
no application {*dscp-app-name*|*dot1p-app-name*}

Context config>router>sgt-qos

Description This command configures DSCP/Dot1p re-marking for applications.

Parameters *dscp-app-name* — Specifies the DSCP application name.

Values bgp, cflowd, dhcp, dns, ftp, icmp, igmp, igmp-reporter, l2tp, ldp, mld, msdp, ndis, ntp, ospf, pim, ptp, radius, rip, rsvp, snmp, snmp-notification, srrp, ssh, syslog, tacplus, telnet, tftp, traceroute, vrrp

dscp-value — Specifies the DSCP value

Values 0 — 63

dscp-name — Specifies the DSCP name.

none, be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63

dot1p-priority — Specifies the Dot1p priority.

Values none, 0 — 7

dot1p-app-name — Specifies the Dot1p application name.

Values arp, isis, pppoe

dscp

Syntax **dscp** *dscp-name* **fc** *fc-name*
no dscp *dscp-name*

Context config>router>sgt-qos

Description This command configures DSCP name to FC mapping.

Parameters *dscp-name* — Specifies the DSCP name.

Values be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63

fc-name — Specifies the forward class name.

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

bfd-template

Syntax **bfd-template** *name* [**create**]
no bfd-template *name*

Context config>router>bfd

Description This command creates or edits a BFD template. A BFD template defines the set of configurable parameters used by a BFD session. These include the transmit and receive timers used for BFD CC packets, the transmit timer interval used when the session is providing a CV function, the multiplier value, the echo-receive interval, and whether ther BFD session terminates in the CPM network processor.

Default no bfd-template

Parameters *name* — Specifies a text string name for the template up to 32 characters in printable 7-bit ASCII, enclosed in double quotes.

transmit-interval

Syntax **transmit-interval** *transmit-interval*
no transmit-interval

Context config>router>bfd>bfd-template

Description This command specifies the transmit timer used for BFD packets. If the template is used for a BFD session on an MPLS-TP LSP, then this timer is used for CC packets.

Default no transmit-interval

Parameters *transmit-interval* — Specifies the transmit interval. Note that the minimum interval that can be configured is hardware dependent.

Values 10 ms — 100,000 ms in 1 ms intervals

Default 10 ms for CPM3 or higher; 1 second for other hardware

receive-interval

Syntax **receive-interval** *receive-interval*
no receive-interval

Context config>router>bfd>bfd-template

Description This command specifies the receive timer used for BFD packets. If the template is used for a BFD session on an MPLS-TP LSP, then this timer is used for CC packets.

Default no receive-interval

Parameters *receive-interval* — Specifies the receive interval. Note that the minimum interval that can be configured is hardware dependent.

Values 10 ms — 100,000 ms in 1 ms intervals

Default 10 ms for CPM3 or higher; 1 second for other hardware

cv-tx

Syntax **cv-tx** *transmit-interval*
no cv-tx

Context config>router>bfd>bfd-template

Description This command specifies the transmit interval used by BFD packets used for MPLS-TP proactive CV.

Default no cv-tx

Parameters *transmit-interval* — Specifies the transmit interval. This parameter is only used if a BFD session is enabled with CV on an MPLS-TP LSP.

Values 1 sec to 30 sec in 1 second increments

Default 1 second

echo-receive

Syntax **echo-receive** *echo-interval*
no echo-receive

Context config>router>bfd>bfd-template

Description This command sets the minimum echo receive interval, in milliseconds, for a session. This is not used by a BFD session for MPLS-TP.

Default no echo-receive

Parameters *echo-interval* — Specifies the echo receive interval.

Values 100 ms — 100,000 ms in 1 ms increments

Default 100

multiplier

Syntax **multiplier** *multiplier*
no multiplier

Context config>router>bfd>bfd-template

Description This command specifies the detect multiplier used for a BFD session. If a BFD control packet is not received for a period of *multiplier* x *receive-interval*, then the session is declared down.

Default 3

Parameters *multiplier* — Specifies the multiplier.

Values 3 — 20, integers

Default 3

type

Syntax [**no**] **type cpm-np**

Context config>router>bfd>bfd-template

Description This command selects the CPM network processor as the local termination point for the BFD session. This is enabled by default.

Default type cpm-np

single-sfm-overload

Syntax **single-sfm-overload** [**holdoff-time** *holdoff-time*]
no single-sfm-overload

Context config>router

Description This command, if enabled, will cause the OSPF for the service to enter an overload state when the node has fewer than the full set of SFMs functioning. Once a significant amount of multicast capacity is lost due to missing SFM(s) then the overload state will be entered.

The **no** form of this command causes the overload state to be cleared.

Default no single-sfm-overload

Parameters *holdoff-time* — This parameter specifies the delay between the detection of a single SFM and enacting the overload state.

Values 1— 600 seconds

Default 0 seconds

static-route

Syntax [**no**] **static-route** {*ip-prefix/prefix-length* **|** *ip-prefix netmask*} [**preference** *preference*] [**metric** *metric*] [**tag** *tag*] [**community** *comm-id*] [**enable | disable**] **next-hop** *ip-int-name* **|** *ip-address* [*mcast-family*] [**bfd-enable** |{**cpe-check** *cpe-ip-address* [**interval** *seconds*] [**drop-count** *count*] [**log**]} {**prefix-list** *prefix-list-name* [**all | none**]} |{**fc** *fc-name* [**priority** {**low | high**}]}] [**ldp-sync**] [**validate-next-hop]**

[**no**] **static-route** {*ip-prefix/prefix-length* **|** *ip-prefix netmask*} [**preference** *preference*] [**metric** *metric*] [**tag** *tag*] [**community** *comm-id*] [**enable | disable**] **indirect** *ip-address* [**ldp | rsvp-te** [**disallow-igp**]] [**cpe-check** *cpe-ip-address* [**interval** *seconds*] [**drop-count** *count*] [**log**]] {**prefix-list** *prefix-list-name* [**all | none**]} |{**fc** *fc-name* [**priority** {**low | high**}]}

[**no**] **static-route** {*ip-prefix/prefix-length* **|** *ip-prefix netmask*} [**preference** *preference*] [**metric** *metric*] [**tag** *tag*] [**community** *comm-id*] [**enable | disable**] **black-hole** [*mcast-family*] {**prefix-list** *prefix-list-name* [**all | none**]}

Context config>router

Description This command creates static route entries for both the network and access routes.
When configuring a static route, either **next-hop**, **indirect** or **black-hole** must be configured.
The **no** form of the command deletes the static route entry. If a static route needs to be removed when multiple static routes exist to the same destination, then as many parameters to uniquely identify the static route must be entered.

If a CPE connectivity check target address is already being used as the target address in a different static route, then cpe-check parameters must match. If they do not, the new configuration command will be rejected.

If a static-route command is issued with no cpe-check target but the destination prefix/netmask and next-hop matches a static route that did have an associated cpe-check, the cpe-check test will be removed from the associated static route.

Default No static routes are defined.

Parameters *ip-prefix/prefix-length* — The destination address of the static route.

Values	ipv4-prefix	a.b.c.d (host bits must be 0)	
	ipv4-prefix-length	0 — 32	
	ipv6-prefix	x:x:x:x:x:x:x:x (eight 16-bit pieces)	
		x:x:x:x:x:x:d.d.d.d	
		x	[0 — FFFF]H
		d	[0 — 255]D
	ipv6-prefix-length	0 — 128	

ip-address — The IP address of the IP interface. The *ip-addr* portion of the **address** command specifies the IP host address that will be used by the IP interface within the subnet. This address must be unique within the subnet and specified in dotted decimal notation.

Values	ipv4-address	a.b.c.d (host bits must be 0)
	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

netmask — The subnet mask in dotted decimal notation.

Values 0.0.0.0 — 255.255.255.255 (network bits all 1 and host bits all 0)

community *comm-id* **—** This configuration option associates a BGP community with the static route. The community can be matched in route policies and is automatically added to BGP routes exported from the static route.

Values		
	comm-id	asn:comm-val | well-known-comm
	asn	0 — 65535
	comm-val	0 — 65535
	well-known-comm	no-advertise, no-export, no-export-subconfed

ldp-sync — Extends the LDP synchronization feature to a static route. When an interface comes back up, it is possible that a preferred static route using the interface as next-hop for a given prefix is enabled before the LDP adjacency to the peer LSR comes up on this interface. In this case, traffic on an SDP that uses the static route for the far-end address would be black-holed until the LDP session comes up and the FECs exchanged.

This option when enabled delays the activation of the static route until the LDP session comes up over the interface and the ldp-sync-timer configured on that interface has expired.

preference *preference* **—** The preference of this static route versus the routes from different sources such as BGP or OSPF, expressed as a decimal integer. When modifing the preference of an existing static route, the metric will not be changed unless specified.

Different protocols should not be configured with the same preference. If this occurs, the tiebreaker is according to the default preference table defined in Table 5 on page 132.

If multiple routes are learned with an identical preference using the same protocol, the lowest-cost route is used. If multiple routes are learned with an identical preference using the same protocol, and the costs (metrics) are equal, then the route to use is determined by the configuration of the **ecmp** command

prefix-list ***prefix-list-name*** [**all | none**] **—** Specifies the prefix-list to be considered.

metric *metric* **—** The cost metric for the static route, expressed as a decimal integer. This value is used when importing the static route into other protocols such as OSPF. When the metric is configured as 0 then the metric configured in OSPF, default-import-metric, applies. When modifying the metric of an existing static route, the preference will not change unless specified. This value is also used to determine which static route to install in the forwarding table:

- If there are multiple static routes with the same preference but different metrics then the lower cost (metric) route will be installed.
- If there are multiple static routes with equal preferences and metrics then ECMP rules apply .
- If there are multiple routes with different preferences then the lower preference route will be installed.

Default 1

Values 0 — 65535

next-hop [*ip-address* | *ip-int-name*] **—** Specifies the directly connected next hop IP address used to reach the destination. If the next hop is over an unnumbered interface or a point-to-point interface, the ip-int-name of the unnumbered or point-to-point interface (on this node) can be configured.

The **next-hop** keyword and the **indirect** or **black-hole** keywords are mutually exclusive. If an identical command is entered (with the exception of either the **indirect** or **black-hole** parameters), then this static route will be replaced with the newly entered command, and unless specified, the respective defaults for preference and metric will be applied.

The *ip-address* configured here can be either on the network side or the access side on this node. This address must be associated with a network directly connected to a network configured on this node.

Values		
	ip-int-name	32 chars max
	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

indirect *ip-address* **—** Specifies that the route is indirect and specifies the next hop IP address used to reach the destination.

The configured *ip-addr* is not directly connected to a network configured on this node. The destination can be reachable via multiple paths. The indirect address can only resolved from dynamic routing protocol. Another static route cannot be used to resolve the indirect address.

The **indirect** keyword and the **next-hop** or **black-hole** keywords are mutually exclusive. If an identical command is entered (with the exception of either the **next-hop** or **black-hole** parameters), then this static route will be replaced with the newly entered command and unless specified the respective defaults for preference and metric will be applied.

The *ip-addr* configured can be either on the network or the access side and is normally at least one hop away from this node.

black-hole — Specifies the route is a black hole route. If the destination address on a packet matches this static route, it will be silently discarded.

The **black-hole** keyword and the **next-hop** or **indirect** keywords are mutually exclusive. If an identical command is entered (with the exception of either the **next-hop** or **indirect** parameters), then this static route will be replaced with the newly entered command, and unless specified, the respective defaults for preference and metric will be applied.

disallow-igp — This value is valid only for indirect static routes. If set and if none of the defined tunneling mechanisms (RSVP-TE, LDP or IP) qualify as a next-hop, the normal IGP next-hop to the indirect next-hop address will not be used. If not set then the IGP next-hop to the indirect next-hop address can be used as the next-hop of the last resort.

tag — Adds a 32-bit integer tag to the static route. The tag is used in route policies to control distribution of the route into other protocols.

validate-next-hop — This configuration option tracks the state of the next-hop in the IPv4 ARP cache or IPv6 Neighbor Cache. When the next-hop is not reachable and is removed from the ARP or Neighbor Cache, the next-hop will no longer be considered valid. When the next-hop is again reachable and present in the ARP/Neighbor Cache, the static route will be considered valid.

Note: This feature is supported for directly connected next-hops only, and is exclusive with indirect routes.

Table 5: Default Route Preferences

Label	Preference	Configurable
Direct attached	0	No
Static-route	5	Yes
OSPF Internal routes	10	Yes
IS-IS level 1 internal	15	Yes
IS-IS level 2 internal	18	Yes
OSPF external	150	Yes
IS-IS level 1 external	160	Yes
IS-IS level 2 external	165	Yes
BGP	170	Yes

Default 5

Values 1 — 255

enable — Static routes can be administratively enabled or disabled. Use the **enable** parameter to re-enable a disabled static route. In order to enable a static route, it must be uniquely identified by the IP address, mask, and any other parameter that is required to identify the exact static route.

The administrative state is maintained in the configuration file.

Default enable

disable — Static routes can be administratively enabled or disabled. Use the **disable** parameter to disable a static route while maintaining the static route in the configuration. In order to enable a static route, it must be uniquely identified by the IP address, mask, and any other parameter that is required to identify the exact static route.

The administrative state is maintained in the configuration file.

Default enable

bfd-enable — Associates the state of the static route to a BFD session between the local system and the configured nexthop. This keyword cannot be configured if the **indirect** or **blackhole** keywords are specified. The remote end of the BFD session must also be configured to originate or accept the BFD session controlling the static-route state.

mcast-family — Enables submission of the IPv4 or IPv6 static route into IPv4 or IPv6 multicast RTM.

Values **mcast-ipv4**, **mcast-ipv6**

rsvp-te — This parameter allows the static route to be resolved via an RSVP-TE based LSP. The static route nexthop will be resolved via the best RSVP-TE based LSP to the associated indirect next hop. By default, if an RSVP-TE LSP is not available, the IGP route table will be used to resolve the associated nexthop. If the keyword “disallow-igp” is configured, the associated static route will not be resolved through the IPv4 route table if an RSVP-TE based LSP is not available.

cpe-check *target-ip-address* **—** This parameter specifies the IP address of the target CPE device. ICMP pings will be sent to this target IP address. This parameter must be configured to enable the CPE connectivity feature for the associated static route. The target-ip-address cannot be in the same subnet as the static route subnet itself to avoid possible circular references. This option is mutually exclusive with BFD support on a given static route.

Default no cpe-check enabled

interval *seconds* — This optional parameter specifies the interval between ICMP pings to the target IP address.

Values 1 —255 seconds

Default 1 seconds

drop-count *count* — This optional parameter specifies the number of consecutive ping-replies that must be missed to declare the CPE down and to de-active the associated static route.

Values 1 —255

Default 3

log — This optional parameter enables the ability to log transitions between active and in-active based on the CPE connectivity check. Events should be sent to the system log, syslog and SNMP traps.

Sample Output

```
*B:Dut-C# configure router "management"
*B:Dut-C>config>router# info
----------------------------------------------
       static-route 1.1.1.0/24 next-hop 172.31.117.1
        static-route 1::/96 next-hop 3000::AC1F:7567
----------------------------------------------
*B:Dut-C>config>router#


*B:Dut-C>config>router# show router "management" route-table
===============================================================================
Route Table (Router: management)
===============================================================================
Dest Prefix                                   Type    Proto    Age         Pref
       Next Hop[Interface Name]                                     Metric
-------------------------------------------------------------------------------
1.1.1.0/24                                    Remote  Static   00h01m29s   0
       172.31.117.1                                                 1
138.203.0.0/16                                Remote  Static   05h01m11s   0
       172.31.117.1                                                 1
172.31.117.0/24                               Local   Local    05h04m10s   0
       management                                                   0
-------------------------------------------------------------------------------
No. of Routes: 3
===============================================================================
*B:Dut-C>config>router#


*B:Dut-C>config>router# show router "management" route-table ipv6
================================================================================
IPv6 Route Table (Router: management)
================================================================================
Dest Prefix                                   Type    Proto    Age         Pref
       Next Hop[Interface Name]                                     Metric
--------------------------------------------------------------------------------
1::/96                                        Remote  Static   00h01m09s   5
       3000::AC1F:7567                                              1
3000::/96                                     Local   Local    05h04m12s   5
       management                                                   0
3FFE::/96                                     Remote  Static   00h00m11s   5
       3000::AC1F:7567                                              0
--------------------------------------------------------------------------------
No. of Routes: 3
================================================================================
*B:Dut-C>config>router#
```

Note that the help info output (?) is inherited from the basic router context and does not reflect the specific syntax for the management context.

```
Only next-hop is allowed with any extra parameters.

*B:Dut-C>config>router# show router "management" static-?
static-arp      static-route


*B:Dut-C>config>router# show router "management" static-route
================================================================================
Static Route Table (Router: management)  Family: IPv4
================================================================================
Prefix                                        Tag         Met    Pref Type Act
   Next Hop                                    Interface
--------------------------------------------------------------------------------
1.1.1.0/24                                    0           1      5    NH   Y
   172.31.117.1                                n/a
--------------------------------------------------------------------------------
No. of Static Routes: 1
================================================================================
*B:Dut-C>config>router#


*B:Dut-C>config>router# show router "management" static-route ipv6
================================================================================
Static Route Table (Router: management)  Family: IPv6
================================================================================
Prefix                                        Tag         Met    Pref Type Act
Next Hop                                    Interface
--------------------------------------------------------------------------------
1::/96                                        0           1      5    NH   Y
   3000::AC1F:7567                             management
--------------------------------------------------------------------------------
No. of Static Routes: 1
================================================================================
*B:Dut-C>config>router#
```

triggered-policy

Syntax **triggered-policy**
no triggered-policy

Context config>router

Description This command triggers route policy re-evaluation.

By default, when a change is made to a policy in the **config router policy options** context and then committed, the change is effective immediately. There may be circumstances when the changes should or must be delayed; for example, if a policy change is implemented that would affect every BGP peer on a router, the consequences could be dramatic. It would be more effective to control changes on a peer-by-peer basis.

If the **triggered-policy** command is enabled, and a given peer is established, and you want the peer to remain up, in order for a change to a route policy to take effect, a **clear** command with the *soft* or *soft inbound* option must be used; for example, **clear router bgp neighbor x.x.x.x soft**. This keeps the peer up, and the change made to a route policy is applied only to that peer or group of peers.

ttl-propagate

Syntax **ttl-propagate**

Context config>router

Description This command enables the context to configure TTL propagation for transit and locally generated packets in the Global Routing Table (GRT) and VPRN routing contexts

Default none

label-route-local

Syntax **label-route-local [all | none]**

Context config>router>ttl-propagate

Description This command configures the TTL propagation for locally generated packets which are forwarded over a BGP label route in the Global Routing Table (GRT) context.

For IPv4 and IPv6 packets forwarded using a RFC 3107 label route in the global routing instance, including 6PE, the all value of the command enables TTL propagation from the IP header into all labels in the transport label stack. The none value reverts to the default mode which disables TTL propagation from the IP header to the labels in the transport label stack. This command does not have a no version.

Note that the TTL of the IP packet is always propagated into the RFC 3107 label itself, and this command only controls the propagation into the transport labels, for example, labels of the RSVP or LDP LSP to which the BGP label route resolves and which are pushed on top of the BGP label.

Note that if the BGP peer advertised the implicit-null label value for the BGP label route, the TTL propagation will not follow the configuration described, but will follow the configuration to which the BGP label route resolves:

RSVP LSP shortcut:

- configure router mpls shortcut-local-ttl-propagate

LDP LSP shortcut:

- configure router ldp shortcut-local-ttl-propagate

This feature does not impact packets forwarded over BGP shortcuts. The ingress LER operates in uniform mode by default and can be changed into pipe mode using the configuration of TTL propagation for RSVP or LDP LSP shortcut listed.

Default none

Parameters **none —** The TTL of the IP packet is not propagated into the transport label stack.

all — The TTL of the IP packet is propagated into all labels of the transport label stack.

label-route-transit

Syntax **label-route-transit [all | none]**

Context cconfig>router>ttl-propagate

Description This command configures the TTL propagation for transit packets which are forwarded over a BGP label route in the Global Routing Table (GRT) context.

For IPv4 and IPv6 packets forwarded using a RFC 3107 label route in the global routing instance, including 6PE, the all value of the command enables TTL propagation from the IP header into all labels in the transport label stack. The none value reverts to the default mode which disables TTL propagation from the IP header to the labels in the transport label stack. This command does not have a no version.

Note that the TTL of the IP packet is always propagated into the RFC 3107 label itself, and this command only controls the propagation into the transport labels, for example, labels of the RSVP or LDP LSP to which the BGP label route resolves and which are pushed on top of the BGP label.

Note that if the BGP peer advertised the implicit-null label value for the BGP label route, the TTL propagation will not follow the configuration described, but will follow the configuration to which the BGP label route resolves.

RSVP LSP shortcut:

- configure router mpls shortcut-transit-ttl-propagate

LDP LSP shortcut:

- configure router ldp shortcut-transit-ttl-propagate

This feature does not impact packets forwarded over BGP shortcuts. The ingress LER operates in uniform mode by default and can be changed into pipe mode using the configuration of TTL propagation for the listed RSVP or LDP LSP shortcut.

Default none

Parameters **none —** The TTL of the IP packet is not propagated into the transport label stack.

all — The TTL of the IP packet is propagated into all labels of the transport label stack.

lsr-label-route

Syntax **ttl-propagate [all | none]**

Context config>router>ttl-propagate

Description This command configures the TTL propagation for transit packets at a router acting as an LSR for a BGP label route.

When an LSR swaps the BGP label for a ipv4 prefix packet, thus acting as a ABR, ASBR, or data-path Route-Reflector (RR) in the base routing instance, or swaps the BGP label for a vpn-ipv4 or vpn-ipv6 prefix packet, thus acting as an inter-AS Option B VPRN ASBR or VPRN data path Route-Reflector (RR), the all value of this command enables TTL propagation of the decremented TTL of the swapped BGP label into all outgoing LDP or RSVP transport labels.

Note that when an LSR swaps a label or stitches a label, it always writes the decremented TTL value into the outgoing swapped or stitched label. What this feature controls is whether this decremented TTL value is also propagated to the transport label stack pushed on top of the swapped or stitched label.

The none value reverts to the default mode which disables TTL propagation. Note this changes the existing default behavior which propagates the TTL to the transport label stack. When a customer upgrades, the new default becomes in effect. This command does not have a no version.

This feature also controls the TTL propagation at an LDP-BGP stitching LSR in the LDP to BGP stitching direction. It also controls the TTL propagation in Carrier Supporting Carrier (CsC) VPRN at both the CsC CE and CsC PE.

Note that SROS does not support ASBR or data path RR functionality for labeled IPv6 routes in the global routing instance (6PE). As such the CLI command of this feature has no impact on prefix packets forwarded in this context.

Default none

Parameters **none —** The TTL of the swapped label is not propagated into the transport label stack.

all — The TTL of the swapped label is propagated into all labels of the transport label stack.

vprn-local

Syntax **vprn-local [all | vc-only | none]**

Context config>router>ttl-propagate

Description This command configures the TTL propagation for locally generated packets which are forwarded over a MPLS LSPs in all VPRN service contexts.

For vpn-ipv4 and vpn-ipv6 packets forwarded in the context of all VPRN services in the system, including 6VPE packets, the all value of the command enables TTL propagation from the IP header into all labels in the stack:

The user can enable the TTL propagation behavior separately for locally generated packets by CPM (vprn-local) and for user and control packets in transit at the node (vprn-transit).

The vc-only value reverts to the default behavior by which the IP TTL is propagated into the VC label but not to the transport labels in the stack. The user can explicitly set the default behavior by configuring the vc-only value. This command does not have a no version.

The value none allows the user to disable the propagation of the IP TTL to all labels in the stack, including the VC label. This is needed for a transparent operation of UDP trace-route in VPRN inter-AS option B such that the ingress and egress ASBR nodes are not traced.

The user can override the global configuration within each VPRN instance using the following commands:

- config service vprn ttl-propagate local [inherit | none | vc-only | all]
- config service vprn ttl-propagate transit [inherit | none | vc-only | all]

Note however the default behavior for a given VPRN instance is to inherit the global configuration for the same command. The user can explicitly set the default behavior by configuring the inherit value.

When a packet is received in a VPRN context but is looked up in the Global Routing Table (GRT), for example, leaking to GRT is enabled, the behavior of the TTL propagation is governed by the RSVP or LDP shortcut configuration when the matching routing is a LSP shortcut route. It is governed by the BGP label route configuration when the matching route is a RFC 3107 label route or a 6PE route.

When a packet is received on one VPRN instance and is redirected using Policy Based Routing (PBR) to be forwarded in another VPRN instance, the TTL propagation is governed by the configuration of the outgoing VPRN instance.

Default vc-only

Parameters **none —** TheTTL of the IP packet is not propagated into the VC label or labels in the transport label stack

vc-only — The TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack.

all — The TTL of the IP packet is propagated into the VC label and all labels in the transport label stack.

vprn-transit

Syntax **vprn-transit [all | vc-only | none**]

Context config>router>ttl-propagate

Description This command configures the TTL propagation for in transit packets which are forwarded over a MPLS LSPs in all VPRN service contexts.

For vpn-ipv4 and vpn-ipv6 packets forwarded in the context of all VPRN services in the system, including 6VPE packets, the all value of the command enables TTL propagation from the IP header into all labels in the stack:

The user can enable the TTL propagation behavior separately for locally generated packets by CPM (vprn-local) and for user and control packets in transit at the node (vprn-transit).

The vc-only value reverts to the default behavior by which the IP TTL is propagated into the VC label but not to the transport labels in the stack. The user can explicitly set the default behavior by configuring the vc-only value. This command does not have a no version.

The value none allows the user to disable the propagation of the IP TTL to all labels in the stack, including the VC label. This is needed for a transparent operation of UDP trace-route in VPRN inter-AS option B such that the ingress and egress ASBR nodes are not traced.

The user can override the global configuration within each VPRN service instance using the following commands:

- config service vprn ttl-propagate local [inherit | none | vc-only | all]
- config service vprn ttl-propagate transit [inherit | none | vc-only | all]

Note however the default behavior for a given VPRN instance is to inherit the global configuration for the same command. The user can explicitly set the default behavior by configuring the inherit value.

When a packet is received in a VPRN context but is looked up in the Global Routing Table (GRT), for example, leaking to GRT is enabled, the behavior of the TTL propagation is governed by the RSVP or LDP shortcut configuration when the matching routing is a LSP shortcut route. It is governed by the BGP label route configuration when the matching route is a RFC 3107 label route or a 6PE route.

When a packet is received on one VPRN instance and is redirected using Policy Based Routing (PBR) to be forwarded in another VPRN instance, the TTL propagation is governed by the configuration of the outgoing VPRN instance

Default vc-only

Parameters **none —** TheTTL of the IP packet is not propagated into the VC label or labels in the transport label stack

vc-only — The TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack.

all — The TTL of the IP packet is propagated into the VC label and all labels in the transport label stack.

Router L2TP Commands

l2tp

Syntax **l2tp**

Context config>router

Description This command enables the context to configure L2TP parameters. L2TP extends the PPP model by allowing Layer 2 and PPP endpoints to reside on different devices interconnected by a packet-switched network.

calling-number-format

Syntax **calling-number-format** *ascii-spec*
no calling-number-format

Context config>router>l2tp

Description This command what string to put in the Calling Number AVP, for L2TP control messages related to a session in this L2TP protocol instance.

Parameters *ascii-spec* — Specifies the L2TP calling number AVP.

Values ascii-spec char-specification ascii-spec
char-specification ascii-char | char-origin
ascii-char a printable ASCII character
char-origin %origin
origin S | c | r | s | l
S - system name, the value of
TIMETRA-CHASSIS-MIB::tmnxChassisName
c - Agent Circuit Id
r - Agent Remote Id
s - SAP ID, formatted as a character string
l - Logical Line ID

exclude-avps

Syntax **exclude-avps** *calling-number*
no exclude-avps

Context config>router>l2tp

Description This command configures the L2TP AVPs to exclude.

next-attempt

Syntax **next-attempt** {**same-preference-level** | **next-preference-level**}
no next-attempt

Context configure>router>l2tp
configure>service>vprn>l2tp

Description This command enables tunnel selection algorithm based on the tunnel preference level.

Parameters **same-preference-level —** In case that the tunnel-spec selection algorithm evaluates into a tunnel that is currently unavailable (for example tunnel in a blacklist) then the next elected tunnel, if available, will be chosen within the same preference-level as the last attempted tunnel. Only when all tunnels within the same preference level are exhausted, the tunnel selection algorithm will move to the next preference level.

In case that a new session setup request is received while all tunnels on the same preference level are blacklisted, the L2TP session will try to be established on blacklisted tunnels before the tunnel selection moves to the next preference level.

next-preference-level — In case that the tunnel-spec selection algorithm evaluates into a tunnel that is currently unavailable (for example tunnel in a blacklist) then the selection algorithm will try to select the tunnel from the next preference level, even though the tunnels on the same preference level might be available for selection.

Default next-preference-level

replace-result-code

Syntax **replace-result-code** *code* [code...(upto 3 max)]
no replace-result-code

Context configure>router>l2tp
configure>service>vprn>l2tp

Description This command will replace CDN Result-Code 4, 5 and 6 on LNS with the Result Code 2. This is needed for interoperability with some implementation of LAC which only take action based on CDN Result-Code 2, while ignore CDN Result-Code 4, 5 and 6.

Default no replace-result-code

Parameters *code* — Specifies the L2TP Result codes that need to be replaced.

Values cdn-tmp-no-facilities — CDN Result-Code 4 on LNS will be replaced with the result code 2 before it is sent to LAC.
cdn-prem-no-facilities — CDN Result-Code 5 on LNS will be replaced with the result code 2 before it is sent to LAC.
cdn-inv-dest — CDN Result-Code 6 on LNS will be replaced with the result code 2 before it is sent to LAC.

tunnel-selection-blacklist

Syntax **tunnel-selection-blacklist**

Context config>router>l2tp

Description This command enables the context to configure L2TP Tunnel Selection Blacklist parameters.

add-tunnel

Syntax **add-tunnel never**
add-tunnel on *reason* [*reason*...(upto 8 max)]
no add-tunnel

Context configure>router>l2tp>tunnel-selection-blacklist
configure>service>vprn>l2tp>tunnel-selection-blacklist

Description This command will force the tunnel to the blacklist and render it unavailable for new sessions for the duration of pre-configured time. Peers are always forced to the black list in case that they time out (failure to receive response to control packets). In addition to time outs, certain events can be used to trigger placement of the tunnel on the black list.

Parameters *reason* — Specifies the return codes or events that determine which tunnels are added to the blacklist

Values **cdn-err-code** — A tunnel will be forced to the blacklist in case that CDN message with the Result Code 2 (Call disconnected for the reasons indicated in error code) is received.
cdn-inv-dest — A tunnel will be forced to the blacklist in case that CDN message with the Result Codes 6 (Invalid destination) is received.
cdn-tmp-no-facilities — A tunnel will be forced to the blacklist in case that CDN message with the Result Code 4 is received (Call failed due to lack of appropriate facilities being available - temporary condition) is received.
cdn-perm-no-facilities — A tunnel will be forced to the blacklist in case that CDN message with the Result Codes 5 (Call failed due to lack of appropriate facilities being available - permanent condition) is received.
tx-cdn-not-established-in-time — A tunnel will be forced to the blacklist in case that CDN message with the Result Code 10 (Call was not established within time allotted by LAC) is sent from the LAC to the LNS.
stop-ccn-err-code — A tunnel will be forced to the blacklist in case that StopCCN message with the Result Code 2 (General error – Error Code indicates the problem) is sent or received.
stop-ccn-other — A tunnel will be forced to the blacklist in case that StopCCN message with the following Result Codes is received:

(1) General request to clear control connection
(4) Requestor is not authorized to establish a control channel
(5) Protocol version not supported
(6) Requestor is being shutdown
Or in the case that the StopCCN with the following result codes is transmitted:

(4) Requestor is not authorized to establish a control channel.
(5) Protocol version not supported

The receipt of the following Result Codes will NEVER blacklist a tunnel:
(0) Reserved
(3) Control channel already exist
(7) Finite state machine error
(8) Undefined

Transmission of the following Result Codes will NEVER blacklist a tunnel:

(1) General request to clear control connection
(3) Control channel already exist
(6) Requestor is being shutdown
(7) Finite state machine error

addr-change-timeout — A timed-out tunnel for which the peer IP address has changed mid-session (from the one that is provided initially during configuration) will be forced to the blacklist. In absence of this configuration option, only the configured peer for the tunnel will be blacklisted, but not the tunnel itself which now has a different peer address than the one initially configured.

never — When specified, no tunnels will be placed on blacklist under any circumstance. This parameter will available to preserve backward compatibility.

max-list-length

Syntax **max-list-length unlimited**
max-list-length *count*
no max-list-length

Context configure>router>l2tp>tunnel-selection-blacklist
configure>service>vprn>l2tp>tunnel-selection-blacklist

Description This command configured the maximum length of the peer/tunnel blacklist.

This command specifies how many items (tunnels or peers) can be in the tunnel-selection-blacklist. If a tunnel or peer needs to be added to the tunnel-selection-blacklist and the tunnel-selection-blacklist is full, the system will remove the item (tunnel or peer) from the blacklist that was in this blacklist forthe longest time.

Default unlimited

Parameters **unlimited —** Specifies there is no limit.

count — Specifies how many items (tunnels or peers) can be in the tunnel-selection-blacklist.

Values 1..65635

max-time

Syntax **max-time** *minutes*
no max-time

Context configure>router>l2tp>tunnel-selection-blacklist
configure>service>vprn>l2tp>tunnel-selection-blacklist

Description This command configures time for which an entity (peer or a tunnel) are kept in the blacklist.

Default 5 minutes

Parameters *minutes* — Specifies the maximum time a tunnel or peer may remain in the blacklist

Values 1..60

timeout-action

Syntax **timeout-action** *action*
no timeout-action

Context configure>router>l2tp>tunnel-selection-blacklist
configure>service>vprn>l2tp>tunnel-selection-blacklist

Description This command defines an action that will be executed on the entity (peer/tunnel) in the blacklist once the entity becomes eligible for selection again.

Default remove-from-blacklist

Parameters *action* — Specifies the Action to be taken when a tunnel or peer has been in the blacklist for the max-period of time.

Values remove-from-blacklist — The peer or tunnel in the blacklist will be removed completely from the blacklist and made eligible for the selection process once the max-time expires. In this mode of operation, multiple new sessions can be mapped into the same, newly released tunnel from the blacklist. The first such session will try to setup the tunnel, while the other will be buffered until the tunnel establishment process is completed. In case that the tunnel remains unavailable, it will be placed in the blacklist again. Consequently all new sessions will have be re-negotiated over an alternate tunnel.
try-one-session — Once the max-time expired, the peer or tunnel in the blacklist is made available for selection only to a single new session request. Only upon successful tunnel establishment will the incoming new sessions be eligible to be mapped into this tunnel. This behavior will avoid session establishment delays in case that the tunnel just removed from the blacklist is still unavailable.

peer-address-change-policy

Syntax **peer-address-change-policy** {**accept | ignore | reject**}

Context config>router>l2tp

Description This command specifies what to do in case the system receives a L2TP responsefrom another address than the one the request was sent to.

Parameters **accept —** Specifies that this system accepts any source IP address change of received L2TP control messages related to a locally originated tunnel in the state waitReply and rejectsany peer address change for other tunnels; in case the new peer IPaddress is accepted, it is learned and used as destination addressin subsequent L2TP messages.

ignore — Specifiesthat this system ignores any source IP address change of received L2TP control messages, does not learn anynew peer IP address and does not change the destination address insubsequent L2TP messages.

reject — Specifies that this system rejects any source IP address change of received L2TP control messages and drops those messages.

receive-window-size

Syntax **receive-window-size** [4..1024]
no receive-window-size

Context config>router>l2tp

Description This command configures the L2TP receive window size.

session-limit

Syntax **session-limit** *session-limit*
no session-limit

Context config>router>l2tp

Description This command configures the L2TP session limit of this router.

Parameters *session-limit* — Specifies the session limit.

Values 1..131071

group

Syntax **group** *tunnel-group-name* [**create**]
no group *tunnel-group-name*

Context config>router>l2tp

Description This command configures an L2TP tunnel group.

Parameters *tunnel-group-name* — Specifies a name string to identify a L2TP group up to 63 characters in length.

create — This keyword is mandatory when creating a tunnel group name. The **create** keyword requirement can be enabled/disabled in the **environment>create** context.

session-limit

Syntax **session-limit** *session-limit*
no session-limit

Context config>router>l2tp

Description This command configures the L2TP session limit for the router. L2TP is connection-oriented. The L2TP Network Server (LNS) and LAC maintain state for each call that is initiated or answered by an LAC. An L2TP session is created between the LAC and LNS when an end-to-end PPP connection is established between a remote system and the LNS. Datagrams related to the PPP connection are sent over the tunnel between the LAC and LNS. There is a one to one relationship between established L2TP sessions and their associated calls.

Parameters *session-limit* — Specifies the number of sessions allowed.

Default no session-limit

Values 1 — 131071

avp-hiding

Syntax **avp-hiding** *sensitive* **|** *always*
no avp-hiding

Context config>router>l2tp>group

Description This command configures Attribute Value Pair (AVP) hiding. This capability can be used to avoid the passing of sensitive data, such as user passwords, as cleartext in an AVP.

The **no** form of the command returns the value to **never** allow AVP hiding.

Parameters *avp-hiding* — Specifies the method to be used for the authentication of the tunnels in this L2TP group.

Default no avp-hiding

Values sensitive — AVP hiding is used only for sensitive information (such as username/password).
always — AVP hiding is always used.

challenge

Syntax **challenge** *always*
no challenge

Context config>router>l2tp>group

Description This command configures the use of challenge-response authentication.

The **no** form of the command reverts to the default **never** value.

Parameters *always* — Specifies that the challenge-response authentication is always used.

Default no challenge

Values always

df-bit-lac

Syntax **df-bit-lac** {**always**|**never**}
no df-bit-lac

Context config>router>l2tp
config>service>vprn>l2tp

Description By default, the LAC df-bit-lac is always set and sends all L2TP packets with the DF bit set to 1. The DF bit is configurable to allow downstream routers to fragment the L2TP packets. The LAC itself will not fragment L2TP packets. L2TP packets that have a larger MTU size than what the LAC egress ports allows are dropped.

Default df-bit-lac always

Parameters **always —** Specifies that the LAC will send all L2TP packets with the DF bit set to 1.

never — Specifies that the LAC will send all L2TP packets with the DF bit set to 0.

df-bit-lac

Syntax **df-bit-lac** {**always**|**never**|**default**}
no df-bit-lac

Context config>router/service>vprn>l2tp>group
config>router/service>vprn>l2tp>group>tunnel

Description By default, the LAC df-bit-lac is set to default and sends all L2TP packets with the DF bit set to 1. The DF bit is configurable to allow downstream routers to fragment the L2TP packets. The LAC itself will not fragment L2TP packets. L2TP packets that have a larger MTU size than what the LAC egress ports allows are dropped. The configuration of the df-bit can be overridden at different levels: l2tp, tunnel, and group. The configuration at the tunnel level overrides the configuration on both group and l2tp. The configuration at the group level overrides the configuration on l2tp.

Default df-bit-lac default

Parameters **always —** Specifies that the LAC will send all L2TP packets with the DF bit set to 1.

never — Specifies that the LAC will send all L2TP packets with the DF bit set to 0.

default — Follows the DF-bit configuration specified on upper levels.

destruct-timeout

Syntax **destruct-timeout** *destruct-timeout*
no destruct-timeout

Context config>router>l2tp>group
config>router>l2tp>group>tunnel

Description This command configures the period of time that the data of a disconnected tunnel will persist before being removed.

The **no** form of the command removes the value from the configuration.

Default no destruct-timeout

Parameters *destruct-timeout* — [Specifies the automatic removal of dynamic L2TP sessions, in seconds, that are no longer active.

Default no destruct-timeout

Values 60 — 86400

hello-interval

Syntax **hello-interval** *hello-interval*
no hello-interval

Context config>router>l2tp>group

Description This command configures the time interval between two consecutive tunnel Hello messages. The Hello message is an L2TP control message sent by either peer of a LAC-LNS control connection. This control message is used as a keepalive for the tunnel.

The **no** form of the command removes the interval from the configuration.

Default 60

Parameters *hello-interval* — Specifies the time interval, in seconds, between two consecutive tunnel Hello messages.

Default no hello-interval

Values 60 — 3600

idle-timeout

Syntax **idle-timeout** *idle-timeout*
no idle-timeout

Context config>router>l2tp>group

Description This command configures the period of time that an established tunnel with no active sessions will persist before being disconnected.

Enter the **no** form of the command to maintain a persistent tunnel.

The **no** form of the command removes the idle timeout from the configuration.

Default no idle-timeout

Parameters *idle-timeout* — Specifies the idle timeout value, in seconds until the group is removed.

Default no idle-timeout

Values 0 — 3600

lns-group

Syntax **lns-group** *lns-group-id*
no lns-group

Context config>router>l2tp>group

Description This command configures the ISA LNS group.

Parameters *lns-group-id* — Specifies the LNS group ID.

Values 1 — 4

load-balance-method

Syntax **load-balance-method** {**per-session|per-tunnel**}
no load-balance-method

Context config>router>l2tp>group
config>router>l2tp>group>tunnel

Description This command describes how new sessions are assigned to an L2TP ISA MDA.

Parameters **per-session —** Specifies that the lowest granularity for load-balancing is a session; each session can be assigned to a different

ISA MDA.

per-tunnel — Specifies that the lowest granularity for load-balancing is a tunnel; all sessions associated with the same tunnel are assigned to the same ISA MDA; this may be useful or required in certain cases, for example:

- MLPPP with multiple links per bundle;
- HPol intermediate destination arbiters where the intermediate destination is an L2TP tunnel.

local-address

Syntax **local-address** *ip-address*
no local-address

Context config>router>l2tp>group>tunnel

Description This command configures the local address.

Parameters *ip-address* — Specifies the IP address used during L2TP authentication.

local-name

Syntax **local-name** *host-name*
no local-name

Context config>router>l2tp>group
config>router>l2tp>group>tunnel

Description This command creates the local host name used by this system for the tunnels in this L2TP group during the authentication phase of tunnel establishment. It can be used to distinguish tunnels.

The **no** form of the command removes thename from the configuration.

Default local-name

Parameters *host-name* — Specifies the host name, up to 64 characters in length, that the router will use to identify itself during L2TP authentication.

Default no local-name

max-retries-estab

Syntax **max-retries-estab** *max-retries*
no max-retries-estab

Context config>router>l2tp>group
config>router>l2tp>group>tunnel

Description This command configures the number of retries allowed for this L2TP tunnel while it is established, before its control connection goes down.

The **no** form of the command removes the value from the configuration.

Default no max-retries-estab

Parameters *max-retries* — Specifies the maximum number of retries for an established tunnel.

Default no max-retries-estab

Values 2 — 7

max-retries-not-estab

Syntax **max-retries-not-estab** *max-retries*
no max-retries-not-estab

Context config>router>l2tp>group
config>router>l2tp>group>tunnel

Description This command configures the number of retries allowed for this L2TP tunnel while it is not established, before its control connection goes down.

The **no** form of the command removes the value from the configuration.

Default no max-retries-not-estab

Parameters *max-retries* — Specifies the maximum number of retries for non-established tunnels.

Default no max-retries-not-estab

Values 2 — 7

password

Syntax **password** *password* [**hash | hash2**]
no password

Context config>router>l2tp>group
config>router>l2tp>group>tunnel

Description This command configures the password between L2TP LAC and LNS

The no form of the command removes the password.

Default no password

Parameters *password* — Configures the password used for challenge/response calculation and AVP hiding. The maximum length can be up to 20 characters if unhashed, 32 characters if hashed, 54 characters if the hash2 keyword is specified.

hash — Specifies the key is entered in an encrypted form. If the **hash** parameter is not used, the key is assumed to be in a non-encrypted, clear text form. For security, all keys are stored in encrypted

hash2 — Specifies the key is entered in a more complex encrypted form. If the **hash2** parameter is not used, the less encrypted **hash** form is assumed.

Default no password

ppp

Syntax **ppp**

Context config>router>l2tp>group

Description This command configures PPP for the L2TP tunnel group.

authentication

Syntax **authentication** {**chap|pap|pref-chap**}

Context config>router>l2tp>group>ppp

Description This command configures the PPP authentication protocol to negotiate.

authentication-policy

Syntax **authentication-policy** *auth-policy-name*
no authentication-policy

Context config>router>l2tp>group>ppp

Description This command configures the authentication policy.

Parameters *auth-policy-name* — Specifies the authentication policy name.

Values 32 chars max

default-group-interface

Syntax **default-group-interface** *ip-int-name* **service-id** *service-id*
no default-group-interface

Context config>router>l2tp>group>ppp

Description This command configures the default group interface.

Parameters *ip-int-name* — Specifies the interface name.

Values 32 chars max

service-id — Specifies the service ID.

Values 1..2147483648

svc-name — Specifies the service name (instead of service ID).

Values 64 chars max

keepalive

Syntax **keepalive** *seconds* [**hold-up-multiplier** *multiplier*]
no keepalive

Context config>router>l2tp>group>ppp

Description This command configures the PPP keepalive interval and multiplier.

Parameters *seconds* — Specifies in seconds the interval.

Values 10 — 300

multiplier — Specifies the multiplier.

Values 1 — 5

mtu

Syntax **mtu** *mtu-bytes*
no mtu

Context config>router>l2tp>group>ppp

Description This command configures the maximum PPP MTU size.

Parameters *mtu-bytes* — Specifies, in bytes, the maximum PPP MTU size.

Values 512 — 9212

proxy-authentication

Syntax [**no**] **proxy-authentication**

Context config>router>l2tp>group>ppp

Description This command configures the use of the authentication AVPs received from the LAC.

proxy-lcp

Syntax [**no**] **proxy-lcp**

Context config>router>l2tp>group>ppp

Description This command configures the use of the proxy LCP AVPs received from the LAC.

user-db

Syntax **user-db** *local-user-db-name*
no user-db

Context config>router>l2tp>group>ppp

Description This command configures the local user database to use for PPP PAP/CHAP authentication.

Parameters *local-user-db-name* — Specifies the local user database name.

Values 32 chars max

session-assign-method

Syntax **session-assign-method** *weighted*
no session-assign-method

Context config>router>l2tp>group

Description This command specifies how new sessions are assigned to one of the set of suitable tunnels that are available or could be made available.

Default no session-assign-method

Parameters *weighted* — specifies that the sessions are shared between the available tunnels. If necessary, new tunnels are set up until the maximum number is reached. The distribution aims at an equal ratio of the actual number of sessions to the maximum number of sessions.

Default no session-assign-method. All new sessions are placed by preference in existing tunnels.

Values weighted — Enables weighted preference to tunnels in the group.

session-limit

Syntax **session-limit** *session-limit*
no session-limit

Context config>router>l2tp>group
config>router>l2tp>group>tunnel

Description This command configures the session limit. The value controls how many L2TP session will be allowed within a given context (system, group, tunnel).

The no form of the command removes the value from the configuration.

Default no session-limit

Parameters *session-limit* — Specifies the allowed number of sessions within the given context.

Values 1 — 131071

Router L2TP Tunnel Commands

tunnel

Syntax **tunnel** *tunnel-name* [**create**]
no tunnel *tunnel-name*

Context config>router>l2tp>group

Description This command configures an L2TP tunnel. A tunnel exists between a LAC-LNS pair and consists of a Control Connection and zero or more L2TP sessions. The tunnel carries encapsulated PPP datagrams and control messages between the LAC and the L2TP Network Server (LNS).

Parameters *tunnel-name* — Specifies a valid string to identify a L2TP up to 32 characters in length.

create — mandatory while creating a new tunnel

auto-establish

Syntax [**no**] **auto-establish**

Context config>router>l2tp>group>tunnel

Description This command specifies if this tunnel is to be automatically set up by the system.

no auto-establish

avp-hiding

Syntax **avp-hiding** {**never | sensitive | always**}
no avp-hiding

Context config>router>l2tp>group>tunnel

Description This command configures Attribute Value Pair (AVP) hiding. This capability can be used to avoid the passing of sensitive data, such as user passwords, as cleartext in an AVP.

Note that it is recommended that sensitive information not be sent in clear text.

The **no** form of the command removes the parameter of the configuration and indicates that the value on group level will be taken.

Default no avp-hiding

Parameters *avp-hiding* — Specifies the method to be used for the authentication of the tunnel.

Values never — AVP hiding is not used.
sensitive — AVP hiding is used only for sensitive information (such as username/password).
always — AVP hiding is always used.

challenge

Syntax **challenge** *challenge-mode*
no challenge

Context config>router>l2tp>group>tunnel

Description This command configures the use of challenge-response authentication.

The **no** form of the command removes the parameter from the configuration and indicates that the value on group level will be taken.

Default no challenge

Parameters *challenge-mode* — Specifies when challenge-response is to be used for the authentication of the tunnel.

Values always — Always allows the use of challenge-response authentication.
never — Never allows the use of challenge-response authentication.

hello-interval

Syntax **hello-interval** *hello-interval*
hello-interval infinite
no hello-interval

Context config>router>l2tp>group>tunnel

Description This command configures the number of seconds between sending Hellos for a L2TP tunnel. The no form removes the parameter from the configuration and indicates that the value on group level will be taken.

Parameters *hello-interval* — Specifies the time interval, in seconds, between two consecutive tunnel Hello messages.

Values 60 — 3600

infinite — Specifies that no hello messages are sent.

idle-timeout

Syntax **idle-timeout** *idle-timeout*
idle-timeout infinite
no idle-timeout

Context config>router>l2tp>group>tunnel

Description This command configures the idle timeout to wait before being disconnect. The no form indicates that the parameter will be removed from the configuration and that the value specified on group level will be taken.

Parameters *idle-timeout* — Specifies the idle timeout, in seconds.

Values 0 — 3600

infinite — Specifies that the tunnel will not be closed when idle.

peer

Syntax **peer** *ip-address*
no peer

Context config>router>l2tp>group>tunnel

Description This command configures the peer address.

The **no** form of the command removes the IP address from the tunnel configuration.

Default no peer

Parameters *ip-address* — Sets the LNS IP address for the tunnel.

preference

Syntax **preference** *preference*
no preference

Context config>router>l2tp>group>tunnel

Description This command configures a preference number that indicates the relative preference assigned to a tunnel when using a weighted session assignment.

The **no** form of the command removes the preference value from the tunnel configuration.

Default no preference

Parameters *preference* — Specifies the tunnel preference number with its group. The value 0 corresponds to the highest preference.

Values 0 — 16777215

remote-name

Syntax **remote-name** *host-name*
no remote-name

Context config>router>l2tp>group>tunnel

Description This command configures a string to be compared to the host name used by the tunnel peer during the authentication phase of tunnel establishment.

Parameters *host-name* — Specifies a remote host name for the tunnel up to 64 characters in length.

tunnel-selection-blacklist

Syntax **tunnel-selection-blacklist**

Context config>router>l2tp

Description This command enables the context to configure L2TP Tunnel Selection Blacklist parameters.

add-tunnel

Syntax **add-tunnel never**
add-tunnel on *reason* [*reason*...(upto 8 max)]
no add-tunnel

Context configure>router>l2tp>tunnel-selection-blacklist
configure>service>vprn>l2tp>tunnel-selection-blacklist

Description This command will force the tunnel to the blacklist and render it unavailable for new sessions for the duration of pre-configured time. Peers are always forced to the black list in case that they time out (failure to receive response to control packets). In addition to time outs, certain events can be used to trigger placement of the tunnel on the black list.

Parameters *reason* — Specifies the return codes or events that determine which tunnels are added to the blacklist

Values **cdn-err-code** — A tunnel will be forced to the blacklist in case that CDN message with the Result Code 2 (Call disconnected for the reasons indicated in error code) is received.
cdn-inv-dest — A tunnel will be forced to the blacklist in case that CDN message with the Result Codes 6 (Invalid destination) is received.
cdn-tmp-no-facilities — A tunnel will be forced to the blacklist in case that CDN message with the Result Code 4 is received (Call failed due to lack of appropriate facilities being available - temporary condition) is received.
cdn-perm-no-facilities — A tunnel will be forced to the blacklist in case that CDN message with the Result Codes 5 (Call failed due to lack of appropriate facilities being available - permanent condition) is received.
tx-cdn-not-established-in-time — A tunnel will be forced to the blacklist in case that CDN message with the Result Code 10 (Call was not established within time allotted by LAC) is sent from the LAC to the LNS.
stop-ccn-err-code — A tunnel will be forced to the blacklist in case that StopCCN message with the Result Code 2 (General error – Error Code indicates the problem) is sent or received.
stop-ccn-other — A tunnel will be forced to the blacklist in case that StopCCN message with the following Result Codes is received:

(1) General request to clear control connection
(4) Requestor is not authorized to establish a control channel
(5) Protocol version not supported
(6) Requestor is being shutdown
Or in the case that the StopCCN with the following result codes is transmitted:
(4) Requestor is not authorized to establish a control channel.

(5) Protocol version not supported
The receipt of the following Result Codes will NEVER blacklist a tunnel:
(0) Reserved
(3) Control channel already exist
(7) Finite state machine error
(8) Undefined
Transmission of the following Result Codes will NEVER blacklist a tunnel:
(1) General request to clear control connection
(3) Control channel already exist
(6) Requestor is being shutdown
(7) Finite state machine error

addr-change-timeout — A timed-out tunnel for which the peer IP address has changed mid-session (from the one that is provided initially during configuration) will be forced to the blacklist. In absence of this configuration option, only the configured peer for the tunnel will be blacklisted, but not the tunnel itself which now has a different peer address than the one initially configured.

never — When specified, no tunnels will be placed on blacklist under any circumstance. This parameter will available to preserve backward compatibility.

max-list-length

Syntax **max-list-length unlimited**
max-list-length *count*
no max-list-length

Context configure>router>l2tp>tunnel-selection-blacklist
configure>service>vprn>l2tp>tunnel-selection-blacklist

Description This command configured the maximum length of the peer/tunnel blacklist.

This command specifies how many items (tunnels or peers) can be in the tunnel-selection-blacklist. If a tunnel or peer needs to be added to the tunnel-selection-blacklist and the tunnel-selection-blacklist is full, the system will remove the item (tunnel or peer) from the blacklist that was in this blacklist forthe longest time.

Default unlimited

Parameters **unlimited —** Specifies there is no limit.

count — Specifies how many items (tunnels or peers) can be in the tunnel-selection-blacklist.

Values 1..65635

max-time

Syntax **max-time** *minutes*
no max-time

Context configure>router>l2tp>tunnel-selection-blacklist configure>service>vprn>l2tp>tunnel-selection-blacklist

Description This command configures time for which an entity (peer or a tunnel) are kept in the blacklist.

Default 5 minutes

Parameters *minutes* — Specifies the maximum time a tunnel or peer may remain in the blacklist

Values 1..60

timeout-action

Syntax **timeout-action** *action*
no timeout-action

Context configure>router>l2tp>tunnel-selection-blacklist
configure>service>vprn>l2tp>tunnel-selection-blacklist

Description This command defines an action that will be executed on the entity (peer/tunnel) in the blacklist once the entity becomes eligible for selection again.

Default remove-from-blacklist

Parameters *action* — Specifies the Action to be taken when a tunnel or peer has been in the blacklist for the max-period of time.

Values remove-from-blacklist — The peer or tunnel in the blacklist will be removed completely from the blacklist and made eligible for the selection process once the max-time expires. In this mode of operation, multiple new sessions can be mapped into the same, newly released tunnel from the blacklist. The first such session will try to setup the tunnel, while the other will be buffered until the tunnel establishment process is completed. In case that the tunnel remains unavailable, it will be placed in the blacklist again. Consequently all new sessions will have be re-negotiated over an alternate tunnel.
try-one-session — Once the max-time expired, the peer or tunnel in the blacklist is made available for selection only to a single new session request. Only upon successful tunnel establishment will the incoming new sessions be eligible to be mapped into this tunnel. This behavior will avoid session establishment delays in case that the tunnel just removed from the blacklist is still unavailable.

Router Interface Commands

interface

Syntax [**no**] **interface** *ip-int-name* [**unnumbered-mpls-tp**]

Context config>router

Description This command creates a logical IP routing or unnumbered MPLS-TP interface. Once created, attributes like IP address, port, or system can be associated with the IP interface.

Interface names are case-sensitive and must be unique within the group of IP interfaces defined for **config router interface** and **config service ies interface**. Interface names must not be in the dotted decimal notation of an IP address.; for example, the name "1.1.1.1" is not allowed, but "int-1.1.1.1" is allowed. Show commands for router interfaces use either the interface names or the IP addresses. Ambiguity can exist if an IP address is used as an IP address and an interface name. Duplicate interface names can exist in different router instances, although this is not recommended because it is confusing.

When a new name is entered, a new logical router interface is created. When an existing interface name is entered, the user enters the router interface context for editing and configuration.

Although not a keyword, the ip-int-name "**system**" is associated with the network entity (such as a specific 7450 ESS), not a specific interface. The system interface is also referred to as the loopback address.

An unnumbered MPLS-TP interface is a special type of interface that is only intended for MPLS-TP LSPs. IP routing protocols are blocked on interfaces of this type. If an interface is configured as unnumbered-mpls-tp, then it can only be associated with an Ethernet port or VLAN, using the port command. then either a unicast, multicast or broadcast remote MAC address may be configured. Only static ARP is supported.

The **no** form of the command removes the IP interface and all the associated configurations. The interface must be administratively shut down before issuing the **no interface** command.

Default No interfaces or names are defined within the system.

Parameters *ip-int-name* — The name of the IP interface. Interface names must be unique within the group of defined IP interfaces for **config router interface** and **config service ies interface** commands. An interface name cannot be in the form of an IP address. If the string contains special characters (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

Values 1 — 32 alphanumeric characters.

If the *ip-int-name* already exists, the context is changed to maintain that IP interface. If *ip-int-name* already exists within another service ID or is an IP interface defined within the **config router** commands, an error will occur and the context will not be changed to that IP interface. If *ip-int-name* does not exist, the interface is created and the context is changed to that interface for further command processing.

unnumbered-mpls-tp — Specifies that an interface is of type Unnumbered MPLS-TP. An unnumbered MPLS-TP interface is a special type of interface that is only intended for MPLS-TP LSPs. IP routing protocols are blocked on interfaces of this type. If an interface is configured as

unnumbered-mpls-tp, then it can only be associated with an Ethernet port or VLAN, using the **port** command. Either a unicast, multicast or broadcast remote MAC address may be configured using the **static-arp** command. Only static ARP is supported.

address

Syntax **address** {*ip-address*/*mask*|*ip-address netmask*} [**broadcast** *all-ones* **| host-ones**] [**track-srrp** *srrp-instance*]
no address

Context config>router>interface

Description This command assigns an IP address, IP subnet, and broadcast address format to an IP interface. Only one IP address can be associated with an IP interface.

An IP address must be assigned to each IP interface. An IP address and a mask combine to create a local IP prefix. The defined IP prefix must be unique within the context of the routing instance. It cannot overlap with other existing IP prefixes defined as local subnets on other IP interfaces in the same routing context within the router.

The local subnet that the **address** command defines must not be part of the services address space within the routing context by use of the **config router service-prefix** command. Once a portion of the address space is allocated as a service prefix, that portion is not available to IP interfaces for network core connectivity.

The IP address for the interface can be entered in either CIDR (Classless Inter-Domain Routing) or traditional dotted decimal notation. **Show** commands display CIDR notation and are stored in configuration files.

By default, no IP address or subnet association exists on an IP interface until it is explicitly created.

The **no** form of the command removes the IP address assignment from the IP interface. Interface specificconfigurations for MPLS/RSVP are also removed. This will operationally stop any MPLS LSPs that explicitly reference that IP address. When a new IP address is defined, interface specific configurations for MPLS/RSVP will need to be re-added. If the **no** form of the command is executed then **ptp-hw-assist** is disabled. If a new address is entered while another address is still active, the new address will be rejected.

Default No IP address is assigned to the IP interface.

Parameters *ip-address* — The IP address of the IP interface. The *ip-addr* portion of the **address** command specifies the IP host address that will be used by the IP interface within the subnet. This address must be unique within the subnet and specified in dotted decimal notation.

Values 1.0.0.0 — 223.255.255.255

/ — The forward slash is a parameter delimiter that separates the *ip-addr* portion of the IP address from the mask that defines the scope of the local subnet. No spaces are allowed between the *ip-addr*, the "/" and the *mask-length* parameter. If a forward slash does not ediately follow the *ip-addr*, a dotted decimal mask must follow the prefix.

mask-length — The subnet mask length when the IP prefix is specified in CIDR notation. When the IP prefix is specified in CIDR notation, a forward slash (/) separates the *ip-addr* from the *mask-length* parameter. The mask length parameter indicates the number of bits used for the network portion of the IP address; the remainder of the IP address is used to determine the host portion of the IP address. Allowed values are integers in the range 1— 32. Note that a mask length of 32 is reserved for system IP addresses.

Values 1 — 32

mask — The subnet mask in dotted decimal notation. When the IP prefix is not specified in CIDR notation, a space separates the *ip-addr* from a traditional dotted decimal mask. The *mask* parameter indicates the complete mask that will be used in a logical 'AND' function to derive the local subnet of the IP address. Note that a mask of 255.255.255.255 is reserved for system IP addresses.

Values 128.0.0.0 — 255.255.255.255

netmask — The subnet mask in dotted decimal notation.

Values 0.0.0.0 — 255.255.255.255 (network bits all 1 and host bits all 0)

broadcast {**all-ones** | **host-ones**} **—** The optional **broadcast** parameter overrides the default broadcast address used by the IP interface when sourcing IP broadcasts on the IP interface. If no broadcast format is specified for the IP address, the default value is **host-ones,** which indictates a subnet broadcast address. Use this parameter to change the broadcast address to **all-ones** or revert back to a broadcast address of **host-ones**.

The **all-ones** keyword following the **broadcast** parameter specifies that the broadcast address used by the IP interface for this IP address will be 255.255.255.255, also known as the local broadcast.

The **host-ones** keyword following the **broadcast** parameter specifies that the broadcast address used by the IP interface for this IP address will be the subnet broadcast address. This is an IP address that corresponds to the local subnet described by the *ip-addr* and the *mask-length* or *mask* with all the host bits set to binary 1. This is the default broadcast address used by an IP interface.

The **broadcast** parameter within the **address** command does not have a negate feature, which is usually used to revert a parameter to the default value. To change the **broadcast** type to **host-ones** after being changed to **all-ones**, the **address** command must be executed with the **broadcast** parameter defined.

The broadcast format on an IP interface can be specified when the IP address is assigned or changed.

This parameter does not affect the type of broadcasts that can be received by the IP interface. A host sending either the local broadcast (**all-ones**) or the valid subnet broadcast address (**host-ones**) will be received by the IP interface.

Default host-ones

Values **all-ones**, **host-ones**

track-srrp — Specifies the SRRP instance ID that this interface route needs to track.

allow-directed-broadcasts

Syntax [**no**] **allow-directed-broadcasts**

Context config>router>interface

Description This command enables the forwarding of directed broadcasts out of the IP interface.

A directed broadcast is a packet received on a local router interface destined for the subnet broadcast address of another IP interface. The **allow-directed-broadcasts** command on an IP interface enables or disables the transmission of packets destined to the subnet broadcast address of the egress IP interface.

When enabled, a frame destined to the local subnet on this IP interface is sent as a subnet broadcast out this interface. **NOTE**: Allowing directed broadcasts is a well-known mechanism used for denial-of-service attacks.

By default, directed broadcasts are not allowed and are discarded at this egress IP interface.

The **no** form of the command disables directed broadcasts forwarding out of the IP interface.

Default no allow-directed-broadcasts — Directed broadcasts are dropped.

arp-timeout

Syntax **arp-timeout** *seconds*
no arp-timeout

Context config>router>interface

Description This command configures the minimum time, in seconds, an ARP entry learned on the IP interface is stored in the ARP table. ARP entries are automatically refreshed when an ARP request or gratuitous ARP is seen from an IP host. Otherwise, the ARP entry is aged from the ARP table. If the **arp-timeout** value is set to 0 seconds, ARP aging is disabled.

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

Default 14400 seconds (4 hours)

Parameters *seconds* — The minimum number of seconds a learned ARP entry is stored in the ARP table, expressed as a decimal integer. A value of 0 specifies that the timer is inoperative and learned ARP entries will not be aged.

Values 0 — 65535

bfd

Syntax **bfd** *transmit-interval* [**receive** *receive-interval*] [**multiplier** *multiplier*] [**echo-receive** *echo-interval*] [**type cpm-np**]
no bfd

Context config>router>interface
config>router>interface>ipv6

Description This command specifies the bi-directional forwarding detection (BFD) parameters for the associated IP interface. If no parameters are defined the default values are used.

The multiplier specifies the number of consecutive BFD messages that must be missed from the peer before the BFD session state is changed to down and the upper level protocols (OSPF, IS-IS, BGP or PIM) is notified of the fault.

The **no** form of the command removes BFD from the router interface regardless of the IGP/RSVP.

Important notes: On the 7750-SR, the *transmit-interval* and **receive *receive-interval*** values can only be modified to a value less than 100 ms when:

1. The **type cpm-np option** is explicitly configured.
2. The service is shut down (**shutdown**)
3. The interval is specified 10 — 100000.
4. The service is re-enabled (**no shutdown**)

To remove the **type cpm-np** option, re-issue the **bfd** command without specifying the **type** parameter.

Default no bfd

Parameters *transmit-interval* — Sets the transmit interval, in milliseconds, for the BFD session.

Values 10 — 100000
10 — 100000 (see Important Notes above)

Default 100

receive *receive-interval* — Sets the receive interval, in milliseconds, for the BFD session.

Values 10 — 100000
10 — 100000 (see Important Notes above)

Default 100

multiplier *multiplier* — Set the multiplier for the BFD session.

Values 3— 20

Default 3

echo-receive *echo-interval* **—** Sets the minimum echo receive interval, in milliseconds, for the session.

Values 100 — 100000

Default 0

type cpm-np — Selects the CPM network processor as the local termination point for the BFD session. See Important Notes, above.

cflowd

Syntax **cflowd** {**acl** | **interface**} [direction]
no cflowd

Context config>router>interface

Description This command enables cflowd to collect traffic flow samples through a router for analysis.

cflowd is used for network planning and traffic engineering, capacity planning, security, application and user profiling, performance monitoring, usage-based billing, and SLA measurement. When cflowd is enabled at the interface level, all packets forwarded by the interface are subjected to analysis according to the cflowd configuration.

If cflowd is enabled without either egress-only or both specified or with the ingress-only keyword specified, then only ingress sampling will be enabled on the associated IP interface.

Default no cflowd

Parameters **acl —** Specifies the policy associated with a filter.

interface — Specifies the policy associated with an IP interface.

direction — Specifies the direction to collect traffic flow samples.

Values ingress-only — Enables ingress sampling only on the associated interface.
egress-only — Enables egress sampling only on the associated interface.
both — Enables both ingress and egress cflowd sampling.

cpu-protection

Syntax **cpu-protection** *policy-id*
no cpu-protection

Context config>router>interface

Description This command assigns an existing CPU protection policy for the interface. The CPU protection policies are configured in the **config>sys>security>cpu-protection>policy** *cpu-protection-policy-id* context.

Parameters *policy-id* — Specifies an existing CPU protection policy.

Values 1 — 255

delayed-enable

Syntax **delayed-enable** *seconds*
no delayed-enable

Context config>router>if

Description This command creates a delay to make the interface operational by the specified number of seconds

The value is used whenever the system attempts to bring the interface operationally up.

Parameters *seconds* — Specifies a delay, in seconds, to make the interface operational.

Values 1 — 1200

dist-cpu-protection

Syntax **dist-cpu-protection** *policy-name*
no dist-cpu-protection

Context config>router>if

Description This command assigns a Distributed CPU protection policy for the interface.

egr-ip-load-balancing

Syntax **egr-ip-load-balancing** {**src-ip** | **dst-ip**}
no egr-ip-load-balancing

Context config>router>interface

Description This command specifies whether to include source address or destination address or both in LAG/ ECMP hash on IP interfaces. Additionally, when l4-load-balancing is enabled the command applies also to inclusion of source/destination port in the hash inputs.

The **no** form of this command includes both source and destination parameters.

Default no egr-ip-load-balancing

Parameters **src-ip —** Specifies using source address and (if l4-load balancing is enabled) source port in the hash, ignore destination address/port.

dst-ip — Specifies using destination address and (if l4-load balancing is enabled) destination port in the hash, ignore source address/port.

enable-ingress-stats

Syntax [**no**] **enable-ingress-stats**

Context config>router>interface
config>service>ies >interface
config>service>vprn>interface
config>service>ies>sub-if>grp-if
config>service>vprn>sub-if>grp-if

Description This command enables the collection of ingress interface IP stats. This command is only appliable to IP statistics, and not to uRPF statistics.

If enabled, then the following statistics are collected:

- IPv4 offered packets
- IPv4 offered octets
- IPv6 offered packets
- IPv6 offered octets

Note that octet statistics for IPv4 and IPv6 bytes at IP interfaces include the layer 2 frame overhead.

Default no enable-ingress-stats

enable-mac-accounting

Syntax [**no**] **enable-mac-accounting**

Context config>router>interface

Description This command enables MAC Accounting functionality for the interface.

if-attribute

Syntax **if-attribute**

Context config>router>interface

Description This command adds and removes interface attributes.

if-admin-group

Syntax [**no**] **if-admin-group** *group-name* [*group-name*...(upto 5 max)]

Context config>router>interface

Description This command configures interface Admin Group memberships for this interface.

if-srlg-group

Syntax [**no**] **if-srlg-group** *group-name* [*group-name*...(upto 5 max)]

Context config>router>interface

Description This command configures interface SRLG Group memberships for this interface

local-proxy-arp

Syntax [**no**] **local-proxy-arp**

Context config>router>interface

Description This command enables local proxy ARP on the interface.

Default no local-proxy-arp

ip-load-balancing

Syntax **ip-load-balancing** {**source**|**destination**}
no ip-load-balancing

Context config>router>if

Description This command specifies whether to include source address or destination address or both in LAG/ECMP hash on IP interfaces. Additionally, when l4-load-balancing is enabled the command applies also to inclusion of source/destination port in the hash inputs.

The **no** form of this command includes both source and destination parameters.

Default no ip-load-balancing

Parameters **source** — Specifies to use source address and (if l4-load balancing is enabled) source port in the hash, ignore destination address/port.

destination — Specifies to use destination address and (if l4-load balancing is enabled) destination port in the hash, ignore source address/port.

lag-link-map-profile

Syntax **lag-link-map-profile** *link-map-profile-id*
no lag-link-map-profile

Context config>router>if

Description This command assigns a pre-configured lag link map profile to a SAP/network interface configured on a LAG or a PW port that exists on a LAG. Once assigned/de-assigned, the SAP/network interface egress traffic will be re-hashed over LAG as required by the new configuration.

The **no** form of this command reverts the SAP/network interface to use per-flow, service or link hash as configured for the service/LAG.

Default **no lag-link-map-profile**

Parameters *link-map-profile-id* — An integer from 1 to 32 that defines a unique lag link map profile on which the LAG the SAP/network interface exist.

ldp-shortcut

Syntax [**no**] **ldp-shortcut**

Context config>router

Description This command enables the resolution of IGP routes using LDP LSP across all network interfaces participating in the IS-IS and OSPF routing protocol in the system.

When LDP shortcut is enabled, LDP populates the routing table with next-hop entries corresponding to all prefixes for which it activated an LDP FEC. For a given prefix, two route entries are populated in the system routing table. One route corresponds to the LDP shortcut next-hop and has an owner of LDP. The other route is the regular IP next-hop. The LDP shortcut next-hop always has preference over the regular IP next-hop for forwarding user packets and specified control packets over a given outgoing interface to the route next-hop.

All user and specified control packets for which the longest prefix match in RTM yields the FEC prefix will be forwarded over the LDP LSP.

When an IPv4 packet is received on an ingress network interface, a subscriber IES interface, or a regular IES interface, the lookup of the packet by the ingress IOM will result in the packet being sent labeled with the label stack corresponding to the NHLFE of the LDP LSP when the preferred RTM entry corresponds to an LDP shortcut.

If the preferred RTM entry corresponds to an IP next-hop, the IPv4 packet is forwarded unlabelled.

When ECMP is enabled and multiple equal-cost next-hops exit for the IGP route, the ingress IOM will spray the packets for this route based on hashing routine currently supported for IPv4 packets. When the preferred RTM entry corresponds to an LDP shortcut route, spraying will be performed across the multiple next-hops for the LDP FEC. The FEC next-hops can either be direct link LDP neighbors or T-LDP neighbors reachable over RSVP LSPs in the case of LDP-over-RSVP but not both.

When the preferred RTM entry corresponds to a regular IP route, spraying will be performed across regular IP next-hops for the prefix..

The no form of this command disables the resolution of IGP routes using LDP shortcuts.

Default no ldp-shortcut

ldp-sync-timer

Syntax **ldp-sync-timer** *seconds*
no ldp-sync-timer

Context config>router>interface

Description This command enables synchronization of IGP and LDP. When a link is restored after a failure, IGP sets the link cost to infinity and advertises it. The actual value advertised in OSPF is 0xFFFF (65535). The actual value advertised in IS-IS regular metric is 0x3F (63) and in IS-IS wide-metric is 0xFFFFFE (16777214). This feature is not supported on RIP interfaces.

Note that if an interface belongs to both IS-IS and OSPF, a physical failure will cause both IGPs to advertise infinite metric and to follow the IGP-LDP synchronization procedures. If only one IGP bounced on this interface or on the system, then only the affected IGP advertises the infinite metric and follow the IGP-LDP synchronization procedures.

Next LDP hello adjacency is brought up with the neighbour. The LDP synchronization timer is started by IGP from the time the LDP session to the neighbor is UP over the interface. This is to allow time for the label-FEC bindings to be exchanged.

When the LDP synchronization timer expires, the link cost is restored and is re-advertised. IGP will announce a new best next-hop and LDP will use it if the label binding for the neighbor's FEC is available.

If the user changes the cost of an interface, the new value is advertised at the next flooding of link attributes by IGP. However, if the LDP synchronization timer is still running, the new cost value will only be advertised after the timer expired. Also, the new cost value will be advertised after the user executes any of the following commands if the currently advertised cost is different:

- tools>perform>router>isis>ldp-sync-exit

- tools>perform>router>ospf>ldp-sync-exit
- config>router>interface>no ldp-sync-timer
- config>router>ospf>disable-ldp-sync
- router>isis>disable-ldp-sync

If the user changes the value of the LDP synchronization timer parameter, the new value will take effect at the next synchronization event. In other words, if the timer is still running, it will continue using the previous value.

If parallel links exist to the same neighbor, then the bindings and services should remain UP as long as there is one interface that is UP. However, the user configured LDP synchronization timer still applies on the failed then restored interface. In this case, the router will only consider this interface for forwarding after IGP re-advertized its actual cost value.

Note that the LDP Sync Timer State is not always synched across to the standby CPM, so after an activity switch the timer state might not be same as it was on the previous active CPM.

The **no** form of this command disables IGP/LDP synchronization and deletes the configuration

Default no ldp-sync-timer

Parameters *seconds* — Specifies the time interval for the IGP-LDP synchronization timer in seconds.

Values 1 – 1800

loopback

Syntax [**no**] **loopback**

Context config>router>interface

Description This command configures the interface as a loopback interface.

Default Not enabled

lsr-load-balancing

Syntax **lsr-load-balancing** *hashing-algorithm*
no lsr-load-balancing

Context config>router>if

Description This command specifies whether the IP header is used in the LAG and ECMP LSR hashing algorithm. This is the per interface setting.

Default no lsr-load-balancing

Parameters **lbl-only —** Only the label is used in the hashing algorithm.

lbl-ip — The IP header is included in the hashing algorithm.

ip-only — the IP header is used exclusively in the hashing algorithm

eth-encap-ip — The hash algorithm parses down the label stack (up to 3 labels supported) and once it hits the bottom, the stack assumes Ethernet II non-tagged header follows. At the expected Ethertype offset location, algorithm checks whether the value present is IPv4/v6 (0x0800 or0x86DD). If the check passes, the hash algorithm checks the first nibble at the expected IP header location for IPv4/IPv6 (0x0100/0x0110). If the secondary check passes, the hash is performed using IP SA/DA fields in the expected IP header; otherwise (any of the check failed) label-stack hash is performed.

mac

Syntax **mac** *ieee-mac-addr*
no mac

Context config>router>interface

Description This command assigns a specific MAC address to an IP interface. Only one MAC address can be assigned to an IP interface. When multiple **mac** commands are entered, the last command overwrites the previous command.

The **no** form of the command returns the MAC address of the IP interface to the default value.

Default IP interface has a system-assigned MAC address.

Parameters *ieee-mac-addr* — Specifies the 48-bit MAC address for the IP interface in the form *aa***:***bb***:***cc***:***dd***:***ee***:***ff* or *aa***-***bb***-***cc***-***dd***-***ee***-***ff,* where *aa*, *bb*, *cc*, *dd*, *ee* and *ff* are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC and non-IEEE reserved MAC addresses.

multihoming

Syntax [**no**] **multihoming primary|secondary** [**hold-time** *holdover-time*]

Context config>router>interface

Description This command sets the associated loopback interface to be an anycast address used in multi-homing resiliency, as either the primary or a secondary (a primary address on the alternate router). The optional hold-time parameter is only applicable for the secondary context and specifies how long label information learned about the secondary anycast address should be kept after that peer is declared down. This timer should be set to a value large enough for the remainder of the network to detect the failure and complete the reconvergence process.

The no form of the command disables this setting.

Default no multihoming

Parameters *holdover-time* — Specifies the number of seconds the router should hold label information learned from the alternate router in its secondary table. This is to allow the reset of the network to reconverge after a router failure before the anycase based label assignments are flushed from the forwarding plane.

Values 0 - 65535

Default 90

network-domain

Syntax **network-domain** *network-domain-name*
no network-domain

Context config>router>interface

Description This command assigns a given interface to a given network-domain. The network-domain is then taken into account during sap-ingress queue allocation for VPLS SAP.

The network-domain association can only be done in a base-routing context. Associating a network domain with an loop-back or system interface will be rejected. Associating a network-domain with an interface that has no physical port specified will be accepted, but will have no effect as long as a corresponding port, or LAG, is defined..

Single interfaces can be associated with multiple network-domains.

Default per default "default" network domain is assigned

ntp-broadcast

Syntax [**no**] **ntp-broadcast**

Context config>router>interface

Description This command enables SNTP broadcasts received on the IP interface. This parameter is only valid when the SNTP **broadcast-client** global parameter is configured.

The **no** form of the command disables SNTP broadcast received on the IP interface.

Default no ntp-broadcast

port

Syntax **port** *port-name*
no port

Context config>router>interface

Description This command creates an association with a logical IP interface and a physical port.

An interface can also be associated with the system (loopback address).

The command returns an error if the interface is already associated with another port or the system. In this case, the association must be deleted before the command is re-attempted. The *port-id* can be in one of the following forms:

- Ethernet interfaces

If the card in the slot has MDAs, *port-id* is in the slot_number/MDA_number/port_number format; for example, **1/1/3** specifies port 3 of the MDA installed in MDA slot 1 on the card installed in chassis slot 1.

- SONET/SDH interfaces

When the *port-id* represents a POS interface, the *port-id* must include the *channel-id.* The POS interface must be configured as a **network** port.

The **no** form of the command deletes the association with the port. The **no** form of this command can only be performed when the interface is administratively down.

Default No port is associated with the IP interface.

Parameters *port-name* — The physical port identifier to associate with the IP interface.

Values	*port-name*	*port-id*[:*encap-val*]		
		encap-val	0	for null
			0..4094	for dot1q
			0..4094.*	for qinq
	port-id	*slot/mda/port*[.*channel*]		
		bundle-id	- bundle-*type-slot/mda.bundle-num*	
			bundle	keyword
			type	ima, fr, ppp
			bundle-num	1..336
		bpgrp-id	bpgrp-*type-bpgrp-num*	
			bpgrp	keyword
			type	ima, ppp
			bpgrp-num	1..2000
		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

proxy-arp-policy

Syntax [**no**] **proxy-arp-policy** *policy-name* [*policy-name*...(up to 5 max)]

Context config>router>interface

Description This command enables and configure proxy ARP on the interface and specifies an existing policy-statement to analyze match and action criteria that controls the flow of routing information to and from a given protocol, set of protocols, or a particular neighbor. The policy-name is configured in the **config>router>policy-options** context.

Use proxy ARP so the router responds to ARP requests on behalf of another device. Static ARP is used when a 7750 SR needs to know about a device on an interface that cannot or does not respond to ARP requests. Thus, the 7750 SR OS configuration can state that if it has a packet that has a certain IP address to send it to the corresponding ARP address.

Default no proxy-arp-policy

Parameters *policy-name* — The export route policy name. 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.

ptp-hw-assist

Syntax [**no**] **ptp-hw-assist**

Context config>router>interface

Description This command configures the 1588 port based timestamping assist function for the interface. Various checks are performed to ensure that this feature can be enabled. If a check fails:

- The command is blocked/rejected with an appropriate error message.
- If the SAP configuration of the interface is removed, the ptp-hw-assist configuration will be removed.
- If the IPv4 address configuration of the interface is removed, the ptp-hw-assist configuration will be removed.

Default no ptp-hw-assist

qos-route-lookup

Syntax **qos-route-lookup** [**source** | **destination**]
no qos-route-lookup

Context config>router>interface
config>router>interface>ipv6

Description This command enables QoS classification of the ingress IP packets on an interface based on the QoS information associated with routes in the forwarding table.

If the optional **destination** parameter is specified and the destination address of an incoming IP packet matches a route with QoS information the packet is classified to the fc and priority associated with that route, overriding the fc and priority/profile determined from the sap-ingress or network qos policy associated with the IP interface. If the destination address of the incoming packet matches a route with no QoS information the fc and priority of the packet remain as determined by the sap-ingress or network qos policy.

If the optional **source** parameter is specified and the source address of an incoming IP packet matches a route with QoS information the packet is classified to the fc and priority associated with that route, overriding the fc and priority/profile determined from the sap-ingress or network qos policy associated with the IP interface. If the source address of the incoming packet matches a route with no QoS information the fc and priority of the packet remain as determined by the sap-ingress or network qos policy.

If neither the optional **source** or **destination** parameter is present, then the default is **destination** address matching.

The functionality enabled by the qos-route-lookup command can be applied to IPv4 packets or IPv6 packets on an interface, depending on whether it is present at the interface context (applies to IPv4) or the interface>ipv6 context (applies to IPv6). Subscriber management group interfaces also do not support the source QPPB option.

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

Default destination

Parameters **source —** Enables QoS classification of incoming IP packets based on the source address matching a route with QoS information.

destination — Enables QoS classification of incoming IP packets based on the destination address matching a route with QoS information.

qos

Syntax **qos** *network-policy-id* [**egress-port-redirect-group** *queue-group-name*] [**egress-instance** *instance-id*]] [**ingress-fp- redirect-group** *queue-group-name* **ingress-instance** *instance-id*]
no qos

Context config>router>interface

Description This command associates a network Quality of Service (QoS) policy with a network IP interface. Only one network QoS policy can be associated with an IP interface at one time. Attempts to associate a second QoS policy return an error.

Associating a network QoS policy with a network interface is useful for the following purposes:

- To apply classification rules for determining the forwarding-class and profile of ingress packets on the interface.
- To associate ingress packets on the interface with a queue-group instance applied to the ingress context of the interface’s forwarding plane (FP). (This is only applicable to interfaces on IOM3 and later cards.) The referenced ingress queue-group instance may have policers defined in order to rate limit ingress traffic on a per-forwarding class (and forwarding type: unicast vs. multicast) basis.
- To perform 802.1p, DSCP, IP precedence and/or MPLS EXP re-marking of egress packets on the interface.
- To associate egress packets on the interface with a queue-group instance applied to the egress context of the interface’s port. The referenced egress queue-group instance may have policers and/or queues defined in order to rate limit egress traffic on a per-forwarding class basis.

The **no** form of the command removes the network QoS policy association from the network IP interface, and the QoS policy reverts to the default.

Default **no qos**

Parameters *network-policy-id* — An existing network policy ID to associate with the IP interface.

Values 1 — 65535

egress-port-redirect-group *queue-group-name* **—** This optional parameter specifies the egress queue-group used for all egress forwarding-class redirections specified within the network QoS policy ID. The specified *queue-group-name* must exist as an egress queue group applied to the egress context of the port associated with the IP interface.

egress-instance *instance-id* **—** Since multiple instances of the same egress queue-group can be applied to the same port this optional parameter is used to specify which particular instance to associate with this particular network IP interface.

Values 1 — 16384

ingress-fp- redirect-group *queue-group-name* **—** This optional parameter specifies the ingress queue-group used for all ingress forwarding-class redirections specified within the network QoS policy ID. The specified queue-group-name must exist as an ingress queue group applied to the ingress context of the forwarding plane associated with the IP interface.

ingress-instance *instance-id* **—** Since multiple instances of the same ingress queue-group can be applied to the same forwarding plane this parameter is required to specify which particular instance to associate with this particular network IP interface.

Values 1 — 16384

remote-proxy-arp

Context config>router>interface

Description This command enables remote proxy ARP on the interface.

Default no remote-proxy-arp

secondary

Syntax **secondary** {[*ip-address***/***mask* **|** *ip-address netmask*]} [**broadcast** {**all-ones** **|** **host-ones**}] [**igp-inhibit**]
no secondary *ip-addr*

Context config>router>interface

Description Use this command to assign up to 16 secondary IP addresses to the interface. Each address can be configured in an IP address, IP subnet or broadcast address format.

ip-address — The IP address of the IP interface. The *ip-address* portion of the **address** command specifies the IP host address that will be used by the IP interface within the subnet. This address must be unique within the subnet and specified in dotted decimal notation.

Values 1.0.0.0 — 223.255.255.255

/ — The forward slash is a parameter delimiter that separates the *ip-address* portion of the IP address from the mask that defines the scope of the local subnet. No spaces are allowed between the *ip-addr*, the "/" and the *mask-length* parameter. If a forward slash does not ediately follow the *ip-addr*, a dotted decimal mask must follow the prefix.

mask-length — The subnet mask length when the IP prefix is specified in CIDR notation. When the IP prefix is specified in CIDR notation, a forward slash (/) separates the *ip-address* from the *mask-length* parameter. The mask length parameter indicates the number of bits used for the network portion of the IP address; the remainder of the IP address is used to determine the host portion of the IP address. Allowed values are integers in the range 1— 32. Note that a mask length of 32 is reserved for system IP addresses.

Values 1 — 32

mask — The subnet mask in dotted decimal notation. When the IP prefix is not specified in CIDR notation, a space separates the *ip-addr* from a traditional dotted decimal mask. The *mask* parameter indicates the complete mask that will be used in a logical 'AND' function to derive the local subnet of the IP address. Note that a mask of 255.255.255.255 is reserved for system IP addresses.

Values 128.0.0.0 — 255.255.255.255

broadcast {**all-ones** | **host-ones**} **—** The optional **broadcast** parameter overrides the default broadcast address used by the IP interface when sourcing IP broadcasts on the IP interface. If no broadcast format is specified for the IP address, the default value is **host-ones,** which indicates a subnet broadcast address. Use this parameter to change the broadcast address to **all-ones** or revert back to a broadcast address of **host-ones**.

The **all-ones** keyword following the **broadcast** parameter specifies that the broadcast address used by the IP interface for this IP address will be 255.255.255.255, also known as the local broadcast.

The **host-ones** keyword following the **broadcast** parameter specifies that the broadcast address used by the IP interface for this IP address will be the subnet broadcast address. This is an IP address that corresponds to the local subnet described by the *ip-addr* and the *mask-length* or *mask* with all the host bits set to binary 1. This is the default broadcast address used by an IP interface.

The **broadcast** parameter within the **address** command does not have a negate feature, which is usually used to revert a parameter to the default value. To change the **broadcast** type to **host-ones** after being changed to **all-ones**, the **address** command must be executed with the **broadcast** parameter defined.

The broadcast format on an IP interface can be specified when the IP address is assigned or changed.

This parameter does not affect the type of broadcasts that can be received by the IP interface. A host sending either the local broadcast (**all-ones**) or the valid subnet broadcast address (**host-ones**) will be received by the IP interface.

igp-inhibit — The secondary IP address should not be recognized as a local interface by the running IGP.

static-arp

Syntax **static-arp** *ip-addr ieee-mac-addr unnumbered*
no static-arp *unnumbered*

Context config>router>interface

Description This command configures a static Address Resolution Protocol (ARP) entry associating an IP address with a MAC address for the core router instance. This static ARP appears in the core routing ARP table. A static ARP can only be configured if it exists on the network attached to the IP interface.

If an entry for a particular IP address already exists and a new MAC address is configured for the IP address, the existing MAC address is replaced by the new MAC address.
The number of static-arp entries that can be configured on a single node is limited to 1000.
Static ARP is used when a 7750 SR needs to know about a device on an interface that cannot or does not respond to ARP requests. Thus, the 7750 SR OS configuration can state that if it has a packet that has a certain IP address to send it to the corresponding ARP address. Use proxy ARP so the 7750 SR responds to ARP requests on behalf of another device.

The **no** form of the command removes a static ARP entry.

Default No static ARPs are defined.

Parameters *unnumbered* — Specifies the static ARP MAC for an unnumbered interface. Unnumbered interfaces support dynamic ARP. Once this command is configured, it overrides any dynamic ARP.

ieee-mac-addr — Specifies the 48-bit MAC address for the static ARP in the form *aa*:*bb*:*cc*:*dd*:*ee*:*ff* or *aa-bb-cc-dd-ee-ff*, where *aa*, *bb*, *cc*, *dd*, *ee* and *ff* are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC and non-IEEE reserved MAC addresses.

strip-label

Syntax [**no**] **strip-label**

Context config>router>interface

Description This command forces packets to be stripped of all (max 5) MPLS labels before the packets are handed over for possible filter (PBR) processing.

If the packets do not have an IP header immediately following the MPLS label stack after the strip, they are discarded. Only MPLS encapsulated IP, IGP shortcuts and VPRN over MPLS packets will be processed.

This command is only supported on:

- Optical ports
- IOM3-XP cards
- Null/Dot1q encaps
- Network ports
- IPv4

The **no** form of the command removes the strip-label command.

In order to associate an interface that is configured with the strip-label parameter with a port, the port must be configured as single-fiber for the command to be valid.

Default no strip-label

teid-load-balancing

Syntax [**no**] **teid-load-balancing**

Context config>router>interface

Description This command enables inclusion of TEID in hashing for GTP-U/C encapsulates traffic for GTPv1/ GTPv2. The **no** form of this command ignores TEID in hashing.

Default disabled

tos-marking-state

Syntax **tos-marking-state** {**trusted** | **untrusted**}
no tos-marking-state

Context config>router>interface

Description This command is used on a network IP interface to alter the default trusted state to a non-trusted state. When unset or reverted to the trusted default, the ToS field will not be remarked by egress network IP interfaces unless the egress network IP interface has the remark-trusted state set, in which case the egress network interface treats all IES and network IP interface as untrusted.
When the ingress network IP interface is set to untrusted, all egress network IP interfaces will remark IP packets received on the network interface according to the egress marking definitions on each network interface. The egress network remarking rules also apply to the ToS field of IP packets routed using IGP shortcuts (tunneled to a remote next-hop). However, the tunnel QoS markings are always derived from the egress network QoS definitions.
Egress marking and remarking is based on the internal forwarding class and profile state of the packet once it reaches the egress interface. The forwarding class is derived from ingress classification functions. The profile of a packet is either derived from ingress classification or ingress policing.
The default marking state for network IP interfaces is trusted. This is equivalent to declaring no tos-marking-state on the network IP interface. When undefined or set to tos-marking-state trusted, the trusted state of the interface will not be displayed when using show config or show info unless the detail parameter is given. The **save config** command will not store the default tos-marking-state trusted state for network IP interfaces unless the detail parameter is also specified.

The **no** form of the command is used to restore the trusted state to a network IP interface. This is equivalent to executing the tos-marking-state trusted command.

Default trusted

Parameters **trusted —** The default prevents the ToS field to not be remarked by egress network IP interfaces unless the egress network IP interface has the remark-trusted state set

untrusted — Specifies that all egress network IP interfaces will remark IP packets received on the network interface according to the egress marking definitions on each network interface.

unnumbered

Syntax **unnumbered** [*ip-address* | *ip-int-name*]
no unnumbered

Context config>router>interface

Description This command sets an IP interface as an unnumbered interface and specifies the IP address to be used for the interface.

To conserve IP addresses, unnumbered interfaces can be configured. The address used when generating packets on this interface is the *ip-addr* parameter configured.
An error message will be generated if an **unnumbered** interface is configured, and an IP address already exists on this interface.

The **no** form of the command removes the IP address from the interface, effectively removing the unnumbered property. The interface must be **shutdown** before **no unnumbered** is issued to delete the IP address from the interface, or an error message will be generated.

Parameters *ip-addr* | *ip-int-name* — Optional. The IP address or IP interface name to associate with the unnumbered IP interface in dotted decimal notation. The configured IP address must exist on this node. It is recommended to use the system IP address as it is not associated with a particular interface and is therefore always reachable. The system IP address is the default if no *ip-addr* or *ip-int-name* is configured.

Default no unnumbered

qos-route-lookup

Syntax **qos-route-lookup** [**source** | **destination**]
no qos-route-lookup

Context config>router>if
config>router>if>ipv6

Description This command enables QoS classification of the ingress IP packets on an interface based on the QoS information associated with routes in the forwarding table.

If the optional **destination** parameter is specified and the destination address of an incoming IP packet matches a route with QoS information the packet is classified to the fc and priority associated with that route, overriding the fc and priority/profile determined from the sap-ingress or network qos policy associated with the IP interface. If the destination address of the incoming packet matches a route with no QoS information the fc and priority of the packet remain as determined by the sap-ingress or network qos policy.

If the optional **source** parameter is specified and the source address of an incoming IP packet matches a route with QoS information the packet is classified to the fc and priority associated with that route, overriding the fc and priority/profile determined from the sap-ingress or network qos policy associated with the IP interface. If the source address of the incoming packet matches a route with no QoS information the fc and priority of the packet remain as determined by the sap-ingress or network qos policy.

If neither the optional **source** or **destination** parameter is present, then the default is **destination** address matching.

The functionality enabled by the qos-route-lookup command can be applied to IPv4 packets or IPv6 packets on an interface, depending on whether it is present at the interface context (applies to IPv4) or the interface>ipv6 context (applies to IPv6). The ability to specify source address based QoS lookup is not supported for IPv6. Subscriber management group interfaces also do not support the source QPPB option.

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

Default destination

Parameters **source —** Enables QoS classification of incoming IP packets based on the source address matching a route with QoS information.

destination — Enables QoS classification of incoming IP packets based on the destination address matching a route with QoS information.

tcp-mss

Syntax **tcp-mss** *mss-value*
no tcp-mss

Context config>router>if
config>router>if>ipv6

Description This command allows the TCP MSS value used for TCP connections associated with the IPv4 or IPv6 interface to be set to a static value insted of beign determined by the IP MTU value. The configured TCP MSS value will onlt be used for future TCP connections associated with the IPv4 or IPv6 interface, existing TCP connections are not affected by the static value.

The **no** form of the command removed the stat MSS configuration and all future TCP connection will use a calulated MSS value based on the IP interface MTU.

Default **no tcp-mss**

Parameters *mss-value* — The TCP MSS value that shoudl be used in the TCP SYN packet during the three-way handshake negotiation of a TCP connection.

Values 384 - 9158 (IPv4)
1220 - 9138 (IPv6)

urpf-check

Syntax [**no**] **urpf-check**

Context config>router>if
config>router>if>ipv6

Description This command enables unicast RPF (uRPF) Check on this interface.

The **no** form of the command disables unicast RPF (uRPF) Check on this interface.

Default disabled

mode

Syntax **mode** {**strict** | **loose** | **strict-no-ecmp**}
no mode

Context config>router>if>urpf-check
config>router>if>>ipv6>urpf-check

Description This command specifies the mode of unicast RPF check.

The **no** form of the command reverts to the default (strict) mode.

Default strict

Parameters **strict —** When specified, uRPF checks whether incoming packet has a source address that matches a prefix in the routing table, and whether the interface expects to receive a packet with this source address prefix.

loose — In **loose** mode, uRPF checks whether incoming packet has source address with a corresponding prefix in the routing table. However, the loose mode does not check whether the interface expects to receive a packet with a specific source address prefix. This object is valid only when **urpf-check** is enabled.

strict-no-ecmp — When a packet is received on an interface in this mode and the SA matches an ECMP route the packet is dropped by uRPF.

mh-primary-interface

Syntax [**no**] **mh-primary-interface**

Context config>router

Description This command creates a loopback interface for use in multihoming resiliency. Once active, this interface can be used to advertise reachability information to the rest of the network using the primary address, which is backed up by the secondary.

The reachability for this address is advertised via IGPs and LDP protocols to allow the resolution of BGP routes advertised with this address.

The no form of the command disables this setting.

Default no multihoming

address

Syntax **address** {*ip-address/mask* | *ip-address netmask*}

no address

Context config>router>mh-primary-interface
config>router>mh-secondary-interface

Description This command assigns an IP address, IP subnet and broadcast address format to an IP interface. Only one IP address can be associated with an IP interface. An IP address must be assigned to each IP interface for the interface to be active. An IP address and a mask combine to create a local IP prefix. The defined IP prefix must be unique within the context of the routing instance. It cannot overlap with other existing IP prefixes defined as local subnets on other IP interface in the same routing context within the router.

The local subnet that the address command defines must not be part of the services address space within the routing context by use of the config>router>service-prefix command. Once a portion of the address space is allocated as a service prefix, that portion is not available to IP interfaces for network core connectivity. The IP address for the interface can be entered in either CIDR (Classless Inter-Domain Routing) or traditional dotted decimal notation. Show commands display CIDR notation and are stored in configuration files.

By default, no IP address or subnet association exists on an IP interface until it is explicitly created.

The no form of the command removes the IP address assignment from the IP interface. Interface specific configurations for IGP protocols like OSPF are also removed. The no form of this command can only be performed when the IP interface is administratively shut down. Shutting down the IP interface will operationally stop any protocol interfaces or MPLS LSPs that explicitly reference that IP address. When a new IP address is defined, the IP interface can be administratively enabled (no shutdown), which reinitializes the protocol interfaces and MPLS LSPs associated with that IP interface.

If a new address is entered while another address is still active, the new address wil be rejected.

Parameters *ip-address* — The IP address of the IP interface. The ip-addr portion of the address command specifies the IP host address that will be used by the IP interface within the subnet. This address must be unique within the subnet and specified in dotted decimal notation.

Values 1.0.0.0 - 223.255.255.255

/ — The forward slash is a parameter delimiter that separates the ipp-addr portion of the IP address from the mask that defines the scope of the local subnet. No spaces are allowed between the ip-addr, the "/" and the mask-length parameter. If a forward slash does not immediately follow the ip-addr, a dotted decimal mask must follow the prefix.

mask-length — The subnet mask length when the IP prefix is specified in CIDR notation. When the IP prefix is specified in CIDR notation, a forward slash (/) separates the ip-addr from the mask-length parameter. The mask length parameter indicates the number of bits used for the network portion of the IP address; the remainder of the IP address is used to determine the host portion of the IP address. Allowed values are integers in the range 1-32. Note that a mask length of 32 is reserved for system IP addresses.

Values 1-32

mask — The subnet mask in dotted decimal notation. When the IP prefix is not specified in CIDR notation, a space separates the ip-addr from a traditional dotted decimal mask. The mask parameters indicates the complete mask that will be used ina logical 'AND' function to derive the local subnet of the IP address. Note that a mask of 255.255.255.255 is reserved for system IP addresses.

Values 128.0.0.0 - 255.255.255.255

netmask — The subnet mask in dotted decimal notation.

Values 0.0.0.0 - 255.255.255.255 (nework bits all 1 and host bits all 0).

description

Syntax **description** *description-string*
no description

Context config>router>mh-primary-interface
config>router>mh-secondary-interface

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

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

Default no description

Parameters *description-string* — The description character string. Allowed values are any string up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special character (#, $, space, etc.), the entire string must be enclosed within double quotes.

shutdown

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

Context config>router>mh-primary-interface
config>router>mh-secondary-interface

Description The shutdown command administratively disables an entity. The operational state of the entity is disabled as well as the operational state of any entities contained within. 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 no shutdown

if-attribute

Syntax **if-attribute**

Context config>router

config>router>interface
config>service>ies>interface
config>service>vprn>interface

Description This command creates the context to configure or apply IP interface attributes such as administrative group (admin-group) or Shared Risk Loss Group (SRLG).

admin-group

Syntax **admin-group** *group-name* **value** *group-value*
no admin-group *group-name*

Context config>router>if-attribute

Description This command defines an administrative group (admin-group) that can be associated with an IP or MPLS interface.

Admin groups, also known as affinity, are used to tag IP and MPLS interfaces that share a specific characteristic with the same identifier. For example, an admin group identifier can represent all links that connect to core routers, or all links that have a bandwidth higher than 10G, or all links that are dedicated to a specific service.

The user first configures locally on each router the name and identifier of each admin group. A maximum of 32 admin groups can be configured per system.

The user then configures the admin group membership of an interface. The user can apply admin groups to a IES, VPRN, network IP, or MPLS interface.

When applied to MPLS interfaces, the interfaces can be included or excluded in the LSP path definition by inferring the admin-group name. CSPF will compute a path that satisfies the admin-group include and exclude constraints.

When applied to IES, VPRN, or network IP interfaces, the interfaces can be included or excluded in the route next-hop selection by inferring the admin-group name in a route next-hop policy template applied to an interface or a set of prefixes.

The following provisioning rules are applied to admin group configuration. The system will reject the creation of an admin-group if it re-uses the same name but with a different group value than an existing group. The system will also reject the creation of an admin-group if it re-uses the same group value but with a different name than an existing group.

It should be noted that only the admin groups bound to an MPLS interface are advertised area-wide in TE link TLVs and sub-TLVs when the **traffic-engineering** option is enabled in IS-IS or OSPF. IES and VPRN interfaces do not have their attributes advertised in TE TLVs.

Parameters *group-name* — Specifies the name of the group with up to 32 characters. The association of group name and value hsould be unique within an IP/MPLS domain.

value *group-value* **—** Specifies the integer value associated with the group. The association of group name and value should be unique within an IP/MPLS domain.

Values 0 — 31

admin-group

Syntax **admin-group** *group-name* [*group-name***...(up to 5 max)**]
no admin-group *group-name* [*group-name***...(up to 5 max)**]
no admin-group

Context config>router>interface>if-attribute
config>service>ies>interface>if-attribute
config>service>vprn>interface>if-attribute
config>router>mpls>interface

Description This command configures the admin group membership of an interface. The user can apply admin groups to an IES, VPRN, network IP, or MPLS interface.

Each single operation of the **admin-group** command allows a maximum of five (5) groups to be specified at a time. However, a maximum of 32 groups can be added to a given interface through multiple operations. Once an admin group is bound to one or more interface, its value cannot be changed until all bindings are removed.

The configured admin-group membership will be applied in all levels/areas the interface is participating in. The same interface cannot have different memberships in different levels/areas.

It should be noted that only the admin groups bound to an MPLS interface are advertised area-wide in TE link TLVs and sub-TLVs when the **traffic-engineering** option is enabled in IS-IS or OSPF. IES and VPRN interfaces do not have their attributes advertised in TE TLVs.

The **no** form of this command deletes one or more of the admin-group memberships of an interface. The user can also delete all memberships of an interface by not specifying a group name.

Parameters *group-name* — Specifies the name of the group with up to 32 characters. The association of group name and value should be unique within an IP/MPLS domain.

srlg-group

Syntax **srlg-group** *group-name* **value** *group-value*
no srlg-group *group-name*

Context config>router>if-attribute

Description This command defines an Shared Risk Loss Group (SRLG) which can be associated with an IP or MPLS interface.

SRLG is used to tag IP or MPLS interfaces which share a specific fate with the same identifier. For example, an SRLG group identifier could represent all links which use separate fibers but are carried in the same fiber conduit. If the conduit is accidentally cut, all the fiber links are cut which means all interfaces using these fiber links will fail.

The user first configures locally on each router the name and identifier of each SRLG group. A maximum of 1024 SRLGs can be configured per system.

The user then configures the SRLG membership of an interface. The user can apply SRLGs to a IES, VPRN, network IP, or MPLS interface. A maximum of 64 SRLGs can be applied to a given interface.

When SRLGs are applied to MPLS interfaces, CSPF at LER will exclude the SRLGs of interfaces used by the LSP primary path when computing the path of the secondary path. CSPF at a LER or LSR will also exclude the SRLGs of the outgoing interface of the primary LSP path in the computation of the path of the FRR backup LSP. This provides path disjointness between the primary path and the secondary path or FRR backup path of an LSP.

When SRLGs applied to IES, VPRN, or network IP interfaces, they are evaluated in the route next-hop selection by adding the **srlg-enable** option in a route next-hop policy template applied to an interface or a set of prefixes. For insance, the user can enable the SRLG constraint to select a LFA next-hop for a prefix which avoids all interfaces that share fate with the primary next-hop.

The following provisioning rules are applied to SRLG configuration. The system will reject the creation of a SRLG if it re-uses the same name but with a different group value than an existing group. The system will also reject the creation of an SRLG if it re-uses the same group value but with a different name than an existing group.

It should be noted that only the SRLGs bound to an MPLS interface are advertised area-wide in TE link TLVs and sub-TLVs when the **traffic-engineering** option is enabled in IS-IS or OSPF. IES and VPRN interfaces do not have their attributes advertised in TE TLVs.

Parameters *group-name* — Specifies the name of the group, up to 32 characters. The association of group name and value should be unique within an IP/MPLS domain.

value *group-value* — Specifies the integer value associated with the group. The association of group name and value should be unique within an IP/MPLS domain.

Values 0 — 4294967295

srlg-group

Syntax **srlg-group** *group-name* [*group-name***...(up to 5 max)**]
no srlg-group *group-name* [*group-name***...(up to 5 max)**]
no srlg-group

Context config>router>interface>if-attribute
config>service>ies>interface>if-attribute
config>service>vprn>interface>if-attribute
config>router>mpls>interface

Description This command configures the SRLG membership of an interface. The user can apply SRLGs to an IES, VPRN, network IP, or MPLS interface.

An interface can belong to up to 64 SRLG groups. However, each single operation of the **srlg-group** command allows a maximum of five (5) groups to be specified at a time. Once an SRLG group is bound to one or more interface, its value cannot be changed until all bindings are removed.

The configured SRLG membership will be applied in all levels/areas the interface is participating in. The same interface cannot have different memberships in different levels/areas.

It should be noted that only the SRLGs bound to an MPLS interface are advertised area-wide in TE link TLVs and sub-TLVs when the **traffic-engineering** option is enabled in IS-IS or OSPF. IES and VPRN interfaces do not have their attributes advertised in TE TLVs.

The **no** form of this command deletes one or more of the SRLG memberships of an interface. The user can also delete all memberships of an interface by not specifying a group name.

Parameters *group-name* — Specifies the name of the group, up to 32 characters. The association of group name and value should be unique within an IP/MPLS domain.

route-next-hop-policy

Syntax **route-next-hop-policy**

Context config>router

Description This command creates the context to configure route next-hop policies.

template

Syntax [**no**] **template** *template-name*

Context config>router>route-next-hop-policy

Description This command creates a template to configure the attributes of a Loop-Free Alternate (LFA) Shortest Path First (SPF) policy. An LFA SPF policy allows the user to apply specific criteria, such as admin group and SRLG constraints, to the selection of an LFA backup next-hop for a subset of prefixes that resolve to a specific primary next-hop.

The user first creates a route next-hop policy template under the global router context and then applies it to a specific OSPF or IS-IS interface in the global routing instance or in a VPRN instance.

A policy template can be used in both IS-IS and OSPF to apply the specific criteria to prefixes protected by LFA. Each instance of IS-IS or OSPF can apply the same policy template to one or more interface.

The commands within the route next-hop policy template use the **begin-commit-abort** model. The following are the steps to create and modify the template:

1. To create a template, the user enters the name of the new template directly under the route-next-hop-policy context.
2. To delete a template that is not in use, the user enters the **no** form for the template name under the route-next-hop-policy context.
3. The user enters the editing mode by executing the begin command under the route-next-hop-policy context. The user can then edit and change any number of route next-hop policy templates. However, the parameter value will still be stored temporarily in the template module until the commit is executed under the route-next-hop-policy context. Any temporary parameter changes will be lost if the user enters the abort command before the commit command.
4. The user is allowed to create or delete a template instantly once in the editing mode without the need to enter the commit command. Furthermore, the abort command, if entered, will have no effect on the prior deletion or creation of a template.

Once the commit command is issued, IS-IS or OSPF will re-evaluate the templates and if there are any net changes, it will schedule a new LFA SPF to re-compute the LFA next-hop for the prefixes associated with these templates.

Parameters *template-name* — Specifies the name of the template, up to 32 characters.

include-group

Syntax **include-group** *group-name* [**pref** *pref*]
no include-group *group-name*

Context config>router>route-next-hop-policy>template

Description This command configures the admin group constraint into the route next-hop policy template.

Each group is entered individually. The **include-group** statement instructs the LFA SPF selection algorithm to pick up a subset of LFA next-hops among the links which belong to one or more of the specified admin groups. A link which does not belong to at least one of the admin-groups is excluded. However, a link can still be selected if it belongs to one of the groups in a include-group statement but also belongs to other groups which are not part of any include-group statement in the route next-hop policy.

The **pref** option is used to provide a relative preference for the admin group to select. A lower preference value means that LFA SPF will first attempt to select a LFA backup next-hop which is a member of the corresponding admin group. If none is found, then the admin group with the next higher preference value is evaluated. If no preference is configured for a given admin group name, then it is supposed to be the least preferred, i.e., numerically the highest preference value.

When evaluating multiple **include-group** statements within the same preference, any link which belongs to one or more of the included admin groups can be selected as an LFA next-hop. There is no relative preference based on how many of those included admin groups the link is a member of.

The **exclude-group** statement simply prunes all links belonging to the specified admin group before making the LFA backup next-hop selection for a prefix.

If the same group name is part of both include and exclude statements, the exclude statement will win. It other words, the exclude statement can be viewed as having an implicit preference value of 0.

Note the admin-group criteria are applied before running the LFA next-hop selection algorithm.

The **no** form deletes the admin group constraint from the route next-hop policy template.

Parameters *group-name* — Specifies the name of the group, up to 32 characters.

pref *pref* **—** An integer specifying the relative preference of a group.

Values 1 — 255

Default 255

exclude-group

Syntax **exclude-group** *group-name*
no exclude-group *group-name*

Context config>router>route-next-hop-policy>template

Description This command configures the admin group constraint into the route next-hop policy template.

Each group is entered individually. The **include-group** statement instructs the LFA SPF selection algorithm to pick up a subset of LFA next-hops among the links that belong to one or more of the specified admin groups. A link that does not belong to at least one of the admin-groups is excluded. However, a link can still be selected if it belongs to one of the groups in an include-group statement but also belongs to other groups that are not part of any include-group statement in the route next-hop policy.

The **pref** option is used to provide a relative preference for the admin group to select. A lower preference value means that LFA SPF will first attempt to select an LFA backup next-hop that is a member of the corresponding admin group. If none is found, then the admin group with the next highest preference value is evaluated. If no preference is configured for a given admin group name, then it is supposed to be the least preferred (i.e., numerically the highest preference value).

When evaluating multiple **include-group** statements within the same preference, any link that belongs to one or more of the included admin groups can be selected as an LFA next-hop. There is no relative preference based on how many of those included admin groups the link is a member of.

The **exclude-group** statement simply prunes all links belonging to the specified admin group before making the LFA backup next-hop selection for a prefix.

If the same group name is part of both include and exclude statements, the exclude statement will win. It other words, the exclude statement can be viewed as having an implicit preference value of zero (0).

Note that the admin-group criteria are applied before running the LFA next-hop selection algorithm.

The **no** form deletes the admin group constraint from the route next-hop policy template.

Parameters *group-name* — Specifies the name of the group, up to 32 characters.

srlg-enable

Syntax [**no**] **srlg-enable**

Context config>router>route-next-hop-policy>template

Description This command configures the SRLG constraint into the route next-hop policy template.

When this command is applied to a prefix, the LFA SPF will attempt to select an LFA next-hop, among the computed ones, which uses an outgoing interface that does not participate in any of the SLRGs of the outgoing interface used by the primary next-hop.

Note that the SRLG criterion is applied before running the LFA next-hop selection algorithm.

The **no** form deletes the SRLG constraint from the route next-hop policy template.

protection-type

Syntax **protection-type** {**link** | **node**}
no protection-type

Context config>router>route-next-hop-policy>template

Description This command configures the protection type constraint into the route next-hop policy template.

The user can select if link protection or node protection is preferred in the selection of an LFA next-hop for all IP prefixes and LDP FEC prefixes to which a route next-hop policy template is applied. The default in SR OS implementation is node protection. The implementation will fall back to the other type if no LFA next-hop of the preferred type is found.

When the route next-hop policy template is applied to an IP interface, all prefixes using this interface as a primary next-hop will follow the protection type preference specified in the template.

The **no** form deletes the protection type constraint from the route next-hop policy template.

Parameters {**link** | **node**} — Specifies the two possible values for the protection type.

Default node

nh-type

Syntax **nh-type** {**ip | tunnel**}
no nh-type

Context config>router>route-next-hop-policy>template

Description This command configures the next-hop type constraint into the route next-hop policy template.

The user can select if tunnel backup next-hop or IP backup next-hop is preferred. The default in SROS implementation is to prefer IP next-hop over tunnel next-hop. The implementation will fall back to the other type if no LFA next-hop of the preferred type is found.

When the route next-hop policy template is applied to an IP interface, all prefixes using this interface as a primary next-hop will follow the next-hop type preference specified in the template.

The **no** form deletes the next-hop type constraint from the route next-hop policy template.

Parameters {**ip** | **tunnel**} — Specifies the two possible values for the next-hop type.

Default ip

mh-secondary-interface

Syntax [**no**] **mh-secondary-interface**

Context config>router

Description This command creates a loopback interface for use in multihoming resiliency. This address is considered the secondary multihoming address and is only used to resolve routes advertised by the primary router in the event that router becomes unavailable. For this purpose, the reachability for this address is advertised via IGPs and LDP protocols to allow the resolution of BGP routes advertised with this address by the primary multihoming router.

The no form of the command disables this setting.

Default no mh-secondary-interface

hold-time

Syntax **hold-time** *holdover-time*
no hold-time

Context config>router>mh-secondary-interface

Description The optional hold-time parameter is only applicable for the secondary context and specifies how long label information leraned about the secondary anycast address should be kept after that peer is declared down. This timer should be set to a value large enough for the remainder of the network to detect the failure and complete the reconvergence process.

The no form of the command resets the hold-time back to the default value.

Default no hold-time

Parameters *holdover-time* — Specifies the number of seconds the router should hold label information learned from the alternate router in its secondary label table. This is to allow the reset of the network to reconverge after a router failure before the anycast based label assignments are flushed from the forwarding plane.

Values 0-65535

Default 90

Router Interface Filter Commands

egress

Syntax **egress**

Context config>router>interface

Description This command enables access to the context to configure egress network filter policies for the IP interface. If an egress filter is not defined, no filtering is performed.

ingress

Syntax **ingress**

Context config>router>interface

Description This command enables access to the context to configure ingress network filter policies for the IP interface. If an ingress filter is not defined, no filtering is performed.

flowspec

Syntax [**no**] **flowspec**

Context config>router>interface>ingress

Description This command enables IPv4 flowspec filtering on a network IP interface. Filtering is based on all of the IPv4 flowspec routes that have been received and accepted by the base router BGP instance. Ingress IPv4 traffic on an interface can be filtered by both a user-defined IPv4 filter and flowspec. Evaluation proceeds in this order:

1.user-defined IPv4 filter entries

2.flowspec-derived filter entries

3.user-defined IPv4 filter default-action

The **no** form of the command removes IPv4 flowspec filtering from the network IP interface.

Default No network interfaces have IPv4 flowspec enabled.

flowspec-ipv6

Syntax [**no**] **flowspec**

Context config>router>interface>ingress

Description This command enables IPv6 flowspec filtering on a network IP interface. Filtering is based on all of the IPv6 flowspec routes that have been received and accepted by the base router BGP instance. Ingress IPv6 traffic on an interface can be filtered by both a user-defined IPv4 filter and flowspec. Evaluation proceeds in this order:

1.user-defined IPv6 filter entries

2.flowspec-derived filter entries

3.user-defined IPv6 filter default-action

The **no** form of the command removes IPv6 flowspec filtering from the network IP interface.

Default No network interfaces have IPv6 flowspec enabled.

filter

Syntax **filter ip** *ip-filter-id*
filter ipv6 *ipv6-filter-id*
no filter [**ip** *ip-filter-ip*] [**ipv6** *ipv6-filter-id*]

Context config>router>if>ingress
config>router>if>egress

Description This command associates an IP filter policy with an IP interface.

Filter policies control packet forwarding and dropping based on IP match criteria.

The *ip-filter-id* must have been pre-configured before this **filter** command is executed. If the filter ID does not exist, an error occurs.

Only one filter ID can be specified.

The **no** form of the command removes the filter policy association with the IP interface.

Default No filter is specified.

Parameters **ip** *ip-filter-id* — The filter name acts as the ID for the IP filter policy expressed as a decimal integer. The filter policy must already exist within the **config>filter>ip** context.

Values 1 — 16384

ipv6 *ipv6-filter-id* **—** The filter name acts as the ID for the IPv6 filter policy expressed as a decimal integer. The filter policy must already exist within the **config>filter>ipv6** context.

Values 1— 65535

Router Interface ICMP Commands

icmp

Syntax **icmp**

Context config>router>interface

Description This command enables access to the context to configure Internet Control Message Protocol (ICMP) parameters on a network IP interface. ICMP is a message control and error reporting protocol that also provides information relevant to IP packet processing.

mask-reply

Syntax [**no**] **mask-reply**

Context config>router>if>icmp

Description This command enables responses to ICMP mask requests on the router interface.

If a local node sends an ICMP mask request to the router interface, the **mask-reply** command configures the router interface to reply to the request.

The **no** form of the command disables replies to ICMP mask requests on the router interface.

Default mask-reply — Replies to ICMP mask requests.

redirects

Syntax **redirects** [*number seconds*]
no redirects

Context config>router>if>icmp

Description This command enables and configures the rate for ICMP redirect messages issued on the router interface.

When routes are not optimal on this router, and another router on the same subnetwork has a better route, the router can issue an ICMP redirect to alert the sending node that a better route is available.

The **redirects** command enables the generation of ICMP redirects on the router interface. The rate at which ICMP redirects are issued can be controlled with the optional *number* and *time* parameters by indicating the maximum number of redirect messages that can be issued on the interface for a given time interval.

By default, generation of ICMP redirect messages is enabled at a maximum rate of 100 per 10 second time interval.

The **no** form of the command disables the generation of ICMP redirects on the router interface.

Default redirects 100 10 — Maximum of 100 redirect messages in 10 seconds.

Parameters *number* — The maximum number of ICMP redirect messages to send, expressed as a decimal integer. This parameter must be specified with the *time* parameter.

Values 10 — 1000

seconds — The time frame, in seconds, used to limit the *number* of ICMP redirect messages that can be issued,expressed as a decimal integer.

Values 1 — 60

ttl-expired

Syntax **ttl-expired** [*number seconds*]
no ttl-expired

Context config>router>if>icmp

Description This command configures the rate that Internet Control Message Protocol (ICMP) Time To Live (TTL) expired messages are issued by the IP interface.

By default, generation of ICMP TTL expired messages is enabled at a maximum rate of 100 per 10 second time interval.

The **no** form of the command disables the generation of TTL expired messages.

Default ttl-expired 100 10 — Maximum of 100 TTL expired message in 10 seconds.

Parameters *number* — The maximum number of ICMP TTL expired messages to send, expressed as a decimal integer. The *seconds* parameter must also be specified.

Values 10 — 1000

seconds — The time frame, in seconds, used to limit the *number* of ICMP TTL expired messages that can be issued, expressed as a decimal integer.

Values 1 — 60

unreachables

Syntax **unreachables** [*number seconds*]
no unreachables

Context config>router>if>icmp

Description This command enables and configures the rate for ICMP host and network destination unreachable messages issued on the router interface.

The **unreachables** command enables the generation of ICMP destination unreachables on the router interface. The rate at which ICMP unreachables is issued can be controlled with the optional *number* and *seconds* parameters by indicating the maximum number of destination unreachable messages that can be issued on the interface for a given time interval.

By default, generation of ICMP destination unreachables messages is enabled at a maximum rate of 100 per 10 second time interval.

The **no** form of the command disables the generation of ICMP destination unreachables on the router interface.

Default unreachables 100 10 — Maximum of 100 unreachable messages in 10 seconds.

Parameters *number* — The maximum number of ICMP unreachable messages to send, expressed as a decimal integer. The *seconds* parameter must also be specified.

Values 10 — 1000

seconds — The time frame, in seconds, used to limit the *number* of ICMP unreachable messages that can be issued, expressed as a decimal integer.

Router Interface IPv6 Commands

ipv6

Syntax [**no**] **ipv6**

Context config>router>interface

Description This command configures IPv6 for a router interface.

The **no** form of the command disables IPv6 on the interface.

Default not enabled

address

Syntax **address** {*ipv6-address/prefix-length*} [**eui-64**]
no address {*ipv6-address/prefix-length*}

Context config>router>if>ipv6

Description This command assigns an IPv6 address to the interface.

Default none

Parameters *ipv6-address/prefix-length* — Specify the IPv6 address on the interface.

Values	ipv6-address/prefix: 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
	prefix-length	1 — 128

eui-64 — When the **eui-64** keyword is specified, a complete IPv6 address from the supplied prefix and 64-bit interface identifier is formed. The 64-bit interface identifier is derived from MAC address on Ethernet interfaces. For interfaces without a MAC address, for example POS interfaces, the Base MAC address of the chassis should be used.

dad-disable

Syntax [**no**] **dad-disable**

Context config>router>interface>ipv6

Description This command disables duplicate address detection (DAD) on a per-interface basis. This prevents the router from performing a DAD check on the interface. All IPv6 addresses of an interface with DAD disabled, immediately enter a preferred state, without checking for uniqueness on the interface. This is useful for interfaces which enter a looped state during troubleshooting and operationally disable themselves when the loop is detected, requiring manual intervention to clear the DAD violation.

The **no** form of the command turns off **dad-disable** on the interface.

Default not enabled

icmp6

Syntax **icmp6**

Context config>router>if>ipv6

Description This command enables the context to configure ICMPv6 parameters for the interface.

packet-too-big

Syntax **packet-too-big** [*number seconds*]
no packet-too-big

Context config>router>if>ipv6>icmp6

Description This command configures the rate for ICMPv6 packet-too-big messages.

Parameters *number* — Limits the number of packet-too-big messages issued per the time frame specifed in the *seconds* parameter.

Values 10 — 1000

seconds — Determines the time frame, in seconds, that is used to limit the number of packet-too-big messages issued per time frame.

Values 1 — 60

param-problem

Syntax **param-problem** [*number seconds*]
no param-problem

Context config>router>if>ipv6>icmp6

Description This command configures the rate for ICMPv6 param-problem messages.

Parameters *number* — Limits the number of param-problem messages issued per the time frame specifed in the *seconds* parameter.

Values 10 — 1000

seconds — Determines the time frame, in seconds, that is used to limit the number of param-problem messages issued per time frame.

Values 1 — 60

redirects

Syntax **redirects** [*number seconds*]
no redirects

Context config>router>if>ipv6>icmp6

Description This command configures the rate for ICMPv6 redirect messages. When configured, ICMPv6 redirects are generated when routes are not optimal on the router and another router on the same subnetwork has a better route to alert that node that a better route is available.

The **no** form of the command disables ICMPv6 redirects.

Default 100 10 (when IPv6 is enabled on the interface)

Parameters *number* — Limits the number of redirects issued per the time frame specifed in *seconds* parameter.

Values 10 — 1000

seconds — Determines the time frame, in seconds, that is used to limit the number of redirects issued per time frame.

Values 1 — 60

time-exceeded

Syntax **time-exceeded** [*number seconds*]
no time-exceeded

Context config>router>if>ipv6>icmp6

Description This command configures rate for ICMPv6 time-exceeded messages.

Parameters *number* — Limits the number of time-exceeded messages issued per the time frame specifed in *seconds* parameter.

Values 10 — 1000

seconds — Determines the time frame, in seconds, that is used to limit the number of time-exceeded messages issued per time frame.

Values 1 — 60

unreachables

Syntax **unreachables** [*number seconds*]
no unreachables

Context config>router>if>ipv6>icmp6

Description This command configures the rate for ICMPv6 unreachable messages. When enabled, ICMPv6 host and network unreachable messages are generated by this interface.

The **no** form of the command disables the generation of ICMPv6 host and network unreachable messages by this interface.

Default 100 10 (when IPv6 is enabled on the interface)

Parameters *number* — Determines the number destination unreachable ICMPv6 messages to issue in the time frame specified in *seconds* parameter.

Values 10 — 1000

seconds — Sets the time frame, in seconds, to limit the number of destination unreachable ICMPv6 messages issued per time frame.

Values 1 — 60

link-local-address

Syntax **link-local-address** *ipv6-address* [**preferred**]
no link-local-address

Context config>router>if>ipv6

Description This command configures the link local address.

local-proxy-nd

Syntax [**no**] **local-proxy-nd**

Context config>router>if>ipv6

Description This command enables local proxy neighbor discovery on the interface.

The **no** form of the command disables local proxy neighbor discovery.

proxy-nd-policy

Syntax **proxy-nd-policy** *policy-name* [*policy-name*...(up to 5 max)]
no proxy-nd-policy

Context config>router>if>ipv6

Description This command configure a proxy neighbor discovery policy for the interface.

Parameters *policy-name* — The neighbor discovery policy name. 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.

neighbor

Syntax **neighbor** [*ipv6-address*] [*mac-address*]
no neighbor [*ipv6-address*]

Context config>router>if>ipv6

Description This command configures an IPv6-to-MAC address mapping on the interface. Use this command if a directly attached IPv6 node does not support ICMPv6 neighbor discovery, or for some reason, a static address must be used. This command can only be used on Ethernet media.

The *ipv6-address* must be on the subnet that was configured from the IPv6 **address** command or a link-local address.

Parameters *ipv6-address* — The IPv6 address assigned to a router interface.

Values 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

mac-address — Specifies the MAC address for the neighbor in the form of xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx.

Router Advertisement Commands

router-advertisement

Syntax [**no**] **router-advertisement**

Context config>router

Description This command configures router advertisement properties. By default, it is disabled for all IPv6 enabled interfaces.

The **no** form of the command disables all IPv6 interface. However, the **no interface** *interface-name* command disables a specific interface.

Default disabled

interface

Syntax [**no**] **interface** *ip-int-name*

Context config>router>router-advertisement

Description This command configures router advertisement properties on a specific interface. The interface must already exist in the **config>router>interface** context.

Default No interfaces are configured by default.

Parameters *ip-int-name* — Specify the interface name. If the string contains special characters (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

current-hop-limit

Syntax **current-hop-limit** *number*
no current-hop-limit

Context config>router>router-advert>if

Description This command configures the current-hop-limit in the router advertisement messages. It informs the nodes on the subnet about the hop-limit when originating IPv6 packets.

Default 64

Parameters *number* — Specifies the hop limit.

Values 0 — 255. A value of zero means there is an unspecified number of hops.

managed-configuration

Syntax [**no**] **managed-configuration**

Context config>router>router-advert>if

Description This command sets the managed address configuration flag. This flag indicates that DHCPv6 is available for address configuration in addition to any address autoconfigured using stateless address autoconfiguration. See RFC 3315, *Dynamic Host Configuration Protocol (DHCP) for IPv6*.

Default no managed-configuration

max-advertisement-interval

Syntax [**no**] **max-advertisement-interval** *seconds*

Context config>router>router-advert>if

Description This command configures the maximum interval between sending router advertisement messages.

Default 600

Parameters *seconds* — Specifies the maximum interval in seconds between sending router advertisement messages.

Values 4 — 1800

min-advertisement-interval

Syntax [**no**] **min-advertisement-interval** *seconds*

Context config>router>router-advert>if

Description This command configures the minimum interval between sending ICMPv6 neighbor discovery router advertisement messages.

Default 200

Parameters *seconds* — Specify the minimum interval in seconds between sending ICMPv6 neighbor discovery router advertisement messages.

Values 3 — 1350

mtu

Syntax [**no**] **mtu** *mtu-bytes*

Context config>router>router-advert>if

Description This command configures the MTU for the nodes to use to send packets on the link.

Default no mtu — The MTU option is not sent in the router advertisement messages.

Parameters *mtu-bytes* — Specify the MTU for the nodes to use to send packets on the link.

Values 1280 — 9212

other-stateful-configuration

Syntax [**no**] **other-stateful-configuration**

Description This command sets the "Other configuration" flag. This flag indicates that DHCPv6lite is available for autoconfiguration of other (non-address) information such as DNS-related information or information on other servers in the network.See RFC 3736, *Stateless Dynamic Host Configuration Protocol (DHCP) for IPv6*

Default no other-stateful-configuration

prefix

Syntax [**no**] **prefix** [*ipv6-prefix*/*prefix-length*]

Context config>router>router-advert>if

Description This command configures an IPv6 prefix in the router advertisement messages. To support multiple IPv6 prefixes, use multiple prefix statements. No prefix is advertised until explicitly configured using prefix statements.

Default none

Parameters *ip-prefix* — The IP prefix for prefix list entry in dotted decimal notation.

Values	ipv4-prefix	a.b.c.d (host bits must be 0)	
	ipv4-prefix-length	0 — 32	
	ipv6-prefix	x:x:x:x:x:x:x:x (eight 16-bit pieces)	
		x:x:x:x:x:x:d.d.d.d	
		x:	[0 — FFFF]H
		d:	[0 — 255]D
	ipv6-prefix-length	0 — 128	

prefix-length — Specifies a route must match the most significant bits and have a prefix length.

Values 1 — 128

autonomous

Syntax [**no**] **autonomous**

Context config>router>router-advert>if>prefix

Description This command specifies whether the prefix can be used for stateless address autoconfiguration.

Default enabled

on-link

Syntax [**no**] **on-link**

Context config>router>router-advert>if>prefix

Description This command specifies whether the prefix can be used for onlink determination.

Default enabled

preferred-lifetime

Syntax [**no**] **preferred-lifetime** {*seconds* | **infinite**}

Context config>router>router-advert>if

Description This command configures the remaining length of time in seconds that this prefix will continue to be preferred, such as, time until deprecation. The address generated from a deprecated prefix should not be used as a source address in new communications, but packets received on such an interface are processed as expected.

Default 604800

Parameters *seconds* — Specifies the remaining length of time in seconds that this prefix will continue to be preferred.

infinite — Specifies that the prefix will always be preferred. A value of 4,294,967,295 represents infinity.

valid-lifetime

Syntax **valid-lifetime** {*seconds* | **infinite**}

Context config>router>router-advert>if

Description This command specifies the length of time in seconds that the prefix is valid for the purpose of on-link determination. A value of all one bits (0xffffffff) represents infinity.

The address generated from an invalidated prefix should not appear as the destination or source address of a packet.

Default 2592000

Parameters *seconds* — Specifies the remaining length of time in seconds that this prefix will continue to be valid.

infinite — Specifies that the prefix will always be valid. A value of 4,294,967,295 represents infinity.

reachable-time

Syntax **reachable-time** *milli-seconds*
no reachable-time

Context config>router>router-advert>if

Description This command configures how long this router should be considered reachable by other nodes on the link after receiving a reachability confirmation.

Default no reachable-time

Parameters *milli-seconds* — Specifies the length of time the router should be considered reachable.

Values 0 — 3600000

retransmit-time

Syntax **retransmit-timer** *milli-seconds*
no retransmit-timer

Context config>router>router-advert>if

Description This command configures the retransmission frequency of neighbor solicitation messages.

Default no retransmit-time

Parameters *milli-seconds* — Specifies how often the retransmission should occur.

Values 0 — 1800000

router-lifetime

Syntax **router-lifetime** *seconds*
no router-lifetime

Context config>router>router-advert>if

Description This command sets the router lifetime.

Default 1800

Parameters *seconds* — The length of time, in seconds, (relative to the time the packet is sent) that the prefix is valid for route determination.

Values 0, 4 — 9000 seconds. 0 means that the router is not a default router on this link.

use-virtual-mac

Syntax [**no**] **use-virtual-mac**

Context config>router>router-advert>if

Description This command enables sending router advertisement messages using the VRRP virtual MAC address, provided that the virtual router is currently the master.

If the virtual router is not the master, no router advertisement messages are sent.

The **no** form of the command disables sending router advertisement messages.

Default no use-virtual-mac

Show Commands

aggregate

Syntax **aggregate** [*family*] [**active**]

Context show>router

Description This command displays aggregate routes.

Parameters *family* — Specifies to display IPv4 or IPv6 aggregate routes.

Values ipv4, ipv6

active — When the active keyword is specified, inactive aggregates are filtered out.

Sample Output

```
*A:CPM133>config>router# show router aggregate
================================================================================
Aggregates (Router: Base)
================================================================================
Prefix                                          Aggr IP-Address   Aggr AS
   Summary                                         AS Set          State
     NextHop                                     Community      NextHopType
--------------------------------------------------------------------------------
10.0.0.0/8                                       0.0.0.0          0
   False                                           False           Inactive
                                                 100:33         Blackhole
--------------------------------------------------------------------------------
No. of Aggregates: 1
================================================================================
*A:CPM133>config>router#
```

arp

Syntax **arp** [*ip-int-name* **|** *ip-address/mask* **| mac** *ieee-mac-address* **| summary**] [**local | dynamic | static | managed**]

Context show>router

Description This command displays the router ARP table sorted by IP address. If no command line options are specified, all ARP entries are displayed.

Parameters *ip-address/mask* — Only displays ARP entries associated with the specified IP address and mask.

ip-int-name — Only displays ARP entries associated with the specified IP interface name.

mac *ieee-mac-addr* **—** Only displays ARP entries associated with the specified MAC address.

summary — Displays an abbreviate list of ARP entries.

[**local** | **dynamic** | **static** | **managed**] — Only displays ARP information associated with the keyword.

Output **ARP Table Output —** The following table describes the ARP table output fields:

Label	Description
`IP Address`	The IP address of the ARP entry.
`MAC Address`	The MAC address of the ARP entry.
`Expiry`	The age of the ARP entry.
`Type`	`Dyn` — The ARP entry is a dynamic ARP entry. `Inv` — The ARP entry is an inactive static ARP entry (invalid). `Oth` — The ARP entry is a local or system ARP entry. `Sta` — The ARP entry is an active static ARP entry.
`*Man`	The ARP entry is a managed ARP entry.
`Int`	The ARP entry is an internal ARP entry.
`[I}`	The ARP entry is in use.
`Interface`	The IP interface name associated with the ARP entry.
`No. of ARP Entries`	The number of ARP entries displayed in the list.

Sample Output

```
*B:7710-Red-RR# show router arp
===============================================================================
ARP Table (Router: Base)
===============================================================================
IP Address      MAC Address       Expiry    Type   Interface
-------------------------------------------------------------------------------
10.20.1.24      00:16:4d:23:91:b8 00h00m00s Oth    system
10.10.4.11      00:03:fa:00:d0:c9 00h57m03s Dyn[I] to-core-sr1
10.10.4.24      00:03:fa:41:8d:20 00h00m00s Oth[I] to-core-sr1
-------------------------------------------------------------------------------
No. of ARP Entries: 3
===============================================================================


A:ALA-A# show router ARP 10.10.0.3
===============================================================================
ARP Table
===============================================================================
IP Address      MAC Address       Expiry      Type Interface
-------------------------------------------------------------------------------
10.10.0.3       04:5d:ff:00:00:00 00:00:00    Oth  system
===============================================================================
A:ALA-A#


A:ALA-A# show router ARP to-ser1
===============================================================================
ARP Table
===============================================================================
IP Address      MAC Address       Expiry      Type Interface
-------------------------------------------------------------------------------
10.10.13.1      04:5b:01:01:00:02 03:53:09    Dyn  to-ser1
===============================================================================
A:ALA-A#
```

authentication

Syntax **authentication**

Context show>router

Description This command enables the command to display authentication statistics.

statistics

Syntax **statistics**
statistics interface [*ip-int-name* **|** *ip-address*]
statistics policy *name*

Context show>router>authentication

Description This command displays interface or policy authentication statistics.

Parameters **interface** [*ip-int-name* | *ip-address*] — Specifies an existing interface name or IP address.

Values *ip-int-name:* 32 chars max
ip-address: a.b.c.d

policy *name* — Specifies an existing policy name.

Output **Authentication Statistics Output —** The following table describes the show authentication statistics output fields:

Label	Description
`Client Packets Authenticate Fail`	The number of packets that failed authentication.
`Client Packets Authenticate Ok`	The number of packets that were authenticated.

Sample Output

```
A:ALU-3>show>router>auth# statistics
===================================================================
Authentication Global Statistics
===================================================================
Client Packets Authenticate Fail     : 0
Client Packets Authenticate Ok       : 12
===================================================================
A:ALU-3>
```

bfd

Syntax **bfd**

Context show>router

Description This command enables the context to display bi-directional forwarding detection (BFD) information.

Sample Output

```
*A:Dut-D# show router 3 bfd session
===============================================================================
BFD Session
===============================================================================
InterfaceState                 Tx Intvl  Rx Intvl  Multipl
  Remote Address              Protocols             Tx Pkts   Rx Pkts   Type
-------------------------------------------------------------------------------
ies-3-121.1.3.3               Up (3)                10        10        3
   121.1.3.2                  ospf2                 N/A       N/A       cpm-np
ies-3-122.1.4.3               Up (3)                100       100       3
   122.1.4.2                  pim                   455       464       iom
-------------------------------------------------------------------------------
No. of BFD sessions: 2
===============================================================================
*A:Dut-D#
```

```
*A:Dut-C# show router bfd session src 11.120.1.4 dest 11.120.1.3
===============================================================================
BFD Session
===============================================================================
Remote Address : 11.120.1.3
Admin State    : Up                       Oper State       : Up (3)
Protocols      : static
Rx Interval    : 10                       Tx Interval      : 10
Multiplier     : 3                        Echo Interval    : 0
Up Time        : 1d 19:03:28              Up Transitions   : 2
Down Time      : None                     Down Transitions : 1
                                          Version Mismatch : 0
Forwarding Information
Local Discr    : 19269                    Local State      : Up (3)
Local Diag     : 0 (None)                 Local Mode       : Async
Local Min Tx   : 10                       Local Mult       : 3
Last Sent (ms) : 6                        Local Min Rx     : 10
Type           : cpm-np
Remote Discr   : 5101                     Remote State     : Up (3)
Remote Diag    : 0 (None)                 Remote Mode      : Async
Remote Min Tx  : 1000                     Remote Mult      : 3
Last Recv (ms) : 367                      Remote Min Rx    : 10
===============================================================================
*A:Dut-C#
```

bfd-template

Syntax **bfd-template** *template-name*

Context show>router>bfd

Description This command displays BFD template information.

Sample Output

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

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

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

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

```
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-35                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-36                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-37                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-38                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-39                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-40                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
pp::lsp-41                    Up (3)                1000      1000      3
    0::0.0.0.0                mplsTp                N/A       N/A       cpm-np
-------------------------------------------------------------------------------
No. of BFD sessions: 20
-------------------------------------------------------------------------------
wp = Working path   pp = Protecting path
===============================================================================
```

interface

Syntax **interface** *[interface-name*]

Context show>router>bfd

Description This command displays interface information.

Output **BFD interface Output —** The following table describes the show BFD interface output fields:

Label	Description
TX Interval	Displays the interval, in milliseconds, between the transmitted BFD messages to maintain the session
RX Interval	Displays the expected interval, in milliseconds, between the received BFD messages to maintain the session
Multiplier	Displays the integer used by BFD to declare when the neighbor is down.

Sample Output

```
*A:Dut-B# show router bfd interface
===============================================================================
BFD Interface
===============================================================================
Interface name                     Tx Interval    Rx Interval    Multiplier
-------------------------------------------------------------------------------
port-1-1                           500            500            3
port-1-1                           10             10             3
port-1-2                           500            500            3
port-1-2                           10             10             3
```

```
port-1-3                            500            500             3
port-1-3                            10             10              3
port-1-4                            500            500             3
port-1-4                            10             10              3
port-1-5                            500            500             3
...
===============================================================================
*A:Dut-B#
```

session

Syntax **session** [**src** *ip-address* [**dst** *ip-address*] | **detail**]
session [**type** *type*]
session [**summary**]

Context show>router>bfd

Description This command displays session information.

Parameters *ip-address* — Only displays the interface information associated with the specified IP address.

Values ipv4-address a.b.c.d (host bits must be 0)

type — Specifies the session type.

Values iom | central | cpm-np

Output **BFD Session Output —** The following table describes the show BFD session output fields:

Label	Description
State	Displays the administrative state for this BFD session.
Protocol	Displays the active protocol.
Tx Intvl	Displays the interval, in milliseconds, between the transmitted BFD messages to maintain the session
Tx Pkts	Displays the number of transmitted BFD packets.
Rx Intvl	Displays the expected interval, in milliseconds, between the received BFD messages to maintain the session
Rx Pkts	Displays the number of received packets.
Mult	Displays the integer used by BFD to declare when the neighbor is down.

Sample Output

```
A:Dut-B# show router bfd session
===============================================================================
BFD Session
```

```
===============================================================================
Interface                     State                 Tx Intvl  Rx Intvl  Multipl
  Remote Address              Protocols             Tx Pkts   Rx Pkts   Type
-------------------------------------------------------------------------------
port-1-1                      Up (3)                500       500       3
   10.1.1.3                   pim isis              50971     50718     iom
port-1-1                      Up (3)                10        10        3
   3FFE::A01:103              static bgp            N/A       N/A       cpm-np
port-1-1                      Up (3)                10        10        3
   FE80::A0A:A03              pim isis ospf3        N/A       N/A       cpm-np
port-1-2                      Up (3)                500       500       3
   10.2.1.3                   pim isis              50968     50718     iom
port-1-2                      Up (3)                10        10        3
   3FFE::A02:103              static bgp            N/A       N/A       cpm-np
port-1-2                      Up (3)                10        10        3
...
===============================================================================
*A:Dut-B#


A:Dut-B# show router bfd session src  3FFE::A01:102 dest  3FFE::A01:103
===============================================================================
BFD Session
===============================================================================
Remote Address : 3FFE::A01:103
Admin State    : Up                       Oper State       : Up (3)
Protocols      : static bgp
Rx Interval    : 10                       Tx Interval      : 10
Multiplier     : 3                        Echo Interval    : 0
Up Time        : 0d 07:24:54              Up Transitions   : 1
Down Time      : None                     Down Transitions : 0
                                          Version Mismatch : 0
Forwarding Information
Local Discr    : 2051                     Local State      : Up (3)
Local Diag     : 0 (None)                 Local Mode       : Async
Local Min Tx   : 10                       Local Mult       : 3
Last Sent (ms) : 5                        Local Min Rx     : 10
Type           : cpm-np
Remote Discr   : 1885                     Remote State     : Up (3)
Remote Diag    : 0 (None)                 Remote Mode      : Async
Remote Min Tx  : 10                       Remote Mult      : 3
Last Recv (ms) : 1                        Remote Min Rx    : 10
===============================================================================
A:Dut-B#

*A:Dut-B# show router bfd session src FE80::A0A:A02-port-1-10 dest FE80::A0A:A03-port-
1-10
===============================================================================
BFD Session
===============================================================================
Remote Address : FE80::A0A:A03
Admin State    : Up                       Oper State       : Up (3)
Protocols      : pim isis ospf3
Rx Interval    : 10                       Tx Interval      : 10
Multiplier     : 3                        Echo Interval    : 0
Up Time        : 0d 07:10:20              Up Transitions   : 3
Down Time      : None                     Down Transitions : 2
                                          Version Mismatch : 0
Forwarding Information
```

```
Local Discr    : 42                       Local State      : Up (3)
Local Diag     : 3 (Neighbor signalled s* Local Mode       : Async
Local Min Tx   : 10                       Local Mult       : 3
Last Sent (ms) : 6                        Local Min Rx     : 10
Type           : cpm-np
Remote Discr   : 270                      Remote State     : Up (3)
Remote Diag    : 0 (None)                 Remote Mode      : Async
Remote Min Tx  : 10                       Remote Mult      : 3
Last Recv (ms) : 8                        Remote Min Rx    : 10
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:Dut-D#


*A:Dut-B# show router bfd session ipv4
===============================================================================
BFD Session
===============================================================================
Interface                     State                 Tx Intvl  Rx Intvl  Multipl
  Remote Address              Protocols             Tx Pkts   Rx Pkts   Type
-------------------------------------------------------------------------------
port-1-1                      Up (3)                500       500       3
   10.1.1.3                   pim isis              51532     51279     iom
port-1-2                      Up (3)                500       500       3
   10.2.1.3                   pim isis              51529     51279     iom
port-1-3                      Up (3)                500       500       3
   10.3.1.3                   pim isis              51529     51279     iom
port-1-4                      Up (3)                500       500       3
   10.4.1.3                   pim isis              51529     51279     iom
port-1-5                      Up (3)                500       500       3
   10.5.1.3                   pim isis              51529     51279     iom
port-1-6                      Up (3)                500       500       3
   10.6.1.3                   pim isis              51529     51279     iom
...
===============================================================================
*A:Dut-B#


*A:Dut-B# show router bfd session ipv6
===============================================================================
BFD Session
===============================================================================
Interface                     State                 Tx Intvl  Rx Intvl  Multipl
  Remote Address              Protocols             Tx Pkts   Rx Pkts   Type
-------------------------------------------------------------------------------
port-1-1                      Up (3)                10        10        3
   3FFE::A01:103              static bgp            N/A       N/A       cpm-np
port-1-1                      Up (3)                10        10        3
   FE80::A0A:A03              pim isis ospf3        N/A       N/A       cpm-np
port-1-2                      Up (3)                10        10        3
   3FFE::A02:103              static bgp            N/A       N/A       cpm-np
port-1-2                      Up (3)                10        10        3
   FE80::A0A:A03              pim isis ospf3        N/A       N/A       cpm-np
port-1-3                      Up (3)                10        10        3
   3FFE::A03:103              static bgp            N/A       N/A       cpm-np
port-1-3                      Up (3)                10        10        3
   FE80::A0A:A03              pim isis ospf3        N/A       N/A       cpm-np
port-1-4                      Up (3)                10        10        3
   3FFE::A04:103              static bgp            N/A       N/A       cpm-np
```

```
port-1-4                      Up (3)           10        10        3
...
===============================================================================
*A:Dut-B#


*A:Dut-D# show router bfd session summary
=============================
BFD Session Summary
=============================
Termination   Session Count
-----------------------------
central                    0
cpm-np                   500
iom, slot 1                0
iom, slot 2                0
iom, slot 3              250
iom, slot 4                0
iom, slot 5                0

Total                    750
=============================
*A:Dut-D#
```

dhcp

Syntax **dhcp**

Context show>router

Description This command enables the context to display DHCP related information.

dhcp6

Syntax **dhcp6**

Context show>router

Description This command enables the context to display DHCP6 related information.

statistics

Syntax **statistics** [*ip-int-name* **|** *ip-address*]

Context show>router>dhcp
show>router>dhcp6

Description This command displays statistics for DHCP relay and DHCP snooping.

If no IP address or interface name is specified, then all configured interfaces are displayed.

If an IP address or interface name is specified, then only data regarding the specified interface is displayed.

Parameters *ip-int-name* | *ip-address* — Displays statistics for the specified IP interface.

Output **Show DHCP Statistics Output —** The following table describes the output fields for DHCP. statistics.

Label	Description
`Received Packets`	The number of packets received from the DHCP clients.
`Transmitted Packets`	The number of packets transmitted to the DHCP clients.
`Received Malformed Packets`	The number of malformed packets received from the DHCP clients.
`Received Untrusted Packets`	The number of untrusted packets received from the DHCP clients.
`Client Packets Discarded`	The number of packets received from the DHCP clients that were discarded.
`Client Packets Relayed`	The number of packets received from the DHCP clients that were forwarded.
`Client Packets Snooped`	The number of packets received from the DHCP clients that were snooped.
`Server Packets Discarded`	The number of packets received from the DHCP server that were discarded.
`Server Packets Relayed`	The number of packets received from the DHCP server that were forwarded.
`Server Packets Snooped`	The number of packets received from the DHCP server that were snooped.

Sample Output

```
A:ALA-1# show router dhcp6 statistics
==========================================================================
DHCP6 statistics (Router: Base)
==========================================================================
Msg-type                      Rx             Tx             Dropped
--------------------------------------------------------------------------
1 SOLICIT                     0              0              0
2 ADVERTISE                   0              0              0
3 REQUEST                     0              0              0
4 CONFIRM                     0              0              0
5 RENEW                       0              0              0
6 REBIND                      0              0              0
```

```
7 REPLY                       0              0              0
8 RELEASE                     0              0              0
9 DECLINE                     0              0              0
10 RECONFIGURE                0              0              0
11 INFO_REQUEST               0              0              0
12 RELAY_FORW                 0              0              0
13 RELAY_REPLY                0              0              0
--------------------------------------------------------------------------
Dhcp6 Drop Reason Counters :
--------------------------------------------------------------------------
 1 Dhcp6 oper state is not Up on src itf                         0
 2 Dhcp6 oper state is not Up on dst itf                         0
 3 Relay Reply Msg on Client Itf                                 0
 4 Hop Count Limit reached                                       0
 5 Missing Relay Msg option, or illegal msg type                 0
 6 Unable to determine destinatinon client Itf                   0
 7 Out of Memory                                                 0
 8 No global Pfx on Client Itf                                   0
 9 Unable to determine src Ip Addr                               0
10 No route to server                                            0
11 Subscr. Mgmt. Update failed                                   0
12 Received Relay Forw Message                                   0
13 Packet too small to contain valid dhcp6 msg                   0
14 Server cannot respond to this message                         0
15 No Server Id option in msg from server                        0
16 Missing or illegal Client Id option in client msg             0
17 Server Id option in client msg                                0
18 Server DUID in client msg does not match our own              0
19 Client sent message to unicast while not allowed              0
20 Client sent message with illegal src Ip address               0
21 Client message type not supported in pfx delegation           0
22 Nbr of addrs or pfxs exceeds allowed max (128) in msg         0
23 Unable to resolve client's mac address                        0
24 The Client was assigned an illegal address                    0
25 Illegal msg encoding                                          0
==========================================================================
A:ALA-1#
```

summary

Syntax **summary**

Context show>router>dhcp

Description Display the status of the DHCP Relay and DHCP Snooping functions on each interface.

Output **Show DHCP Summary Output —** The following table describes the output fields for DHCP summary.

Label	Description
`Interface Name`	Name of the router interface.
`Info Option`	Indicates whether Option 82 processing is enabled on the interface.

Auto Filter	Indicates whether IP Auto Filter is enabled on the interface.
Snoop	Indicates whether Auto ARP table population is enabled on the interface.
Interfaces	Indicates the total number of router interfaces on the router.

Sample Output

```
A:ALA-1# show router dhcp summary
===============================================================================
DHCP6 Summary (Router: Base)
===============================================================================
Interface Name                   Nbr      Used/Max Relay     Admin  Oper Relay
  SapId                          Resol.   Used/Max Server    Admin  Oper Server
-------------------------------------------------------------------------------
interfaceServiceDefault          No          0/0             Up     NoServerCo*
  sap:1/2/12:1                               0/8000          Up     Up
interfaceService                 No          0/0             Down   Down
  sap:1/2/1                                  0/8000          Down   Down
interfaceServiceNonDefault       No          0/0             Up     NoServerCo*
  sap:1/2/12:2                               0/8000          Down   Down
ip-61.4.113.4                    Yes       575/8000          Up     Up
  sap:1/1/1:1                              580/8000          Up     Up
=============================================================================
A:ALA-1#
```

ecmp

Syntax **ecmp**

Context show>router

Description This command displays the ECMP settings for the router.

Output **ECMP Settings Output —** The following table describes the output fields for the router ECMP settings.

Label	Description
Instance	The router instance number.
Router Name	The name of the router instance.
ECMP	False — ECMP is disabled for the instance.
	True — ECMP is enabled for the instance.
Configured-ECMP-Routes	The number of ECMP routes configured for path sharing.

Sample Output

```
A:ALA-A# show router ecmp
===============================================================================
Router ECMP
===============================================================================
Instance       Router Name                      ECMP    Configured-ECMP-Routes
-------------------------------------------------------------------------------
1              Base                             True    8
===============================================================================
A:ALA-A#
```

fib

Syntax **fib** *slot-number* [*family*] [*ip-prefix/prefix-length*] [**longer**] [**secondary**] [**exclude-services**]
fib *slot-number* [*family*] **summary**
fib *slot-number* **nh-table-usage**

Context show>router

Description This command displays the active FIB entries for a specific IOM.

Parameters *slot-number* — Displays routes only matching the specified chassis slot number.

Default all IOMs

Values 1 — 10

family — Displays the router IP interface table to display.

Values **ipv4** — Displays only those peers that have the IPv4 family enabled.
ipv6 — Displays the peers that are IPv6-capable.

ip-prefix/prefix-length — Displays FIB entries only matching the specified ip-prefix and length.

Values	ipv4-prefix:	a.b.c.d (host bits must be 0)
	ipv4-prefix-length:[	0 — 32
Values	ipv6-prefix:	x:x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D
	ipv6-prefix-length:	0 — 128

longer — Displays FIB entries matching the *ip-prefix/mask* and routes with longer masks.

secondary — Displays secondary VRF ID information.

summary — Displays summary FIB information for the specified slot number.

nh-table-usage — Displays next-hop table usage.

Sample Output

```
show router fib 1 131.132.133.134/32
```

```
========================================================================
FIB Display
========================================================================
Prefix                                                      Protocol
    NextHop
------------------------------------------------------------------------
131.132.133.134/32                                          OSPF
    66.66.66.66 (loop7)
    Next-hop type: tunneled, Owner: RSVP, Tunnel-ID: <out-ifindex-from-route>
------------------------------------------------------------------------
Total Entries : 1
------------------------------------------------------------------------
========================================================================

*A:Dut-C# show router fib 1 1.1.1.1/32
===============================================================================
FIB Display
===============================================================================
Prefix                                                      Protocol
    NextHop
-------------------------------------------------------------------------------
1.1.1.1/32                                                  BGP
    10.20.1.1 (Transport:RSVP LSP:1)
-------------------------------------------------------------------------------
Total Entries : 1
-------------------------------------------------------------------------------
===============================================================================
*A:Dut-C# show router fib 1
===============================================================================
FIB Display
===============================================================================
Prefix                                                      Protocol
    NextHop
-------------------------------------------------------------------------------
1.1.2.0/24                                                  ISIS
    1.1.3.1 (to_Dut-A)
    1.2.3.2 (to_Dut-B)
1.1.3.0/24                                                  LOCAL
    1.1.3.0 (to_Dut-A)
1.1.9.0/24                                                  ISIS
    1.1.3.1 (to_Dut-A)
1.2.3.0/24                                                  LOCAL
    1.2.3.0 (to_Dut-B)
1.2.9.0/24                                                  ISIS
    1.2.3.2 (to_Dut-B)
10.12.0.0/24                                                LOCAL
    10.12.0.0 (itfToArborCP_02)
10.20.1.1/32                                                ISIS
    1.1.3.1 (to_Dut-A)
10.20.1.2/32                                                ISIS
    1.2.3.2 (to_Dut-B)
10.20.1.3/32                                                LOCAL
    10.20.1.3 (system)
20.12.0.43/32                                               STATIC
    vprn1:mda-1-1
20.12.0.44/32                                               STATIC
    vprn1:mda-2-1
20.12.0.45/32                                               STATIC
    vprn1:mda-2-2
```

```
20.12.0.46/32                                               STATIC
    vprn1:mda-3-1
100.0.0.1/32                                                TMS
    vprn1:mda-1-1
    vprn1:mda-3-1
138.203.71.202/32                                           STATIC
    10.12.0.2 (itfToArborCP_02)
-------------------------------------------------------------------------------
Total Entries : 15
-------------------------------------------------------------------------------
===============================================================================
```

fp-tunnel-table

Syntax **fp-tunnel-table** *slot-number* [*ip-prefix/prefix-length*]

Context show>router

Description This command displays the IOM/IMM label, next-hop and outgoing interface information for BGP, LDP and RSVP tunnels used in any of the following applications:

- BGP shortcut (**configure>router>bgp>igp-shortcut**)
- IGP shortcut (**config>router>isis**[**ospf**]**>rsvp-shortcut**)
- IGP prefix resolved to an LDP LSP (**config>router>ldp-shortcut**)
- Static prefix **shortcut**
- VPRN auto-bind
- 6PE/6VPE.

Parameters *slot-number* — Displays information for the specified slot.

Values 1 — 10

ip-prefix[/*prefix-length*] **—** Displays routes only matching the specified ip-address and length.

Values			
	ipv4-prefix:		a.b.c.d (host bits must be set to 0)
	ipv4-prefix-length:		0 — 32
	ipv6	ipv6-prefix[/pref*:	x:x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D
		prefix-length:	1 — 128ipv6

icmp6

Syntax **icmp6**

Context show>router

Description This command displays Internet Control Message Protocol Version 6 (ICMPv6) statistics. ICMP generates error messages (for example, ICMP destination unreachable messages) to report errors during processing and other diagnostic functions. ICMPv6 packets can be used in the neighbor discovery protocol and path MTU discovery.

Output **icmp6 Output —** The following table describes the show router icmp6 output fields:

Label	Description
`Total`	The total number of all messages.
`Destination Unreachable`	The number of message that did not reach the destination.

Label	Description (Continued)
Time Exceeded	The number of messages that exceeded the time threshold.
Echo Request	The number of echo requests.
Router Solicits	The number of times the local router was solicited.
Neighbor Solicits	The number of times the neighbor router was solicited.
Errors	The number of error messages.
Redirects	The number of packet redirects.
Pkt Too big	The number of packets that exceed appropriate size.
Echo Reply	The number of echo replies.
Router Advertisements	The number of times the router advertised its location.
Neighbor Advertisements	The number of times the neighbor router advertised its location.

Sample Output

```
A:SR-3>show>router>auth# show router icmp6
===============================================================================
Global ICMPv6 Stats
===============================================================================
Received
Total                    : 14           Errors                   : 0
Destination Unreachable : 5            Redirects                : 5
Time Exceeded            : 0            Pkt Too Big              : 0
Echo Request             : 0            Echo Reply               : 0
Router Solicits          : 0            Router Advertisements    : 4
Neighbor Solicits        : 0            Neighbor Advertisements : 0
-------------------------------------------------------------------------------
Sent
Total                    : 10           Errors                   : 0
Destination Unreachable : 0            Redirects                : 0
Time Exceeded            : 0            Pkt Too Big              : 0
Echo Request             : 0            Echo Reply               : 0
Router Solicits          : 0            Router Advertisements    : 0
Neighbor Solicits        : 5            Neighbor Advertisements : 5
===============================================================================
A:SR-3>show>router>auth#
```

interface

Syntax **interface** [*interface-name*]

Context show>router>icmpv6

Description This command displays interface ICMPv6 statistics.

Parameters *interface-name* — Only displays entries associated with the specified IP interface name.

Output **icmp6 interface Output —** The following table describes the show router icmp6 interface output fields:

Label	Description
Total	The total number of all messages.
Destination Unreachable	The number of message that did not reach the destination.
Time Exceeded	The number of messages that exceeded the time threshold.
Echo Request	The number of echo requests.
Router Solicits	The number of times the local router was solicited.
Neighbor Solicits	The number of times the neighbor router was solicited.
Errors	The number of error messages.
Redirects	The number of packet redirects.
Pkt Too big	The number of packets that exceed appropriate size.
Echo Reply	The number of echo replies.
Router Advertisements	The number of times the router advertised its location.
Neighbor Advertisements	The number of times the neighbor router advertised its location.

Sample Output

```
B:CORE2# show router icmp6 interface net1_1_2
===============================================================================
Interface ICMPv6 Stats
===============================================================================
Interface "net1_1_2"
-------------------------------------------------------------------------------
Received
Total                   : 41           Errors                  : 0
Destination Unreachable : 0            Redirects               : 0
Time Exceeded           : 0            Pkt Too Big             : 0
Echo Request            : 0            Echo Reply              : 0
```

```
Router Solicits         : 0            Router Advertisements   : 0
Neighbor Solicits       : 20           Neighbor Advertisements : 21
-------------------------------------------------------------------------------
Sent
Total                   : 47           Errors                  : 0
Destination Unreachable : 0            Redirects               : 0
Time Exceeded           : 0            Pkt Too Big             : 0
Echo Request            : 0            Echo Reply              : 0
Router Solicits         : 0            Router Advertisements   : 0
Neighbor Solicits       : 27           Neighbor Advertisements : 20
===============================================================================
B:CORE2#
```

interface

Syntax **interface** [{[*ip-address*|*ip-int-name*][**detail**] [**family**]}|**summary**| **exclude-services**]
interface *ip-address*|*ip-int-name* **eth-cfm** [**detail**]
interface *ip-address*|*ip-int-name* **mac** [*ieee-address*]
interface *ip-address*|*ip-int-name* **statistics**
interface dist-cpu-protection [**detail**]
interface policy-accounting [**class** [*index*]]

Context show>router

Description This command displays the router IP interface table sorted by interface index.

Parameters *ip-address* — Only displays the interface information associated with the specified 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

ip-int-name — Only displays the interface information associated with the specified IP interface name.

detail — Displays detailed IP interface information.

statistics — Displays packet statistics for an interface on the router.

summary — Displays summary IP interface information for the router.

exclude-services — Displays IP interface information, excluding IP interfaces configured for customer services. Only core network IP interfaces are displayed.

family — Specifies the router IP interface family to display.

Values **ipv4** — Displays only those peers that have the IPv4 family enabled.
Values **ipv6** — Displays the peers that are IPv6-capable.

Output **Standard IP Interface Output —** The following table describes the standard output fields for an IP interface.

Label	Description
Interface-Name	The IP interface name.
Type	n/a — No IP address has been assigned to the IP interface, so the IP address type is not applicable. Pri — The IP address for the IP interface is the Primary address on the IP interface. Sec — The IP address for the IP interface is a secondary address on the IP interface.
IP-Address	The IP address and subnet mask length of the IP interface. n/a — Indicates no IP address has been assigned to the IP interface.
Adm	Down — The IP interface is administratively disabled. Up — The IP interface is administratively enabled.
Opr	Down — The IP interface is operationally disabled. Up — The IP interface is operationally disabled.
Mode	Network — The IP interface is a network/core IP interface. Service — The IP interface is a service IP interface.
Port/SAP Id	The physical network port or the SAP identifier associated with the IP interface.

Sample Output

```
*A:Dut-C# show router interface "DUTC_TO_DUTB.1.0" detail
=======================================================================Interface Table
(Router: Base)
=======================================================================
-----------------------------------------------------------------------
Interface
-----------------------------------------------------------------------
If Name          : DUTC_TO_DUTB.1.0
Admin State      : Up                   Oper (v4/v6)      : Up/Up
Protocols        : OSPFv2
IP Addr/mask     : 1.0.23.3/24          Address Type      : Primary
IGP Inhibit      : Disabled             Broadcast Address : Host-ones
HoldUp-Time      : 0                    Track Srrp Inst   : 0
IPv6 Addr    : 3FFE::100:1703/120                                 PREFERRED
HoldUp-Time      : 0                    Track Srrp Inst   : 0
IP Addr/mask     : 51.0.23.3/24         Address Type      : Secondary
IGP Inhibit      : Disabled             Broadcast Address : Host-ones
HoldUp-Time      : 0                    Track Srrp Inst   : 0
IPv6 Addr    : FE80::200:FF:FE00:3/64                             PREFERRED
-----------------------------------------------------------------------
Details
-----------------------------------------------------------------------
Description      : (Not Specified)
If Index         : 2                    Virt. If Index    : 2
Last Oper Chg    : 01/14/2014 14:33:04  Global If Index   : 30
Lag Link Map Prof: none
```

```
Port Id          : 1/1/2:1
TOS Marking      : Trusted              If Type           : Network
Egress Filter    : none                 Ingress Filter    : none
Egr IPv6 Flt     : none                 Ingr IPv6 Flt     : none
BGP IP FlowSpec  : Disabled
BGP IPv6 FlowSpec: Disabled
SNTP B.Cast      : False                QoS Policy        : 1
Queue-group      : None
MAC Address      : 00:00:00:00:00:03    Mac Accounting    : Disabled
Ingress stats    : Disabled             IPv6 DAD          : Enabled
TCP MSS V4       : 0                    TCP MSS V6        : 0
Arp Timeout      : 14400                IPv6 Nbr ReachTime: 30
                                        IPv6 stale time(s): 14400
IP Oper MTU      : 1500                 ICMP Mask Reply   : True
Arp Populate     : Disabled
Cflowd           : None
LdpSyncTimer     : None                 Strip-Label       : Disabled
LSR Load Balance : system
EGR Load Balance : both
TEID Load Balance: Disabled
uRPF Chk         : disabled
uRPF Ipv6 Chk    : disabled
PTP HW Assist    : Disabled
Rx Pkts          : N/A                  Rx Bytes          : N/A
Rx V4 Pkts       : N/A                  Rx V4 Bytes       : N/A
Rx V6 Pkts       : N/A                  Rx V6 Bytes       : N/A
Tx Pkts          : 410                  Tx Bytes          : 40204
Tx V4 Pkts       : 408                  Tx V4 Bytes       : 40032
Tx V4 Discard Pk*: 0                    Tx V4 Discard Byt*: 0
Tx V6 Pkts       : 2                    Tx V6 Bytes       : 172
Tx V6 Discard Pk*: 0                    Tx V6 Discard Byt*: 0

Proxy ARP Details
Rem Proxy ARP    : Disabled             Local Proxy ARP   : Disabled
Policies         : none

Proxy Neighbor Discovery Details
Local Pxy ND     : Disabled
Policies         : none

Secure ND Details
Secure ND        : Disabled

ICMP Details
Redirects    : Number - 100                    Time (seconds)   - 10
Unreachables : Number - 100                    Time (seconds)   - 10
TTL Expired  : Number - 100                    Time (seconds)   - 10

IPCP Address Extension Details
Peer IP Addr     : Not configured
Peer Pri DNS Addr: Not configured
Peer Sec DNS Addr: Not configured

Network Domains Associated
default

-----------------------------------------------------------------------
Admin Groups
-----------------------------------------------------------------------
```

```
"group1"                           "group2"

----------------------------------------------------------------------

----------------------------------------------------------------------
Srlg Groups
----------------------------------------------------------------------
"group3"                           "group4"

----------------------------------------------------------------------
-----------------------------------------------------------------------Qos Details
-----------------------------------------------------------------------
Ing Qos Policy   : (none)               Egr Qos Policy    : (none)
Ingress FP QGrp  : (none)               Egress Port QGrp  : (none)
Ing FP QGrp Inst : (none)               Egr Port QGrp Inst: (none)
=======================================================================
* indicates that the corresponding row element may have been truncated.
*A:Dut-C#


*A:mlstp-dutA# show router interface "AtoB_1"
===============================================================================
Interface Table (Router: Base)
===============================================================================
Interface-Name                   Adm         Opr(v4/v6)  Mode    Port/SapId
   IP-Address                                                    PfxState
-------------------------------------------------------------------------------
AtoB_1                           Down        Down/--     Network 1/2/3:1
   Unnumbered If[system]                                         n/a
-------------------------------------------------------------------------------
Interfaces : 1


A:ALA-A# show router interface
===============================================================================
Interface Table (Router: Base)
===============================================================================
Interface-Name                   Adm(v4/v6)  Opr(v4/v6)  Mode    Port/SapId
   IP-Address                                                    PfxState
-------------------------------------------------------------------------------
ip-100.0.0.2                     Up/Up       Up/Up       Network lag-1
   100.0.0.2/10                                                  n/a
   3FFE:1::2/64                                                  PREFERRED
   FE80::200:FF:FE00:4/64                                        PREFERRED
ip-100.128.0.2                   Up/Up       Up/Up       Network lag-2
   100.128.0.2/10                                                n/a
   3FFE:2::2/64                                                  PREFERRED
   FE80::200:FF:FE00:4/64                                        PREFERRED
ip-11.2.4.4                      Up/Up       Down/Down   Network 3/1/1
   11.2.4.4/24                                                   n/a
   15::2/120
ip-11.4.101.4                    Up/Up       Up/Up       Network 5/2/1
   11.4.101.4/24                                                 n/a
   3FFE::B04:6504/120                                            PREFERRED
   FE80::200:FF:FE00:4/64                                        PREFERRED
ip-11.4.113.4                    Up/Up       Up/Up       Network 6/1/1
   11.4.113.4/24                                                 n/a
   3FFE::B04:7104/120                                            PREFERRED
   FE80::200:FF:FE00:4/64                                        PREFERRED
```

```
ip-11.4.114.4                    Up/Up       Up/Up       Network 6/1/2
   11.4.114.4/24                                                 n/a
   3FFE::B04:7204/120                                            PREFERRED
   FE80::200:FF:FE00:4/64                                        PREFERRED
ip-12.2.4.4                      Up/Up       Down/Down   Network 3/1/2
   12.2.4.4/24                                                   n/a
   3FFE::C02:404/120
ip-13.2.4.4                      Up/Up       Down/Down   Network 3/1/3
   13.2.4.4/24                                                   n/a
   3FFE::D02:404/120
ip-14.2.4.4                      Up/Up       Down/Down   Network 3/1/4
   14.2.4.4/24                                                   n/a
   3FFE::E02:404/120
ip-15.2.4.4                      Up/Up       Down/Down   Network 3/1/5
   15.2.4.4/24                                                   n/a
   3FFE::F02:404/120
ip-21.2.4.4                      Up/Up       Up/Up       Network 6/2/11
   21.2.4.4/24                                                   n/a
   3FFE::1502:404/120                                            PREFERRED
   FE80::200:FF:FE00:4/64                                        PREFERRED
ip-22.2.4.4                      Up/Up       Up/Up       Network 6/2/12
   22.2.4.4/24                                                   n/a
   3FFE::1602:404/120                                            PREFERRED
   FE80::200:FF:FE00:4/64                                        PREFERRED
ip-23.2.4.4                      Up/Up       Up/Up       Network 6/2/13
   23.2.4.4/24                                                   n/a
   3FFE::1702:404/120                                            PREFERRED
   FE80::200:FF:FE00:4/64                                        PREFERRED
ip-24.2.4.4                      Up/Up       Up/Up       Network 6/2/14
   24.2.4.4/24                                                   n/a
   3FFE::1802:404/120                                            PREFERRED
   FE80::200:FF:FE00:4/64                                        PREFERRED
system                           Up/Up       Up/Up       Network system
   200.200.200.4/32                                              n/a
   3FFE::C8C8:C804/128                                           PREFERRED
-------------------------------------------------------------------------------
Interfaces : 15
===============================================================================
A:ALA-A#


A:ALA-A# show router interface 10.10.0.3/32
===============================================================================
Interface Table
===============================================================================
Interface-Name                   Type IP-Address         Adm    Opr  Mode
-------------------------------------------------------------------------------
system                           Pri  10.10.0.3/32       Up     Up   Network
===============================================================================
A:ALA-A#

*A:Dut-C# show router 1 interface
===============================================================================
Interface Table (Service: 1)
===============================================================================
Interface-Name                   Adm         Opr(v4/v6)  Mode    Port/SapId
   IP-Address                                                    PfxState
-------------------------------------------------------------------------------
mda-1-1                          Up          Up/Down     TMS     1/1
```

```
   20.12.0.43/32                                                 n/a
mda-2-1                          Up          Up/Down     TMS     2/1
   20.12.0.44/32                                                 n/a
mda-2-2                          Up          Up/Down     TMS     2/2
   20.12.0.45/32                                                 n/a
mda-3-1                          Up          Up/Down     TMS     3/1
   20.12.0.46/32                                                 n/a
-------------------------------------------------------------------------------
Interfaces : 4
===============================================================================
A:ALA-A# show router interface to-ser1
===============================================================================
Interface Table
===============================================================================
Interface-Name                   Type IP-Address         Adm    Opr  Mode
-------------------------------------------------------------------------------
to-ser1                          Pri  10.10.13.3/24      Up     Up   Network
===============================================================================
A:ALA-A#
A:ALA-A# show router interface exclude-services
===============================================================================
Interface Table
===============================================================================
Interface-Name                   Type IP-Address         Adm    Opr  Mode
-------------------------------------------------------------------------------
system                           Pri  10.10.0.3/32       Up     Up   Network
to-ser1                          Pri  10.10.13.3/24      Up     Up   Network
to-ser4                          Pri  10.10.34.3/24      Up     Up   Network
to-ser5                          Pri  10.10.35.3/24      Up     Up   Network
to-ser6                          n/a  n/a                Up     Down Network
management                       Pri  192.168.2.93/20    Up     Up   Network
===============================================================================
A:ALA-A#
```

Detailed IP Interface Output — The following table describes the detailed output fields for an IP interface.

Label	Description
If Name	The IP interface name.
Admin State	Down — The IP interface is administratively disabled. Up — The IP interface is administratively enabled.
Oper State	Down — The IP interface is operationally disabled. Up — The IP interface is operationally enabled.
IP Addr/mask	The IP address and subnet mask length of the IP interface. Not Assigned — Indicates no IP address has been assigned to the IP interface.
IPV6 Addr	The IPv6 address of the interface.
If Index	The interface index of the IP router interface.

Label	Description (Continued)
Virt If Index	The virtual interface index of the IP router interface.
Last Oper Change	The last change in operational status.
Global If Index	The global interface index of the IP router interface.
Sap ID	The SAP identifier.
TOS Marker	The TOS byte value in the logged packet.
If Type	Network — The IP interface is a network/core IP interface. Service — The IP interface is a service IP interface.
SNTP B.cast	Displays if the broadcast-client global parameter is configured.
IES ID	The IES identifier.
QoS Policy	The QoS policy ID associated with the IP interface.
MAC Address	The MAC address of the interface.
Arp Timeout	The ARP timeout for the interface, in seconds, which is the time an ARP entry is maintained in the ARP cache without being refreshed.
ICMP Mask Reply	False — The IP interface will not reply to a received ICMP mask request. True — The IP interface will reply to a received ICMP mask request.
Arp Populate	Displays whether ARP is enabled or disabled.
Host Conn Verify	The host connectivity verification.
LdpSyncTimer	Specifies the IGP/LDP sync timer value.
uRPF Chk	Specifies whether unicast RPF (uRPF) Check is enabled on this interface.
uRPF Iv6 Chk	Specifies whether unicast RPF (uRPF) Check IPv6 is enabled on this interface.
PTP HW Assist	Specifies whether the PTP Hardware Assist function is enabled on this interface.
Cflowd	Specifies the type of Cflowd analysis that is applied to the interface. acl — ACL Cflowd analysis is applied to the interface. interface — Interface cflowd analysis is applied to the interface. none — No Cflowd analysis is applied to the interface.

Sample Output

```
B:bksim1619# show router interface "to-sim1621" detail
===============================================================================
Interface Table (Router: Base)
===============================================================================
-------------------------------------------------------------------------------
Interface
-------------------------------------------------------------------------------
If Name          : to-sim1621
Admin State      : Up                   Oper (v4/v6)      : Up/--
Protocols        : None
IP Addr/mask     : 1.1.1.2/24           Address Type      : Primary
IGP Inhibit      : Disabled             Broadcast Address : Host-ones
HoldUp-Time      : 0                    Track Srrp Inst   : 0
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Description      : (Not Specified)
If Index         : 5                    Virt. If Index    : 5
Last Oper Chg    : 01/03/2012 13:29:19  Global If Index   : 125
Port Id          : 1/1/1
TOS Marking      : Trusted              If Type           : Network
Egress Filter    : none                 Ingress Filter    : none
Egr IPv6 Flt     : none                 Ingr IPv6 Flt     : none
BGP FlowSpec     : Disabled
SNTP B.Cast      : False                QoS Policy        : 1
Queue-group      : None
MAC Address      : ac:5e:01:01:00:01    Arp Timeout       : 14400
IP Oper MTU      : 1564                 ICMP Mask Reply   : True
Arp Populate     : Disabled
Cflowd           : None
LdpSyncTimer     : None                 Strip-Label       : Disabled
LSR Load Balance : system
uRPF Chk         : disabled
uRPF Ipv6 Chk    : disabled
PTP HW Assist    : Enabled
Rx Pkts          : 360899               Rx Bytes          : 32482050
Tx Pkts          : 724654               Tx Bytes          : 68885238
Tx V4 Pkts       : 724654               Tx V4 Bytes       : 68885238
Tx V4 Discard Pk*: 0                    Tx V4 Discard Byt*: 0
Tx V6 Pkts       : 0                    Tx V6 Bytes       : 0
Tx V6 Discard Pk*: 0                    Tx V6 Discard Byt*: 0

Proxy ARP Details
Rem Proxy ARP    : Disabled             Local Proxy ARP   : Disabled
Policies         : none

Proxy Neighbor Discovery Details
Local Pxy ND     : Disabled
Policies         : none

ICMP Details
Redirects    : Number - 100                     Time (seconds)   - 10
Unreachables : Number - 100                     Time (seconds)   - 10
TTL Expired  : Number - 100                     Time (seconds)   - 10

IPCP Address Extension Details
Peer IP Addr     : Not configured
Peer Pri DNS Addr: Not configured
Peer Sec DNS Addr: Not configured

Network Domains Associated
```

```
default
-------------------------------------------------------------------------------
Qos Details
-------------------------------------------------------------------------------

Ing Qos Policy   : (none)               Egr Qos Policy    : (none)
Ingress FP QGrp  : (none)               Egress Port QGrp  : (none)
Ing FP QGrp Inst : (none)               Egr Port QGrp Inst: (none)
===============================================================================
* indicates that the corresponding row element may have been truncated.
B:bksim1619#
```

```
*A:Dut-C# show router 1 interface "mda-3-1" detail
===============================================================================
Interface Table (Service: 1)
===============================================================================

-------------------------------------------------------------------------------
Interface
-------------------------------------------------------------------------------
If Name          : mda-3-1
Admin State      : Up                   Oper (v4/v6)      : Up/Down
Protocols        : None
IP Addr/mask     : 20.12.0.46/32        Address Type      : Primary
IGP Inhibit      : Disabled             Broadcast Address : Host-ones
HoldUp-Time      : 0                    Track Srrp Inst   : 0
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Description      : tms-3-1
If Index         : 5                    Virt. If Index    : 5
Last Oper Chg    : 07/08/2011 06:49:45  Global If Index   : 95
If Type          : TMS
Rx Pkts          : 14935                Rx Bytes          : 955840
Tx Pkts          : 14892                Tx Bytes          : 953088
Tx Discard Pkts  : 0

TMS Health Information
Status           : Up
Version          : Peakflow TMS 5.6 (build BF42)
Mitigations      : 1
Status message   : (Unavailable)
===============================================================================
*A:Dut-C# show router 1 interface "mda-2-1" detail

===============================================================================
Interface Table (Service: 1)
===============================================================================

-------------------------------------------------------------------------------
Interface
-------------------------------------------------------------------------------
If Name          : mda-2-1
Admin State      : Up                   Oper (v4/v6)      : Up/Down
Protocols        : None
IP Addr/mask     : 20.12.0.44/32        Address Type      : Primary
```

```
IGP Inhibit      : Disabled             Broadcast Address : Host-ones
HoldUp-Time      : 0                    Track Srrp Inst   : 0
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Description      : tms-2-1
If Index         : 3                    Virt. If Index    : 3
Last Oper Chg    : 09/14/2011 08:39:24  Global If Index   : 122
If Type          : TMS
Rx Pkts          : 13508                Rx Bytes          : 864512
Tx Pkts          : 13552                Tx Bytes          : 867328
Tx Discard Pkts  : 0

TMS Health Information
Status           : Up
Version          : Peakflow TMS 5.6 (build BHDF)
Mitigations      : 1
Status message   : (Unavailable)
===============================================================================
with
  Rx Pkts/Rx Bytes: Offramped traffic counters
  Tx Pkts/Tx Bytes: Onramped traffic counters
  Tx Discard Pkts:  Discarded packets by TMS
It displays the #of pkts dropped while the  traffic is getting distributed to various
  It doesn't account for the pkts dropped in HW level.
  Status:  TMS status could be Up/Down
  Version: TMS software version
  Mitigations: Number of active mitigations on this TMS
  Status message: Not applicable.  For future usage
===============================================================================
```

Statistics IP Interface Output — The following table describes the packet statistics for the router IP interfaces.

Label	Description
Ifname	The interface name.
Admin State	The administrative status of the router interface.
Oper	The operational status of the router instance.

Sample Output

The following displays output if **enable-interface-statistics** is enabled for a given interface.

```
A:ALA-A# show router interface “to_ixia” statistics
===============================================================================
Interface Statistics
===============================================================================
If Name          : to_Ixia
Admin State      : Up                   Oper (v4/v6)      : Up/Up
Rx Pkts          : 6244                 Rx Bytes          : 599424
Rx V4 Pkts       : 3122                 Rx V4 Bytes       : 299712
Rx V6 Pkts       : 3122                 Rx V6 Bytes       : 299712
```

```
Tx Pkts          : 0                    Tx Bytes          : 0
Tx V4 Pkts       : 0                    Tx V4 Bytes       : 0
Tx V4 Discard Pk*: 0                    Tx V4 Discard Byt*: 0
Tx V6 Pkts       : 0                    Tx V6 Bytes       : 0
Tx V6 Discard Pk*: 0                    Tx V6 Discard Byt*: 0
uRPF Chk Fail Pk*: 6244                 uRPF Fail Bytes   : 487032
uRPF Fail V4 Pk  : 3122                 uRPF Fail V4 Byt  : 243516
uRPF Fail V6 Pk  : 3122                 uRPF Fail V6 Byt  : 243516
===============================================================================


*A:Dut-C# show  router interface "to_Ixia" detail
===============================================================================
Interface Table (Router: Base)
===============================================================================
-------------------------------------------------------------------------------
Interface
-------------------------------------------------------------------------------
If Name          : to_Ixia
Admin State      : Up                   Oper (v4/v6)      : Up/Up
Protocols        : None
IP Addr/mask     : 1.3.9.3/24           Address Type      : Primary
IGP Inhibit      : Disabled             Broadcast Address : Host-ones
HoldUp-Time      : 0                    Track Srrp Inst   : 0
IPv6 Addr    : 3FFE::103:903/120                                   PREFERRED
HoldUp-Time      : 0                    Track Srrp Inst   : 0
IPv6 Addr    : FE80::200:FF:FE00:3/64                              PREFERRED
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Description      : (Not Specified)
If Index         : 3                    Virt. If Index    : 3
Last Oper Chg    : 01/27/2014 16:42:40  Global If Index   : 19
Lag Link Map Prof: none
Port Id          : 1/1/4
TOS Marking      : Trusted              If Type           : Network
Egress Filter    : none                 Ingress Filter    : none
Egr IPv6 Flt     : none                 Ingr IPv6 Flt     : none
BGP IP FlowSpec  : Disabled
BGP IPv6 FlowSpec: Disabled
SNTP B.Cast      : False                QoS Policy        : 1
Queue-group      : None
MAC Address      : 00:00:00:00:00:03    Mac Accounting    : Disabled
Ingress stats    : Enabled              IPv6 DAD          : Enabled
TCP MSS V4       : 0                    TCP MSS V6        : 0
Arp Timeout      : 14400                IPv6 Nbr ReachTime: 30
                                        IPv6 stale time(s): 14400
IP Oper MTU      : 1500                 ICMP Mask Reply   : True
Arp Populate     : Disabled
Cflowd           : None
LdpSyncTimer     : None                 Strip-Label       : Disabled
LSR Load Balance : system
EGR Load Balance : both
TEID Load Balance: Disabled
uRPF Chk         : enabled              uRPF Chk Mode     : strict
uRPF Ipv6 Chk    : enabled              uRPF Ipv6 Chk Mode: strict
PTP HW Assist    : Disabled
Rx Pkts          : 6244                 Rx Bytes          : 599424
Rx V4 Pkts       : 3122                 Rx V4 Bytes       : 299712
Rx V6 Pkts       : 3122                 Rx V6 Bytes       : 299712
Tx Pkts          : 0                    Tx Bytes          : 0
Tx V4 Pkts       : 0                    Tx V4 Bytes       : 0
Tx V4 Discard Pk*: 0                    Tx V4 Discard Byt*: 0
Tx V6 Pkts       : 0                    Tx V6 Bytes       : 0
Tx V6 Discard Pk*: 0                    Tx V6 Discard Byt*: 0
uRPF Chk Fail Pk*: 6244                 uRPF Fail Bytes   : 487032
uRPF Fail V4 Pk  : 3122                 uRPF Fail V4 Byt  : 243516
uRPF Fail V6 Pk  : 3122                 uRPF Fail V6 Byt  : 243516

Proxy ARP Details
Rem Proxy ARP    : Disabled             Local Proxy ARP   : Disabled
Policies         : none

Proxy Neighbor Discovery Details
Local Pxy ND     : Disabled
Policies         : none

Secure ND Details
Secure ND        : Disabled

ICMP Details
Redirects    : Number - 100                     Time (seconds)   - 10
Unreachables : Number - 100                     Time (seconds)   - 10
TTL Expired  : Number - 100                     Time (seconds)   - 10

IPCP Address Extension Details
Peer IP Addr     : Not configured
Peer Pri DNS Addr: Not configured
Peer Sec DNS Addr: Not configured

Network Domains Associated
default
----------------------------------------------------------------------
Admin Groups
----------------------------------------------------------------------
No Matching Entries
----------------------------------------------------------------------
----------------------------------------------------------------------
Srlg Groups
----------------------------------------------------------------------
No Matching Entries
----------------------------------------------------------------------
-------------------------------------------------------------------------------
Qos Details
-------------------------------------------------------------------------------
Ing Qos Policy   : (none)               Egr Qos Policy    : (none)
Ingress FP QGrp  : (none)               Egress Port QGrp  : (none)
Ing FP QGrp Inst : (none)               Egr Port QGrp Inst: (none)
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

The following displays output if **enable-interface-statistics** is not enabled for a given interface.

```
===============================================================================
Interface Statistics
===============================================================================
If Name          : to_Ixia
Admin State      : Up                    Oper (v4/v6)      : Up/Up
Rx Pkts          : N/A                   Rx Bytes          : N/A
Rx V4 Pkts       : N/A                   Rx V4 Bytes       : N/A
Rx V6 Pkts       : N/A                   Rx V6 Bytes       : N/A
Tx Pkts          : 0                     Tx Bytes          : 0
Tx V4 Pkts       : 0                     Tx V4 Bytes       : 0
Tx V4 Discard Pk*: 0                     Tx V4 Discard Byt*: 0
Tx V6 Pkts       : 0                     Tx V6 Bytes       : 0
Tx V6 Discard Pk*: 0                     Tx V6 Discard Byt*: 0
uRPF Chk Fail Pk*: 0                     uRPF Fail Bytes   : 0
uRPF Fail V4 Pk  : 0                     uRPF Fail V4 Byt  : 0
uRPF Fail V6 Pk  : 0                     uRPF Fail V6 Byt  : 0
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

```
*A:Dut-C# show router 1 interface "mda-3-1" detail
===============================================================================
Interface Table (Service: 1)
===============================================================================
-------------------------------------------------------------------------------
Interface
-------------------------------------------------------------------------------
If Name          : mda-3-1
Admin State      : Up                     Oper (v4/v6)      : Up/Down
Protocols        : None
IP Addr/mask     : 20.12.0.46/32          Address Type      : Primary
IGP Inhibit      : Disabled               Broadcast Address : Host-ones
HoldUp-Time      : 0                      Track Srrp Inst   : 0
-------------------------------------------------------------------------------
Details
-------------------------------------------------------------------------------
Description      : tms-3-1
If Index         : 5                      Virt. If Index    : 5
Last Oper Chg    : 07/08/2011 06:49:45    Global If Index   : 95
If Type          : TMS
Rx Pkts          : 14935                  Rx Bytes          : 955840
Tx Pkts          : 14892                  Tx Bytes          : 953088
Tx Discard Pkts  : 0

TMS Health Information
Status           : Up
Version          : Peakflow TMS 5.6 (build BF42)
Mitigations      : 1
Status message   : (Unavailable)
===============================================================================
```

Summary IP Interface Output — The following table describes the summary output fields for the router IP interfaces.

Label	Description
Instance	The router instance number.
Router Name	The name of the router instance.
Interfaces	The number of IP interfaces in the router instance.
Admin-Up	The number of administratively enabled IP interfaces in the router instance.
Oper-Up	The number of operationally enabled IP interfaces in the router instance.

Sample Output

```
A:ALA-A# show router interface summary
===============================================================================
Router Summary (Interfaces)
===============================================================================
Instance  Router Name                        Interfaces    Admin-Up   Oper-Up
-------------------------------------------------------------------------------
```

```
1         Base                              7             7          5
===============================================================================
```

routes

Syntax **routes alternative**

Context show:router>isis

Description This command displays IS-IS route information.

Sample Output

```
*A:SRR# show router isis routes 1.1.1.0/24
===============================================================================
Route Table
===============================================================================
Prefix[Flags]                     Metric     Lvl/Typ    Ver.   SysID/Hostname
  NextHop                          MT         AdminTag
-------------------------------------------------------------------------------
1.1.1.0/24 [L]                    7540       1/Int.     6109   SRL
   60.60.1.1                       0           0
-------------------------------------------------------------------------------
No. of Routes: 1
Flags: L = LFA nexthop available
===============================================================================
*A:SRR#
*A:SRR# show router isis routes 1.1.1.0/24 alternative
===============================================================================
Route Table
===============================================================================
Prefix[Flags]                     Metric     Lvl/Typ    Ver.   SysID/Hostname
  NextHop                          MT         AdminTag
Alt-Nexthop                       Alt-Metric Alt-Type
-------------------------------------------------------------------------------
1.1.1.0/24                        7550       1/Int.     6114   SRL
   60.60.1.1                       0           0
   11.22.12.4 (LFA)                16784764    linkProtection
-------------------------------------------------------------------------------
No. of Routes: 1
Flags: LFA = Loop-Free Alternate nexthop
===============================================================================
*A:SRR#

*A:Dut-B# show router isis routes
============================================================================
Route Table
============================================================================
Prefix [Flags]                   Metric     Lvl/Typ    Ver.   SysID/Hostname
  NextHop                          MT         AdminTag
----------------------------------------------------------------------------
10.20.1.2/32                      0          1/Int.     3      Dut-B
   0.0.0.0                         0           0
10.20.1.3/32 [L]                  10         2/Int.     2      Dut-C
   10.20.3.3                       0           0
```

```
10.20.1.4/32                      10         2/Int.     3      Dut-D
   10.20.4.4                       0           0
10.20.1.5/32                      20         2/Int.     3      Dut-C
   10.20.3.3                       0           0
10.20.1.6/32                      20         2/Int.     3      Dut-D
   10.20.4.4                       0           0
10.20.3.0/24                      10         1/Int.     3      Dut-B
   0.0.0.0                         0           0
10.20.4.0/24                      10         1/Int.     3      Dut-B
   0.0.0.0                         0           0
10.20.5.0/24                      20         2/Int.     2      Dut-C
   10.20.3.3                       0           0
10.20.6.0/24                      20         2/Int.     4      Dut-D
   10.20.4.4                       0           0
10.20.9.0/24                      20         2/Int.     3      Dut-D
   10.20.4.4                       0           0
10.20.10.0/24                     30         2/Int.     3      Dut-C
   10.20.3.3                       0           0
----------------------------------------------------------------------------
Routes : 11
Flags: L = LFA nexthop available
============================================================================
*A:Dut-B#

*A:Dut-B# show router isis routes alternative

============================================================================
Route Table
============================================================================
Prefix [Flags]                   Metric     Lvl/Typ    Ver.   SysID/Hostname
  NextHop                          MT         AdminTag
Alt-Nexthop                    Alt-Metric
----------------------------------------------------------------------------
10.20.1.2/32                      0          1/Int.     3      Dut-B
   0.0.0.0                         0           0
10.20.1.3/32                      10         2/Int.     2      Dut-C
   10.20.3.3                       0           0
   10.20.3.3 (lfa)                15
10.20.1.4/32                      10         2/Int.     3      Dut-D
   10.20.4.4                       0           0
10.20.1.5/32                      20         2/Int.     3      Dut-C
   10.20.3.3                       0           0
10.20.1.6/32                      20         2/Int.     3      Dut-D
   10.20.4.4                       0           0
10.20.3.0/24                      10         1/Int.     3      Dut-B
   0.0.0.0                         0           0
10.20.4.0/24                      10         1/Int.     3      Dut-B
   0.0.0.0                         0           0
10.20.5.0/24                      20         2/Int.     2      Dut-C
   10.20.3.3                       0           0
10.20.6.0/24                      20         2/Int.     4
4      Dut-D
   10.20.4.4                       0           0
10.20.9.0/24                      20         2/Int.     3      Dut-D
   10.20.4.4                       0           0
10.20.10.0/24                     30         2/Int.     3      Dut-C
   10.20.3.3                       0           0
----------------------------------------------------------------------------
Routes : 11
```

```
Flags: LFA = Loop-Free Alternate nexthop
============================================================================
*A:Dut-B#
```

bindings

Syntax **bindings active**

Context show>router>ldp

Description This command displays LDP bindings information.

Sample Output

```
*A:Dut-A# show router ldp bindings active

========================================================================
Legend:  (S) - Static       (M) - Multi-homed Secondary Support
         (B) - BGP Next Hop (BU) - Alternate Next-hop for Fast Re-Route
========================================================================
LDP Prefix Bindings (Active)
========================================================================
Prefix                  Op   IngLbl    EgrLbl    EgrIntf/LspId  EgrNextHop
------------------------------------------------------------------------
10.20.1.1/32            Pop  131071      --        --             --
10.20.1.2/32            Push   --      131071    1/1/1          10.10.1.2
10.20.1.2/32            Swap 131070    131071    1/1/1          10.10.1.2
10.20.1.2/32            Push   --      262141BU  1/1/2          10.10.2.3
10.20.1.2/32            Swap 131070    262141BU  1/1/2          10.10.2.3
10.20.1.3/32            Push   --      131069BU  1/1/1          10.10.1.2
10.20.1.3/32            Swap 131069    131069BU  1/1/1          10.10.1.2
10.20.1.3/32            Push   --      262143    1/1/2          10.10.2.3
10.20.1.3/32            Swap 131069    262143    1/1/2          10.10.2.3
10.20.1.4/32            Push   --      131068    1/1/1          10.10.1.2
10.20.1.4/32            Swap 131068    131068    1/1/1          10.10.1.2
10.20.1.4/32            Push   --      262140BU  1/1/2          10.10.2.3
10.20.1.4/32            Swap 131068    262140BU  1/1/2          10.10.2.3
10.20.1.5/32            Push   --      131067BU  1/1/1          10.10.1.2
10.20.1.5/32            Swap 131067    131067BU  1/1/1          10.10.1.2
10.20.1.5/32            Push   --      262139    1/1/2          10.10.2.3
10.20.1.5/32            Swap 131067    262139    1/1/2          10.10.2.3
10.20.1.6/32            Push   --      131066    1/1/1          10.10.1.2
10.20.1.6/32            Swap 131066    131066    1/1/1          10.10.1.2
10.20.1.6/32            Push   --      262138BU  1/1/2          10.10.2.3
10.20.1.6/32            Swap 131066    262138BU  1/1/2          10.10.2.3
------------------------------------------------------------------------
No. of Prefix Active Bindings: 21
========================================================================
LDP P2MP Bindings (Active)
========================================================================
P2MP-Id         RootAddr
Interface       Op              IngLbl    EgrLbl EgrIntf/       EgrNextHop
                                                 LspId
------------------------------------------------------------------------
No Matching Entries Found
```

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

*A:Dut-A# show router ldp bindings

========================================================================
LDP LSR ID: 10.20.1.1
========================================================================
Legend: U - Label In Use, N - Label Not In Use, W - Label Withdrawn
        S - Status Signaled Up,  D - Status Signaled Down
        E - Epipe Service, V - VPLS Service, M - Mirror Service
        A - Apipe Service, F - Fpipe Service, I - IES Service, R - VPRN service
        P - Ipipe Service, WP - Label Withdraw Pending, C - Cpipe Service
        BU - Alternate Next-hop for Fast Re-Route, TLV - (Type, Length: Value)
========================================================================
LDP Prefix Bindings
========================================================================
Prefix             Peer            IngLbl     EgrLbl EgrIntf/    EgrNextHop
                                                     LspId
------------------------------------------------------------------------
10.20.1.1/32       10.20.1.2       131071U     --     --          --
10.20.1.1/32       10.20.1.3       131071U     --     --          --
10.20.1.2/32       10.20.1.2         --       131071 1/1/1       10.10.1.2
10.20.1.2/32       10.20.1.3       131070U    262141 1/1/2       10.10.2.3
10.20.1.3/32       10.20.1.2       131069U    131069 1/1/1       10.10.1.2
10.20.1.3/32       10.20.1.3         --       262143 1/1/2       10.10.2.3
10.20.1.4/32       10.20.1.2       131068N    131068 1/1/1       10.10.1.2
10.20.1.4/32       10.20.1.3       131068BU    262140 1/1/2       10.10.2.3
10.20.1.5/32       10.20.1.2       131067U    131067 1/1/1       10.10.1.2
10.20.1.5/32       10.20.1.3       131067N    262139 1/1/2       10.10.2.3
10.20.1.6/32       10.20.1.2       131066N    131066 1/1/1       10.10.1.2
10.20.1.6/32       10.20.1.3       131066BU   262138 1/1/2       10.10.2.3
------------------------------------------------------------------------
No. of Prefix Bindings: 12
========================================================================
LDP P2MP Bindings
========================================================================
P2MP-Id            RootAddr
Interface          Peer            IngLbl    EgrLbl EgrIntf/    EgrNextHop
                                                    LspId
------------------------------------------------------------------------
No Matching Entries Found

========================================================================
LDP Service FEC 128 Bindings
========================================================================
Type   VCId       SvcId      SDPId    Peer            IngLbl  EgrLbl  LMTU RMTU
------------------------------------------------------------------------
No Matching Entries Found

========================================================================
LDP Service FEC 129 Bindings
========================================================================
AGI                                   SAII
                                      TAII
Type              SvcId      SDPId    Peer            IngLbl  EgrLbl  LMTU RMTU
------------------------------------------------------------------------
No Matching Entries Found
========================================================================
========================================================================
```

mvpn

Syntax **mvpn**

Context show>router *router-instance*

Description This command displays Multicast VPN related information. The router instance must be specified.

Sample Output

```
*A:Dut-C# show router 1 mvpn
===============================================================================
MVPN 1 configuration data
===============================================================================
signaling          : Bgp                  auto-discovery     : Enabled
UMH Selection      : Highest-Ip           intersite-shared   : Enabled
vrf-import         : N/A
vrf-export         : N/A
vrf-target         : target:1:1
C-Mcast Import RT  : target:10.20.1.3:2

ipmsi              : pim-asm 224.1.1.1
admin status       : Up                   three-way-hello    : N/A
hello-interval     : N/A                  hello-multiplier   : 35 * 0.1
tracking support   : Disabled             Improved Assert    : N/A

spmsi              : pim-ssm 225.0.0.0/32
join-tlv-packing   : N/A
data-delay-interval: 3 seconds
data-threshold     : 224.0.0.0/4 --> 1 kbps

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

neighbor

Syntax **neighbor** [*ip-int-name* **|** *ip-address* **| mac** *ieee-mac-address* **| summary**]

Context show>router

Description This command displays information about the IPv6 neighbor cache.

Parameters *ip-int-name* — Specify the IP interface name.

ip-address — Specify the address of the IPv6 interface address.

mac *ieee-mac-address* — Specify the MAC address.

summary — Displays summary neighbor information.

Output **Neighbor Output —** The following table describes neighbor output fields.

Label	Description
`IPv6 Address`	Displays the IPv6 address.
`Interface`	Displays the name of the IPv6 interface name.
`MAC Address`	Specifies the link-layer address.
`State`	Displays the current administrative state.
`Exp`	Displays the number of seconds until the entry expires.
`Type`	Displays the type of IPv6 interface.
`Interface`	Displays the interface name.
`Rtr`	Specifies whether a neighbor is a router.
`Mtu`	Displays the MTU size.

Sample Output

```
B:CORE2# show router neighbor
===============================================================================
Neighbor Table (Router: Base)
===============================================================================
IPv6 Address                                   Interface
   MAC Address                State         Expiry          Type         RTR
-------------------------------------------------------------------------------
FE80::203:FAFF:FE78:5C88                       net1_1_2
   00:16:4d:50:17:a3          STALE         03h52m08s       Dynamic      Yes
FE80::203:FAFF:FE81:6888                       net1_2_3
   00:03:fa:1a:79:22          STALE         03h29m28s       Dynamic      Yes
-------------------------------------------------------------------------------
No. of Neighbor Entries: 2
===============================================================================
B:CORE2#
```

network-domains

Syntax **network-domains** [**detail**] [*network-domain-name*]

Context show>router

Description This command displays network-domains information.

Parameters **detail —** Displays detailed network-domains information.

network-domain-name — Displays information for a specific network domain.

Sample

```
*A:Dut-T>config>router# show router network-domains
===============================================================================
Network Domain Table
===============================================================================
Network Domain                   Description
-------------------------------------------------------------------------------
net1                             Network domain 1
default                          Default Network Domain
-------------------------------------------------------------------------------
Network Domains : 2
===============================================================================
*A:Dut-T>config>router#
```

```
*A:Dut-T>config>router# show router network-domains detail
===============================================================================
Network Domain Table (Router: Base)
===============================================================================
-------------------------------------------------------------------------------
Network Domain                  : net1
-------------------------------------------------------------------------------
Description                     : Network domain 1
No. Of Ifs Associated           : 2
No. Of SDPs Associated          : 0

-------------------------------------------------------------------------------
Network Domain                  : default
-------------------------------------------------------------------------------
Description                     : Default Network Domain
No. Of Ifs Associated           : 3
No. Of SDPs Associated          : 0
===============================================================================
*A:Dut-T>config>router#
```

```
*A:Dut-T>config>router# show router network-domains "net1" interface-association
===============================================================================
Interface Network Domain Association Table
===============================================================================
Interface Name                Port             Network Domain
-------------------------------------------------------------------------------
intf1                         1/2/2            net1
intf2                         6/1/2            net1
-------------------------------------------------------------------------------
Interfaces : 2
===============================================================================
*A:Dut-T>config>router#
```

```
*A:Dut-T>config>service# show router network-domains "net1" sdp-association
===============================================================================
SDP Network Domain Association Table
===============================================================================
SDP Id                           Network Domain
-------------------------------------------------------------------------------
100                              net1
-------------------------------------------------------------------------------
```

```
SDPs : 1
===============================================================================
*A:Dut-T>config>service#
```

policy

Syntax **policy** [*name* | **damping** | **prefix-list** *name* | **as-path** *name* | **community** *name* | **admin**]

Context show>router

Description This command displays policy-related information.

Parameters **name —** Specify an existing policy-statement name.

damping — Specify damping to display route damping profiles.

prefix-list *name* **—** Specify a prefix list name to display the route policy entries.

as-path *name* **—** Specify the route policy AS path name to display route policy entries.

community *name* **—** Specify a route policy community name to display information about a particular community member.

admin — Specify the **admin** keyword to display the entities configured in the config>router>policy-options context.

Output **Policy Output —** The following table describes policy output fields.

Label	Description
Policy	The policy name.
Description	Displays the description of the policy.

Sample Output

```
B:CORE2# show router policy
===============================================================================
Route Policies
===============================================================================
Policy                          Description
-------------------------------------------------------------------------------
fromStatic
-------------------------------------------------------------------------------
Policies : 1
===============================================================================
B:CORE2#
```

policy-edits

Syntax **policy-edits**

Context show>router

Description This command displays edited policy information.

route-table

Syntax **route-table** [*family*] [*ip-prefix*[/*prefix-length*] [**longer**|**exact**|**protocol** *protocol-name*] [**all**]]
[**next-hop-type** *type*][**qos**][**alternative**]
route-table [**family**] **summary**
route-table *tunnel-endpoints* [**ip-prefix[/prefix-length]**] [**longer**|**exact**] [**detail**]

Context show>router

Description This command displays the active routes in the routing table.

If no command line arguments are specified, all routes are displayed, sorted by prefix.

Parameters **family —** Specify the type of routing information to be distributed by this peer group.

Values **ipv4** — Displays only those BGP peers that have the IPv4 family enabled and not those capable of exchanging IP-VPN routes.
ipv6 — Displays the BGP peers that are IPv6 capable.
mcast-ipv4 — Displays the BGP peers that are IPv4 multicast capable.

mcast-ipv6 — Displays multicast IPv6 route table.

ip-prefix[/*prefix-length*] **—** Displays routes only matching the specified ip-address and length.

Values			
	ipv4-prefix:		a.b.c.d (host bits must be set to 0)
	ipv4-prefix-length:		0 — 32
	ipv6	ipv6-prefix[/pref*:	x:x:x:x:x:x:x:x (eight 16-bit pieces)
			x:x:x:x:x:x:d.d.d.d
			x: [0 — FFFF]H
			d: [0 — 255]D
		prefix-length:	1 — 128ipv6

longer — Displays routes matching the *ip-prefix/mask* and routes with longer masks.

exact — Displays the exact route matching the *ip-prefix*/*mask* masks.

protocol *protocol-name* **—** Displays routes learned from the specified protocol.

Values local, sub-mgmt, managed, static, ospf, ospf3, isis, rip, aggregate, bgp, bgp-vpn

summary — Displays a route table summary information.

tunnel-endpoints — Specifies to include tunnel endpoint information.

Output **Standard Route Table Output —** The following table describes the standard output fields for the route table.

Label	Description
Dest Address	The route destination address and mask.
Next Hop	The next hop IP address for the route destination.
Type	Local — The route is a local route.
	Remote — The route is a remote route.
Protocol	The protocol through which the route was learned.
Age	The route age in seconds for the route.
Metric	The route metric value for the route.
Pref	The route preference value for the route.
No. of Routes	The number of routes displayed in the list.

Sample Output

```
*A:Dut-B#config>service>vprn# show router 1 route-table

===============================================================================
Route Table (Service: 1)
===============================================================================
Dest Prefix[Flags]                            Type    Proto     Age        Pref
      Next Hop[Interface Name]                                    Metric
-------------------------------------------------------------------------------
10.0.0.0/30                                   Local   Local     02h09m23s  0
       to_4007                                                      0
10.0.0.8/30                                   Remote  BGP VPN   00h06m38s  170
       1.1.1.9 (tunneled)                                           0
11.0.0.8/30                                   Remote  BGP VPN   00h06m38s  170
       1.1.1.9 (tunneled)                                           0
192.168.0.0/16 [E]                            Remote  BGP VPN   00h06m38s  170
       1.1.1.9 (tunneled)                                           0
192.168.0.0/16 [E]                            Remote  BGP VPN   00h06m38s  170
       2.1.1.9 (tunneled)                                           0
-------------------------------------------------------------------------------
No. of Routes: 4
Flags: L = LFA nexthop available    B = BGP backup route available
       E = best-external BGP route available
       n = Number of times nexthop is repeated
===============================================================================


*A:Dut-B#config>service>vprn# show router 1 route-table alternative

===============================================================================
Route Table (Service: 1)
===============================================================================
Dest Prefix[Flags]                            Type    Proto     Age        Pref
```

```
      Next Hop[Interface Name]                                    Metric
      Alt-NextHop                                                Alt-
                                                                Metric
-------------------------------------------------------------------------------
10.0.0.0/30                                   Local   Local     02h17m23s  0
       to_4007                                                      0
10.0.0.8/30                                   Remote  BGP VPN   00h14m37s  170
       1.1.1.9 (tunneled)                                           0
11.0.0.8/30                                   Remote  BGP VPN   00h14m37s  170
       1.1.1.9 (tunneled)                                           0
192.168.0.0/16                                Remote  BGP VPN   00h14m37s  170
       1.1.1.9 (tunneled)                                           0
192.168.0.0/16 (Backup)                       Remote  BGP VPN   00h14m37s  170
       2.1.1.9 (tunneled)                                           0
192.168.0.0/16 (Best-ext)                     Remote  BGP       00h24m37s  170
       10.0.0.9                                                     0
-------------------------------------------------------------------------------
No. of Routes: 5
Flags: Backup = BGP backup route  LFA = Loop-Free Alternate nexthop
       Best-ext = best-external BGP route
       n = Number of times nexthop is repeated
===============================================================================

*A:Dut-B# show router route-table
============================================================================
Route Table (Router: Base)
============================================================================
Dest Prefix[Flags] Type Proto Age Pref
Next Hop[Interface Name] Metric
----------------------------------------------------------------------------
10.10.1.0/24 Local Local 00h01m25s 0
ip-10.10.1.2 0
10.10.2.0/24 [L] Remote ISIS 00h00m58s 15
10.10.12.3 13
10.10.3.0/24 Local Local 00h01m25s 0
ip-10.10.3.2 0
10.10.4.0/24 Local Local 00h01m25s 0
ip-10.10.4.2 0
10.10.5.0/24 [L] Remote ISIS 00h00m58s 15
10.10.12.3 13
10.10.6.0/24 [L] Remote ISIS 00h00m58s 15
10.10.4.4 20
10.10.9.0/24 [L] Remote ISIS 00h00m58s 15
10.10.4.4 20
10.10.10.0/24 [L] Remote ISIS 00h00m58s 15
10.10.12.3 23
10.10.11.0/24 [L] Remote ISIS 00h00m58s 15
10.10.12.3 13
10.10.12.0/24 Local Local 00h01m25s 0
ip-10.10.12.2 0
10.20.1.1/32 [L] Remote ISIS 00h00m58s 15
10.10.1.1 10
10.20.1.2/32 Local Local 00h01m25s 0
system 0
10.20.1.3/32 [L] Remote ISIS 00h00m58s 15
10.10.12.3 3
10.20.1.4/32 [L] Remote ISIS 00h00m58s 15
10.10.4.4 10
10.20.1.5/32 [L] Remote ISIS 00h00m58s 15
```

```
10.10.12.3 13
10.20.1.6/32 [L] Remote ISIS 00h00m58s 15
10.10.4.4 20
----------------------------------------------------------------------------
No. of Routes: 16
Flags: L = LFA nexthop available B = BGP backup route available
============================================================================

*A:Dut-B# show router route-table alternative
============================================================================
Route Table (Router: Base)
============================================================================
Dest Prefix[Flags] Type Proto Age Pref
Next Hop[Interface Name] Metric
Alt-NextHop Alt-Metric
----------------------------------------------------------------------------
10.10.1.0/24 Local Local 00h02m28s 0
ip-10.10.1.2 0
10.10.2.0/24 Remote ISIS 00h02m01s 15
10.10.12.3 13
10.10.1.1 (LFA) 20
10.10.3.0/24 Local Local 00h02m27s 0
ip-10.10.3.2 0
10.10.4.0/24 Local Local 00h02m28s 0
ip-10.10.4.2 0
10.10.5.0/24 Remote ISIS 00h02m01s 15
10.10.12.3 13
10.10.1.1 (LFA) 20
10.10.6.0/24 Remote ISIS 00h02m01s 15
10.10.4.4 20
10.10.12.3 (LFA) 13
10.10.9.0/24 Remote ISIS 00h02m01s 15
10.10.4.4 20
10.10.12.3 (LFA) 13
10.10.10.0/24 Remote ISIS 00h02m01s 15
10.10.12.3 23
10.10.4.4 (LFA) 20
10.10.11.0/24 Remote ISIS 00h02m01s 15
10.10.12.3 13
10.10.1.1 (LFA) 20
10.10.12.0/24 Local Local 00h02m28s 0
ip-10.10.12.2 0
10.20.1.1/32 Remote ISIS 00h02m01s 15
10.10.1.1 10
10.10.12.3 (LFA) 13
10.20.1.2/32 Local Local 00h02m28s 0
system 0
10.20.1.3/32 Remote ISIS 00h02m05s 15
10.10.12.3 3
10.10.1.1 (LFA) 20
10.20.1.4/32 Remote ISIS 00h02m05s 15
10.10.4.4 10
10.10.12.3 (LFA) 13
10.20.1.5/32 Remote ISIS 00h02m05s 15
10.10.12.3 13
10.10.4.4 (LFA) 20
10.20.1.6/32 Remote ISIS 00h02m05s 15
10.10.4.4 20
10.10.12.3 (LFA) 23
```

```
----------------------------------------------------------------------------
No. of Routes: 16
Flags: Backup = BGP backup routeLFA = Loop-Free Alternate nexthop
============================================================================


*A:Dut-C# show router route-table 1.1.1.1/32

===============================================================================
Route Table (Router: Base)
===============================================================================
Dest Prefix                                   Type    Proto    Age         Pref
       Next Hop[Interface Name]                                    Metric
-------------------------------------------------------------------------------
1.1.1.1/32                                    Remote  BGP      00h00m09s   170
       10.20.1.1 (tunneled:RSVP:1)                                 0
-------------------------------------------------------------------------------
No. of Routes: 1
===============================================================================



A:ALA# show router route-table
===============================================================================
Route Table (Router: Base)
===============================================================================
Dest Prefix                                   Type    Proto
Age         Pref
       Next Hop[Interface Name]                                    Metric
-------------------------------------------------------------------------------
11.2.103.0/24                                 Remote  OSPF
00h59m02s   10
       21.2.4.2                                                    2
11.2.103.0/24                                 Remote  OSPF
00h59m02s   10
       22.2.4.2                                                    2
11.2.103.0/24                                 Remote  OSPF
00h59m02s   10
       23.2.4.2                                                    2
11.2.103.0/24                                 Remote  OSPF
00h59m02s   10
       24.2.4.2                                                    2
11.2.103.0/24                                 Remote  OSPF
00h59m02s   10
       100.0.0.1                                                   2
11.2.103.0/24                                 Remote  OSPF
00h59m02s   10
       100.128.0.1                                                 2
11.4.101.0/24                                 Local   Local    02h14m29s   0
...
-------------------------------------------------------------------------------
A:ALA#

B:ALA-B# show router route-table 100.10.0.0 exact
===============================================================================
Route Table (Router: Base)
===============================================================================
Dest Address Next Hop Type Proto Age Metric Pref
-------------------------------------------------------------------------------
```

```
100.10.0.0/16 Black Hole Remote Static 00h03m17s 1 5
-------------------------------------------------------------------------------
No. of Routes: 1
===============================================================================
B:ALA-B#


A:ALA-A# show router route-table 10.10.0.4
===============================================================================
Route Table
===============================================================================
Dest Address       Next Hop        Type    Protocol    Age       Metric  Pref
-------------------------------------------------------------------------------
10.10.0.4/32       10.10.34.4      Remote  OSPF        3523      1001    10
-------------------------------------------------------------------------------
A:ALA-A#


A:ALA-A# show router route-table 10.10.0.4/32 longer
===============================================================================
Route Table
===============================================================================
Dest Address       Next Hop        Type    Protocol    Age       Metric  Pref
-------------------------------------------------------------------------------
10.10.0.4/32       10.10.34.4      Remote  OSPF        3523      1001    10
-------------------------------------------------------------------------------
No. of Routes: 1
===============================================================================
+ : indicates that the route matches on a longer prefix
A:ALA-A#

*A:Dut-C# show router route-table

===============================================================================
Route Table (Router: Base)
===============================================================================
Dest Prefix[Flags]                            Type    Proto    Age         Pref
      Next Hop[Interface Name]                                   Metric
-------------------------------------------------------------------------------
1.1.2.0/24                                    Remote  ISIS     00h44m24s   15
       1.1.3.1                                                      20
1.1.2.0/24                                    Remote  ISIS     00h44m24s   15
       1.2.3.2                                                      20
1.1.3.0/24                                    Local   Local    00h44m30s   0
       to_Dut-A                                                     0
1.1.9.0/24                                    Remote  ISIS     00h44m16s   15
       1.1.3.1                                                      20
1.2.3.0/24                                    Local   Local    00h44m30s   0
       to_Dut-B                                                     0
1.2.9.0/24                                    Remote  ISIS     00h43m55s   160
       1.2.3.2                                                      10
10.12.0.0/24                                  Local   Local    00h44m29s   0
       itfToArborCP_02                                              0
10.20.1.1/32                                  Remote  ISIS     00h44m24s   15
       1.1.3.1                                                      10
10.20.1.2/32                                  Remote  ISIS     00h44m28s   15
       1.2.3.2                                                      10
10.20.1.3/32                                  Local   Local    00h44m32s   0
       system                                                       0
```

```
20.12.0.43/32                                 Remote  Static   00h44m31s   5
       vprn1:mda-1-1                                                1
20.12.0.44/32                                 Remote  Static   00h44m31s   5
       vprn1:mda-2-1                                                1
20.12.0.45/32                                 Remote  Static   00h44m31s   5
       vprn1:mda-2-2                                                1
20.12.0.46/32                                 Remote  Static   00h44m30s   5
       vprn1:mda-3-1                                                1
100.0.0.1/32                                  Remote  TMS      00h34m39s   167
       vprn1:mda-1-1                                                0
100.0.0.1/32                                  Remote  TMS      00h34m39s   167
       vprn1:mda-3-1                                                0
138.203.71.202/32                             Remote  Static   00h44m29s   5
       10.12.0.2                                                    1
-------------------------------------------------------------------------------
No. of Routes: 17
Flags: L = LFA nexthop available    B = BGP backup route available
       n = Number of times nexthop is repeated
===============================================================================
A:ALA-A# show router route-table protocol ospf
===============================================================================
Route Table
===============================================================================
Dest Address       Next Hop        Type    Protocol    Age       Metric  Pref
-------------------------------------------------------------------------------
10.10.0.1/32       10.10.13.1      Remote  OSPF        65844     1001    10
10.10.0.2/32       10.10.13.1      Remote  OSPF        65844     2001    10
10.10.0.4/32       10.10.34.4      Remote  OSPF        3523      1001    10
10.10.0.5/32       10.10.35.5      Remote  OSPF        1084022   1001    10
10.10.12.0/24      10.10.13.1      Remote  OSPF        65844     2000    10
10.10.15.0/24      10.10.13.1      Remote  OSPF        58836     2000    10
10.10.24.0/24      10.10.34.4      Remote  OSPF        3523      2000    10
10.10.25.0/24      10.10.35.5      Remote  OSPF        399059    2000    10
10.10.45.0/24      10.10.34.4      Remote  OSPF        3523      2000    10
-------------------------------------------------------------------------------
A:ALA-A#

show router route-table 131.132.133.134/32 next-hop-type tunneled

Route Table (Router: Base)
========================================================================
Dest Prefix                                Type        Proto    Age              Pref
       Next Hop[Interface Name]                                 Metric
------------------------------------------------------------------------
131.132.133.134/32                   Remote  OSPF    00h02m09s   10
       66.66.66.66                                                     10
       Next-hop type: tunneled, Owner: RSVP, Tunnel-ID: <out-ifindex-from-route>
------------------------------------------------------------------------No. of Routes:
1
========================================================================
*A:Dut-B# show router route-table next-hop-type tunneled

===============================================================================
Route Table (Router: Base)
===============================================================================
Dest Prefix                                   Type    Proto    Age         Pref
       Next Hop[Interface Name]                                     Metric
-------------------------------------------------------------------------------
10.10.5.0/24                                  Remote  OSPF     00h02m20s   10
```

```
       10.20.1.5 (tunneled:RSVP:1)                                  1100
10.10.10.0/24                                 Remote  OSPF     00h02m20s   10
       10.20.1.5 (tunneled:RSVP:1)                                  1100
10.20.1.5/32                                  Remote  OSPF     00h02m20s   10
       10.20.1.5 (tunneled:RSVP:1)                                  100
10.20.1.6/32                                  Remote  OSPF     00h02m20s   10
       10.20.1.5 (tunneled:RSVP:1)                                  1100
-------------------------------------------------------------------------------
No. of Routes: 4
===============================================================================


*A:Dut-B# show router route-table 10.20.1.5/32 next-hop-type tunneled

===============================================================================
Route Table (Router: Base)
===============================================================================
Dest Prefix                                   Type    Proto    Age         Pref
       Next Hop[Interface Name]                                     Metric
-------------------------------------------------------------------------------
10.20.1.5/32                                  Remote  OSPF     00h03m55s   10
       10.20.1.5 (tunneled:RSVP:1)                                  100
-------------------------------------------------------------------------------
No. of Routes: 1
===============================================================================
*A:Dut-C# show router route-table protocol tms

===============================================================================
Route Table (Router: Base)
===============================================================================
Dest Prefix[Flags]                            Type    Proto    Age         Pref
     Next Hop[Interface Name]                                   Metric
-------------------------------------------------------------------------------
100.0.0.1/32                                  Remote  TMS      00h23m07s   167
vprn1:mda-2-1                                                0
-------------------------------------------------------------------------------
No. of Routes: 1
Flags: L = LFA nexthop available    B = BGP backup route available
     n = Number of times nexthop is repeated
===============================================================================
*A:Dut-C#
*A:Dut-C# show router route-table summary

===============================================================================
Route Table Summary (Router: Base)
===============================================================================
                                   Active                   Available
-------------------------------------------------------------------------------
     Static                        5                        5
     Direct                        12                       12
     Host                          0                        11
     BGP                           0                        0
     BGP (Backup)                  0                        0
     VPN Leak                      0                        0
     OSPF                          0                        0
     ISIS                          6                        6
     ISIS (LFA)                    0                        0
     RIP                           0                        0
     LDP                           0                        0
     Aggregate                     0                        0
     Sub Mgmt                      0                        0
     Managed                       0                        0
     NAT                           0                        0
     TMS                           1                        1
-------------------------------------------------------------------------------
     Total                         24                       35
===============================================================================
     NOTE: ISIS LFA routes and BGP Backup routes are not counted towards the total.
```

Summary Route Table Output — Summary output for the route table displays the number of active routes and the number of routes learned by the router by protocol. Total active and available routes are also displayed.

Sample Output

```
A:ALA-A# show router route-table summary
===============================================================================
Route Table Summary
===============================================================================
                              Active                   Available
-------------------------------------------------------------------------------
Static                        1                        1
Direct                        6                        6
BGP                           0                        0
OSPF                          9                        9
ISIS                          0                        0
RIP                           0                        0
Aggregate                     0                        0
-------------------------------------------------------------------------------
Total                         16                      16
===============================================================================
A:ALA-A#

*A:SRR# show router route-table summary
===============================================================================
Route Table Summary (Router: Base)
===============================================================================
                              Active                   Available
-------------------------------------------------------------------------------
Static                        6                        6
Direct                        1698                     1698
Host                          0                        1477
BGP                           0                        0
BGP (Backup)                  0                        0
VPN Leak                      0                        0
OSPF                          0                        0
ISIS                          3296                     6383
ISIS (LFA)                    472                      1499
RIP                           0                        0
LDP                           6                        6
Aggregate                     0                        0
Sub Mgmt                      0                        0
Managed                       0                        0
NAT                           0                        0
TMS                           0                        0
-------------------------------------------------------------------------------
```

```
Total                          5006                    9570
===============================================================================
NOTE: ISIS LFA routes and BGP Backup routes are not counted towards the total.
*A:SRR#
```

rtr-advertisement

Syntax **rtr-advertisement** [**interface** *interface-name*] [**prefix** *ipv6-prefix[/prefix-length]*]
rtr-advertisement [**conflicts**]

Context show>router

Description This command displays router advertisement information.

If no command line arguments are specified, all routes are displayed, sorted by prefix.

Parameters *interface-name* — Maximum 32 characters.

ipv6-prefix[*/prefix-length*] **—** Displays routes only matching the specified ip-address and length.

Values	ipv6	ipv6-prefix[/pref*:	x:x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D
		prefix-length:	1 — 128

Output **Router-Advertisement Table Output —** The following table describes the output fields for router-advertisement.

Label	Description
`Rtr Advertisement Tx/Last Sent`	The number of router advertisements sent and time since they were sent.
`Nbr Solicitation Tx`	The number of neighbor solicitations sent and time since they were sent.
`Nbr Advertisement Tx`	The number of neighbor advertisements sent and time since they were sent.
`Rtr Advertisement Rx`	The number of router advertisements received and time since they were received.
`Nbr Advertisement Rx`	The number of neighbor advertisements received and time since they were received.
`Max Advert Interval`	The maximum interval between sending router advertisement messages.
`Managed Config`	`True` — Indicates that DHCPv6 has been configured.

Label	Description (Continued)
	False — Indicates that DHCPv6 is not available for address configuration.
Reachable Time	The time, in milliseconds, that a node assumes a neighbor is reachable after receiving a reachability confirmation.
Retransmit Time	The time, in milliseconds, between retransmitted neighbor solicitation messages.
Link MTU	The MTU number the nodes use for sending packets on the link.
Rtr Solicitation Rx	The number of router solicitations received and time since they were received.
Nbr Solicitation Rx	The number of neighbor solicitations received and time since they were received.
Min Advert Interval	The minimum interval between sending ICMPv6 neighbor discovery router advertisement messages.
Other Config	True — Indicates there are other stateful configurations.
	False — Indicates there are no other stateful configurations.
Router Lifetime	Displays the router lifetime in seconds.
Hop Limit	Displays the current hop limit.

Sample Output

```
A:Dut-A# show router rtr-advertisement
=======================================================================
Router Advertisement
=======================================================================
-------------------------------------------------------------------------------
Interface: interfaceNetworkNonDefault
-------------------------------------------------------------------------------
Rtr Advertisement Tx : 8                 Last Sent            : 00h01m28s
Nbr Solicitation Tx  : 83                Last Sent            : 00h00m17s
Nbr Advertisement Tx : 74                Last Sent            : 00h00m25s
Rtr Advertisement Rx : 8                 Rtr Solicitation Rx  : 0
Nbr Advertisement Rx : 83                Nbr Solicitation Rx  : 74
-------------------------------------------------------------------------------
Max Advert Interval  : 601               Min Advert Interval  : 201
Managed Config       : TRUE              Other Config         : TRUE
Reachable Time       : 00h00m00s400ms   Router Lifetime      : 00h30m01s
Retransmit Time      : 00h00m00s400ms   Hop Limit            : 63
Link MTU             : 1500

Prefix: 211::/120
Autonomous Flag      : FALSE             On-link flag         : FALSE
Preferred Lifetime   : 07d00h00m         Valid Lifetime       : 30d00h00m

Prefix: 231::/120
```

```
Autonomous Flag      : FALSE            On-link flag         : FALSE
Preferred Lifetime   : 49710d06h        Valid Lifetime       : 49710d06h

Prefix: 241::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 00h00m00s        Valid Lifetime       : 00h00m00s

Prefix: 251::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m
-------------------------------------------------------------------------------
Advertisement from: FE80::200:FF:FE00:2
Managed Config       : FALSE            Other Config         : FALSE
Reachable Time       : 00h00m00s0ms     Router Lifetime      : 00h30m00s
Retransmit Time      : 00h00m00s0ms     Hop Limit            : 64
Link MTU             : 0
-------------------------------------------------------------------------------
Interface: interfaceServiceNonDefault
-------------------------------------------------------------------------------
Rtr Advertisement Tx : 8                Last Sent            : 00h06m41s
Nbr Solicitation Tx  : 166              Last Sent            : 00h00m04s
Nbr Advertisement Tx : 143              Last Sent            : 00h00m05s
Rtr Advertisement Rx : 8                Rtr Solicitation Rx  : 0
Nbr Advertisement Rx : 166              Nbr Solicitation Rx  : 143
-------------------------------------------------------------------------------
Max Advert Interval  : 601              Min Advert Interval  : 201
Managed Config       : TRUE             Other Config         : TRUE
Reachable Time       : 00h00m00s400ms   Router Lifetime      : 00h30m01s
Retransmit Time      : 00h00m00s400ms   Hop Limit            : 63
Link MTU             : 1500

Prefix: 23::/120
Autonomous Flag      : FALSE            On-link flag         : FALSE
Preferred Lifetime   : infinite         Valid Lifetime       : infinite

Prefix: 24::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 00h00m00s        Valid Lifetime       : 00h00m00s

Prefix: 25::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m
-------------------------------------------------------------------------------
Advertisement from: FE80::200:FF:FE00:2
Managed Config       : FALSE            Other Config         : FALSE
Reachable Time       : 00h00m00s0ms     Router Lifetime      : 00h30m00s
Retransmit Time      : 00h00m00s0ms     Hop Limit            : 64
Link MTU             : 0

Prefix: 2::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m

Prefix: 23::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m

Prefix: 24::/119
Autonomous Flag      : TRUE             On-link flag         : TRUE
```

```
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m

Prefix: 25::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : infinite

Prefix: 231::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m
-------------------------------------------------------------------------------
...
A:Dut-A#
```

Output **Router-Advertisement Conflicts Output —** The following table describes the output fields for router- advertisement conflicts.

Label	Description
`Advertisement from`	The address of the advertising router.
`Reachable Time`	The time, in milliseconds, that a node assumes a neighbor is reachable after receiving a reachability confirmation.
`Router Lifetime`	Displays the router lifetime in seconds.
`Retransmit Time`	The time, in milliseconds, between retransmitted neighbor solicitation messages.
`Hop Limit`	Displays the current hop limit
`Link MTU`	The MTU number the nodes use for sending packets on the link.

Sample Output

```
A:Dut-A# show>router# rtr-advertisement conflicts
===============================================================================
Router Advertisement
===============================================================================
Interface: interfaceNetworkNonDefault
-------------------------------------------------------------------------------
Advertisement from: FE80::200:FF:FE00:2
Managed Config    : FALSE [TRUE]
Other Config      : FALSE [TRUE]
Reachable Time    : 00h00m00s0ms [00h00m00s400ms]
Router Lifetime   : 00h30m00s [00h30m01s]
Retransmit Time   : 00h00m00s0ms [00h00m00s400ms]
Hop Limit         : 64 [63]
Link MTU          : 0 [1500]

Prefix not present in neighbor router advertisement
Prefix: 211::/120
Autonomous Flag      : FALSE            On-link flag         : FALSE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m

Prefix not present in neighbor router advertisement
```

```
Prefix: 231::/120
Autonomous Flag      : FALSE            On-link flag         : FALSE
Preferred Lifetime   : 49710d06h        Valid Lifetime       : 49710d06h

Prefix not present in neighbor router advertisement
Prefix: 241::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 00h00m00s        Valid Lifetime       : 00h00m00s

Prefix not present in neighbor router advertisement
Prefix: 251::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m
-------------------------------------------------------------------------------
Interface: interfaceServiceNonDefault
-------------------------------------------------------------------------------
Advertisement from: FE80::200:FF:FE00:2
Managed Config    : FALSE [TRUE]
Other Config      : FALSE [TRUE]
Reachable Time    : 00h00m00s0ms [00h00m00s400ms]
Router Lifetime   : 00h30m00s [00h30m01s]
Retransmit Time   : 00h00m00s0ms [00h00m00s400ms]
Hop Limit         : 64 [63]
Link MTU          : 0 [1500]

Prefix not present in own router advertisement
Prefix: 2::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m

Prefix: 23::/120
Autonomous Flag   : TRUE [FALSE]
On-link flag      : TRUE [FALSE]
Preferred Lifetime: 07d00h00m [infinite]
Valid Lifetime    : 30d00h00m [infinite]

Prefix not present in own router advertisement
Prefix: 24::/119
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m

Prefix not present in neighbor router advertisement
Prefix: 24::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 00h00m00s        Valid Lifetime       : 00h00m00s

Prefix: 25::/120
Valid Lifetime    : infinite [30d00h00m]

Prefix not present in own router advertisement
Prefix: 231::/120
Autonomous Flag      : TRUE             On-link flag         : TRUE
Preferred Lifetime   : 07d00h00m        Valid Lifetime       : 30d00h00m
===============================================================================
A:Dut-A#
```

static-arp

Syntax **static-arp** [*ip-addr* **|** *ip-int-name* **| mac** *ieee-mac-addr*]

Context show>router

Description This command displays the router static ARP table sorted by IP address. If no options are present, all ARP entries are displayed.

Parameters *ip-addr* — Only displays static ARP entries associated with the specified IP address.

ip-int-name — Only displays static ARP entries associated with the specified IP interface name.

mac *ieee-mac-addr* **—** Only displays static ARP entries associated with the specified MAC address.

Output **Static ARP Table Output —** The following table describes the output fields for the ARP table.

Label	Description
IP Address	The IP address of the static ARP entry.
MAC Address	The MAC address of the static ARP entry.
Age	The age of the ARP entry. Static ARPs always have 00:00:00 for the age.
Type	Inv — The ARP entry is an inactive static ARP entry (invalid).
	Sta — The ARP entry is an active static ARP entry.
Interface	The IP interface name associated with the ARP entry.
No. of ARP Entries	The number of ARP entries displayed in the list.

Sample Output

```
A:ALA-A# show router static-arp
===============================================================================
ARP Table
===============================================================================
IP Address      MAC Address       Age      Type Interface
-------------------------------------------------------------------------------
10.200.0.253    00:00:5a:40:00:01 00:00:00 Sta  to-ser1
12.200.1.1      00:00:5a:01:00:33 00:00:00 Inv  to-ser1a
-------------------------------------------------------------------------------
No. of ARP Entries: 1
===============================================================================
A:ALA-A#


A:ALA-A# show router static-arp 12.200.1.1
===============================================================================
ARP Table
===============================================================================
IP Address      MAC Address       Age      Type Interface
-------------------------------------------------------------------------------
```

```
12.200.1.1      00:00:5a:01:00:33 00:00:00 Inv  to-ser1

===============================================================================
A:ALA-A#


A:ALA-A# show router static-arp to-ser1
===============================================================================
ARP Table
===============================================================================
IP Address      MAC Address       Age      Type Interface
-------------------------------------------------------------------------------
10.200.0.253  00:00:5a:40:00:01 00:00:00 Sta to-ser1
===============================================================================
A:ALA-A#


A:ALA-A# show router static-arp mac 00:00:5a:40:00:01
===============================================================================
ARP Table
===============================================================================
IP Address      MAC Address       Age      Type Interface
-------------------------------------------------------------------------------
10.200.0.253  00:00:5a:40:00:01 00:00:00 Sta to-ser1
===============================================================================
A:ALA-A#
```

static-route

Syntax **static-route** [**family**] [[*ip-prefix /mask*] **|** [**preference** *preference*] **|** [**next-hop** *ip-address*] **| tag** *tag*]

Context show>router

Description This command displays the static entries in the routing table. If no options are present, all static routes are displayed sorted by prefix.

Parameters **family —** Specify the type of routing information to be distributed by this peer group.

Values **ipv4** — Displays only those BGP peers that have the IPv4 family enabled and not those capable of exchanging IP-VPN routes.
ipv6 — Displays the BGP peers that are IPv6 capable.
mcast-ipv4 — Displays the BGP peers that are IPv4 multicast capable.

ip-prefix /mask **—** Displays static routes only matching the specified *ip-prefix* and *mask*.

Values

ipv4-prefix:	a.b.c.d (host bits must be 0)
ipv4-prefix-length:	0 — 32
ipv6-prefix:	x:x:x:x:x:x:x:x (eight 16-bit pieces)
	x:x:x:x:x:x:d.d.d.d
	x: [0 — FFFF]H
	d: [0 — 255]D
ipv6-prefix-length:	0 — 128

preference *preference* **—** Only displays static routes with the specified route preference.

Values 0 — 65535

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

tag *tag* **—** Displays the tag used to add a 32-bit integer tag to the static route. The tag is used in route policies to control distribution of the route into other protocols.

Values 1 — 4294967295

Output **Static Route Output —** The following table describes the output fields for the static route table.

Label	Description
`IP Addr/mask`	The static route destination address and mask.
`Pref`	The route preference value for the static route.
`Metric`	The route metric value for the static route.
`Type`	`BH` — The static route is a black hole route. The `Nexthop` for this type of route is `black-hole`. `ID` — The static route is an indirect route, where the `nexthop` for this type of route is the non-directly connected next hop. `NH` — The route is a static route with a directly connected next hop. The `Nexthop` for this type of route is either the next hop IP address or an egress IP interface name.
`Next Hop`	The next hop for the static route destination.
`Protocol`	The protocol through which the route was learned.
`Interface`	The egress IP interface name for the static route. `n/a` — indicates there is no current egress interface because the static route is inactive or a black hole route.
`Active`	`N` — The static route is inactive; for example, the static route is disabled or the next hop IP interface is down. `Y` — The static route is active.
`No. of Routes`	The number of routes displayed in the list.

Sample Output

```
A:ALA-A# show router static-route
===============================================================================
Route Table
===============================================================================
IP Addr/mask       Pref Metric Type Nexthop              Interface       Active
-------------------------------------------------------------------------------
192.168.250.0/24   5    1      ID   10.200.10.1          to-ser1              Y
192.168.252.0/24   5    1      NH   10.10.0.254          n/a                  N
192.168.253.0/24   5    1      NH   to-ser1              n/a                  N
192.168.253.0/24   5    1      NH   10.10.0.254          n/a                  N
192.168.254.0/24   4    1      BH   black-hole           n/a                  Y
===============================================================================
A:ALA-A#


A:ALA-A# show router static-route 192.168.250.0/24
===============================================================================
Route Table
===============================================================================
IP Addr/mask       Pref Metric Type Nexthop              Interface       Active
-------------------------------------------------------------------------------
192.168.250.0/24   5    1      ID   10.200.10.1          to-ser1              Y
===============================================================================
A:ALA-A#


A:ALA-A# show router static-route preference 4
===============================================================================
Route Table
===============================================================================
IP Addr/mask       Pref Metric Type Nexthop              Interface       Active
-------------------------------------------------------------------------------
192.168.254.0/24   4    1      BH   black-hole           n/a                  Y
===============================================================================
A:ALA-A#


A:ALA-A# show router static-route next-hop 10.10.0.254
===============================================================================
Route Table
===============================================================================
IP Addr/mask       Pref Metric Type Nexthop              Interface       Active
-------------------------------------------------------------------------------
192.168.253.0/24   5    1      NH   10.10.0.254          n/a                  N
===============================================================================
A:ALA-A#
*A:sim1# show router static-route 10.10.0.0/16 detail
===============================================================================
Static Route Table (Router: Base)            Family : [IPv4|MCast-IPv4|IPv6]
===============================================================================
Network : 3FFD:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFE3/120  Type : [Nexthop|Indirect|Black-
hole]
Nexthop : [address | LSP label & name]                 Nexthop type: [IP|LDP|RSVP-TE]
Interface :
Metric  : 1                                        Prefence :  5
Active  : [Y|N]                                    Admin State : [Up|Down]
Tag :
BFD: [enable|disabled]

CPE-check: [enabled|disabled]                      State: [Up|Down]
Target   : <address>
```

```
Interval : [value | n/a]                           Drop Count : <value>
Log      : [Y|N]
CPE Host Up/Dn Time : 0d 16:32:28
CPE Echo Req Tx      : 0                           CPE Echo Reply Rx: 0
CPE Up Transitions  : 0                            CPE Down Transitions : 0
CPE TTL : 13
===============================================================================
A:sim1#

*A:CPM133>config>router# show router static-route 3.3.3.3/32 detail

===============================================================================
Static Route Table (Router: Base)  Family: IPv4
===============================================================================
Prefix           : 3.3.3.3/32
Nexthop          : n/a
Type             : Blackhole                       Nexthop Type      : IP
Interface        : n/a                             Active            : Y
Prefix List      : n/a                             Prefix List Type  : n/a
Metric           : 1                               Preference        : 5
Admin  State     : Up                              Tag               : 0
BFD              : disabled                        Community         : 100:33
CPE-check        : disabled
-------------------------------------------------------------------------------
No. of Static Routes: 1

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

service-prefix

Syntax **service-prefix**

Description This command displays the address ranges reserved by this node for services sorted by prefix.

Output **Service Prefix Output —** The following table describes the output fields for service prefix information.

Label	Description
`IP Prefix`	The IP prefix of the range of addresses included in the range for services.
`Mask`	The subnet mask length associated with the IP prefix.
`Exclusive`	`false` — Addresses in the range are not exclusively for use for service IP addresses. `true` — Addresses in the range are exclusively for use for service IP addresses and cannot be assigned to network IP interfaces.

Sample Output

```
A:ALA-A# show router service-prefix
=================================================
Address Ranges reserved for Services
=================================================
IP Prefix                Mask      Exclusive
-------------------------------------------------
172.16.1.0               24        true
172.16.2.0               24        false
=================================================
A:ALA-A#
```

sgt-qos

Syntax **sgt-qos**

Context show>router

Description This command displays self-generated traffic QoS related information.

application

Syntax **application** [*app-name*] [**dscp|dot1p**]

Context show>router>sgt-qos

Description This command displays application QoS settings.

Parameters *app-name* — The specific application.

Values arp, bgp, cflowd, dhcp, dns, ftp, icmp, igmp, isis, ldp, mld, msdp, ndis, ntp, ospf, pimradius, rip, rsvpsnmp, snmp-notification, srrp, ssh, syslog, tacplus, telnet, tftp, traceroute, vrrp, pppoe

dscp-map

Syntax **dscp-map** [*dscp-name*]

Context show>router>sgt-qos

Description This command displays DSCP to FC mappings.

Parameters *dscp-name* — The specific DSCP name.

Values be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63

status

Syntax **status**

Context show>router

Description This command displays the router status.

Output **Router Status Output —** The following table describes the output fields for router status information.

Label	Description
`Router`	The administrative and operational states for the router.
`OSPF`	The administrative and operational states for the OSPF protocol.
`RIP`	The administrative and operational states for the RIP protocol.
`ISIS`	The administrative and operational states for the IS-IS protocol.
`MPLS`	The administrative and operational states for the MPLS protocol.
`RSVP`	The administrative and operational states for the RSVP protocol.
`LDP`	The administrative and operational states for the LDP protocol.
`BGP`	The administrative and operational states for the BGP protocol.
`IGMP`	The administrative and operational states for the IGMP protocol.
`MLD`	The administrative and operational states for the MLD protocol.
`PIM`	The administrative and operational states for the PIM protocol.
`PIMv4`	The administrative and operational states for the PIMv4 protocol..
`PIMv6`	The administrative and operational states for the PIMv6 protocol..
`OSPFv3`	The administrative and operational states for the OSPFv3 protocol.
`MSDP`	The administrative and operational states for the HSDP protocol
`Max Routes`	The maximum number of routes configured for the system.
`Total Routes`	The total number of routes in the route table.
`ECMP Max Routes`	The number of ECMP routes configured for path sharing.
`service-id`	`state` — Current single SFM state `start` — Last time this vRtr went into overload, after having respected the hold-off time `interval` — How long the vRtr remained or is in overload

Label	Description (Continued)
ICMP Tunneling	No — ICMP tunneling is disabled. Yes — TICMP tunneling is enabled.
VPRN Local TTL Propagate	inherit — VPRN instance is to inherit the global configuration none — TTL of IP packet is not propagated into the VC or transport label stack vc-only — TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack al — TTL of the IP packet is propagated into the VC label and all labels in the transport label stack
VPRN Transit TTL Propag*	inherit — VPRN instance is to inherit the global configuration none — TTL of IP packet is not propagated into the VC or transport label stack vc-only — TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack al — TTL of the IP packet is propagated into the VC label and all labels in the transport label stack
Label Route Local TTL P*	all — TTL of the IP packet is propagated into all labels of the transport label stack none — TTL of the IP packet is not propagated into the transport label stack
Label Route Transit TTL*	all — TTL of the IP packet is propagated into all labels of the transport label stack none — TTL of the IP packet is not propagated into the transport label stack
LSR Label Route TTL Pro*	all — TTL of the swapped label is propagated into all labels of the transport label stack none — TTL of the swapped label is not propagated into the transport label stack
Triggered Policies	No — Triggered route policy re-evaluation is disabled. Yes — Triggered route policy re-evaluation is enabled.

Sample Output

Note that there are multiple instances of OSPF. OSPF-0 is persistent. OSPF-1 through OSPF-31 are present when that particular OSPF instance is configured.

```
*A:Performance# show router status
================================================================
Router Status (Router: Base)
================================================================
                         Admin State         Oper State
----------------------------------------------------------------
Router                   Up                  Up
OSPFv2-0                 Up                  Up
RIP                      Up                  Up
```

```
ISIS                     Up                  Up
MPLS                     Not configured      Not configured
RSVP                     Not configured      Not configured
LDP                      Not configured      Not configured
BGP                      Up                  Up
IGMP                     Not configured      Not configured
PIM                      Not configured      Not configured
OSPFv3                   Not configured      Not configured
MSDP                     Not configured      Not configured
Max Routes               No Limit
Total IPv4 Routes        244285
Total IPv6 Routes        0
Max Multicast Routes     No Limit
Total Multicast Routes   PIM not configured
ECMP Max Routes          1
Triggered Policies       No
================================================================
*A:Performance#

*A:Performance# configure router ospf [1..31] shutdown
*A:Performance# show router status
================================================================
Router Status (Router: Base)
================================================================
                         Admin State         Oper State
----------------------------------------------------------------
Router                   Up                  Up
OSPFv2-0                 Up                  Up
OSPFv2-1                 Down                Down
OSPFv2-2                 Down                Down
OSPFv2-3                 Down                Down
OSPFv2-4                 Down                Down
OSPFv2-5                 Down                Down
OSPFv2-6                 Down                Down
OSPFv2-7                 Down                Down
OSPFv2-8                 Down                Down
OSPFv2-9                 Down                Down
OSPFv2-10                Down                Down
OSPFv2-11                Down                Down
OSPFv2-12                Down                Down
OSPFv2-13                Down                Down
OSPFv2-14                Down                Down
OSPFv2-15                Down                Down
OSPFv2-16                Down                Down
OSPFv2-17                Down                Down
OSPFv2-18                Down                Down
OSPFv2-19                Down                Down
OSPFv2-20                Down                Down
OSPFv2-21                Down                Down
OSPFv2-22                Down                Down
OSPFv2-23                Down                Down
OSPFv2-24                Down                Down
OSPFv2-25                Down                Down
OSPFv2-26                Down                Down
OSPFv2-27                Down                Down
OSPFv2-28                Down                Down
OSPFv2-29                Down                Down
OSPFv2-30                Down                Down
OSPFv2-31                Down                Down
```

```
RIP                      Up                  Up
ISIS                     Up                  Up
MPLS                     Not configured      Not configured
RSVP                     Not configured      Not configured
LDP                      Not configured      Not configured
BGP                      Up                  Up
IGMP                     Not configured      Not configured
PIM                      Not configured      Not configured
OSPFv3                   Not configured      Not configured
MSDP                     Not configured      Not configured
Max Routes               No Limit
Total IPv4 Routes        244277
Total IPv6 Routes        0
Max Multicast Routes     No Limit
Total Multicast Routes   PIM not configured
ECMP Max Routes          1
Single SFM Overload      Enabled             hold-off 30 sec
Single SFM State         normal
Single SFM Start         004 19:03:39.680
Single SFM Interval      0d 00:16:06
Reassembly ISA-BB group  Not configured
Ipv6 Nbr Reachab. time   Not configured                     30
Triggered Policies       No
================================================================
*A:Performance#
```

Sample Output

The folowing show command outputs show TTL propagation and ICMP tunneling configurations, first in base router and then in a VPRN service.

```
*A:Performance# show router status
================================================================
Router Status (Router: Base)
================================================================
                         Admin State         Oper State
----------------------------------------------------------------
Router                   Up                  Up
OSPFv2-0                 Up                  Up
OSPFv2-2                 Down                               Down
RIP                      Not configured                     Not configured
RIP-NG                   Not configured                     Not configured
ISIS-0                   Up                                 Up
ISIS-1024                Down                               Down
MPLS                     Down                               Down
RSVP                     Down                               Down
LDP                      Up                                 Down
BGP                      Up                                 Down
IGMP
MLD
PIM
PIMv4
PIMv6
OSPFv3
MSDP

Max IPv4 Routes          No Limit
Max IPv6 Routes          No Limit
Total IPv4 Routes        0
Total IPv6 Routes        0
Max Multicast Routes     No Limit
Total IPv4 Mcast Routes  PIM not configured
Total IPv6 Mcast Routes  PIM not configured
ECMP Max Routes          1
Mcast Info Policy        default
Triggered Policies       No
LDP Shortcut             Disabled
Single SFM Overload      Disabled
IP Fast Reroute          Disabled
ICMP Tunneling           Disabled
Reassembly ISA-BB group  Not configured
ICMP Tunneling           Disabled
Ipv6 Nbr Reachab. time   Not configured                     30
IPv6 Nbr stale time (s)  14400
VPRN Local TTL Propagate vc-only
VPRN Transit TTL Propag* vc-only
Label Route Local TTL P* none
Label Route Transit TTL* none
LSR Label Route TTL Pro* none
===============================================================================
* indicates that the corresponding row element may have been truncated.
*B:bkvm31#
```

The folowing is output of the show command for the TTL propagation and ICMP tunneling configurations in a VPRN service. The ttl-propagation has been specified as local and all for VPRN service 5001.

```
*A:Dut-A# configure service vprn 5001 ttl-propagate local all
*A:Dut-A# show router 5001 status

===============================================================================
Router Status (Service: 5001)
===============================================================================
                         Admin State                        Oper State
-------------------------------------------------------------------------------
Router                   Up                                 Up
OSPFv2                   Not configured                     Not configured
RIP                      Not configured                     Not configured
RIP-NG                   Not configured                     Not configured
ISIS                     Not configured                     Not configured
MPLS                     Not configured                     Not configured
RSVP                     Not configured                     Not configured
LDP                      Not configured                     Not configured
BGP                      Not configured                     Not configured
IGMP                     Not configured                     Not configured
MLD                      Not configured                     Not configured
PIM                      Not configured                     Not configured
PIMv4                    Not configured                     Not configured
PIMv6                    Not configured                     Not configured
OSPFv3                   Not configured                     Not configured
MSDP                     Not configured                     Not configured

Max IPv4 Routes          No Limit
Max IPv6 Routes          No Limit
Total IPv4 Routes        2
Total IPv6 Routes        2
```

```
Max Multicast Routes     No Limit
Total IPv4 Mcast Routes  PIM not configured
Total IPv6 Mcast Routes  PIM not configured
ECMP Max Routes          1
Mcast Info Policy        default
Triggered Policies       No
GRT Lookup               Disabled
Local Management         Disabled
Single SFM Overload      Disabled
IP Fast Reroute          Disabled
ICMP Tunneling           Disabled
Reassembly ISA-BB group  Not configured
ICMP Tunneling           Disabled
Ipv6 Nbr Reachab. time   Not configured                     30
VPRN Local TTL Propagate all
VPRN Transit TTL Propag* inherit (vc-only)
===============================================================================
* indicates that the corresponding row element may have been truncated.
*A:Dut-A#
```

tms

Syntax **tms routes**

Context show>router *router-instance*

Description This command displays Threat Management Services related information. The router instance must be specified.

Sample Output

```
show router <router-instance> tms routes
-------------------------------------------
*A:Dut-C# show router 1 tms routes

===============================================================================
TMS Routes (IPv4)
===============================================================================
Status    Network                                Next Hop[Interface Name]
-------------------------------------------------------------------------------
Active    100.0.0.1/32                           mda-2-1
Inactive  101.0.0.1/32                           mda-2-1
Inactive  102.0.0.1/32                           mda-2-1
Inactive  103.0.0.1/32                           mda-2-1
Inactive  104.0.0.1/32                           mda-2-1
Inactive  105.0.0.1/32                           mda-2-1
Inactive  106.0.0.1/32                           mda-2-1
Inactive  107.0.0.1/32                           mda-2-1
Inactive  108.0.0.1/32                           mda-2-1
Inactive  109.0.0.1/32                           mda-2-1
-------------------------------------------------------------------------------
No. of Routes: 10
===============================================================================
*A:Dut-C# show router 1 tms routes
```

```
===============================================================================
TMS Routes (IPv4)
===============================================================================
Status    Network                                      Next Hop[Interface Name]
-------------------------------------------------------------------------------
Active    100.0.0.1/32                                 mda-2-1
-------------------------------------------------------------------------------
No. of Routes: 1
===============================================================================
```

tunnel-table

Syntax **tunnel-table** [*ip-address*[/*mask*]] [**protocol** *protocol* **|** **sdp** *sdp-id*] [**summary**]

Context show>router

Description This command displays tunnel table information. Note that auto-bind GRE tunnels are not displayed in **show** command output. GRE tunnels are not the same as SDP tunnels that use the GRE encapsulation type. When the **auto-bind** command is used when configuring a VPRN service, it means the MP-BGP NH resolution is refering to the core routing instance for IP reachability. For a VPRN service this object specifies the lookup to be used by the routing instance if no SDP to the destination exists.

Parameters *ip-address*[*/mask*] — Displays the specified tunnel table's destination IP address and mask.

protocol *protocol* **—** Dislays LDP protocol information.

sdp *sdp-id* **—** Displays information pertaining to the specified SDP.

summary — Displays summary tunnel table information.

Output **Tunnel Table Output —** The following table describes tunnel table output fields.

Label	Description
`Destination`	The route's destination address and mask.
`Owner`	Specifies the tunnel owner.
`Encap`	Specifies the tunnel's encapsulation type.
`Tunnel ID`	Specifies the tunnel (SDP) identifier.
`Pref`	Specifies the route preference for routes learned from the configured peer(s).
`Nexthop`	The next hop for the route's destination.
`Metric`	The route metric value for the route.

Sample Output

```
*A:Dut-D>config>service>vpls# show router tunnel-table sdp 17407
=======================================================================
Tunnel Table (Router: Base)
================================================================================
Destination        Owner Encap TunnelId  Pref     Nexthop        Metric
------------------------------------------------------------------------
127.0.68.0/32      sdp   MPLS  17407     5        127.0.68.0     0
========================================================================
*A:Dut-D# show service id 1 sdp 17407:4294967294 detail
========================================================================
Service Destination Point (Sdp Id : 17407:4294967294) Details
========================================================================
--------------------------------------------------------------------------------
 Sdp Id 17407:4294967294  -(not applicable)
------------------------------------------------------------------------
Description     : (Not Specified)
SDP Id             : 17407:4294967294         Type              : VplsPmsi
Split Horiz Grp    : (Not Specified)
VC Type            : Ether                    VC Tag            : n/a
Admin Path MTU     : 9194                     Oper Path MTU     : 9194
Delivery           : MPLS
Far End            : not applicable
Tunnel Far End     : n/a                      LSP Types         : None
Hash Label         : Disabled                 Hash Lbl Sig Cap  : Disabled
Oper Hash Label    : Disabled

Admin State        : Up                       Oper State        : Up
Acct. Pol          : None                     Collect Stats     : Disabled
Ingress Label      : 0                        Egress Label      : 3
Ingr Mac Fltr-Id   : n/a                      Egr Mac Fltr-Id   : n/a
Ingr IP Fltr-Id    : n/a                      Egr IP Fltr-Id    : n/a
Ingr IPv6 Fltr-Id  : n/a                      Egr IPv6 Fltr-Id  : n/a
Admin ControlWord  : Not Preferred            Oper ControlWord  : False
Last Status Change : 12/14/2012 12:42:22      Signaling         : None
Last Mgmt Change   : 12/14/2012 12:42:19      Force Vlan-Vc     : Disabled
Endpoint           : N/A                      Precedence        : 4
PW Status Sig      : Enabled
Class Fwding State : Down
Flags              : None
Time to RetryReset : never                    Retries Left      : 3
Mac Move           : Blockable                Blockable Level   : Tertiary
Local Pw Bits      : None
Peer Pw Bits       : None
Peer Fault Ip      : None
Peer Vccv CV Bits  : None
Peer Vccv CC Bits  : None
Application Profile: None
Max Nbr of MAC Addr: No Limit                 Total MAC Addr    : 0
Learned MAC Addr   : 0                        Static MAC Addr   : 0

MAC Learning       : Enabled                  Discard Unkwn Srce: Disabled
MAC Aging          : Enabled
BPDU Translation   : Disabled
L2PT Termination   : Disabled
MAC Pinning        : Disabled
Ignore Standby Sig : False                    Block On Mesh Fail: False
Oper Group         : (none)                   Monitor Oper Grp  : (none)
Rest Prot Src Mac  : Disabled
Auto Learn Mac Prot: Disabled                 RestProtSrcMacAct : Disable

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

-----------------------------------------------------------------------
ETH-CFM SDP-Bind specifics
-----------------------------------------------------------------------
V-MEP Filtering    : Disabled

KeepAlive Information :
Admin State        : Disabled                 Oper State        : Disabled
Hello Time         : 10                       Hello Msg Len     : 0
Max Drop Count     : 3                        Hold Down Time    : 10

Statistics            :
I. Fwd. Pkts.      : 0                        I. Dro. Pkts.     : 0
I. Fwd. Octs.      : 0                        I. Dro. Octs.     : 0
E. Fwd. Pkts.      : 2979761                  E. Fwd. Octets    : 476761760

-----------------------------------------------------------------------
Control Channel Status
-----------------------------------------------------------------------
PW Status          : disabled                 Refresh Timer     : <none>
Peer Status Expire : false                    Clear On Timeout  : true

MCAC Policy Name   :
MCAC Max Unconst BW: no limit                 MCAC Max Mand BW  : no limit
MCAC In use Mand BW: 0                        MCAC Avail Mand BW: unlimited
MCAC In use Opnl BW: 0                        MCAC Avail Opnl BW: unlimited

-----------------------------------------------------------------------
RSVP/Static LSPs
-----------------------------------------------------------------------
Associated LSP List :
No LSPs Associated

-----------------------------------------------------------------------
Class-based forwarding :
-----------------------------------------------------------------------
Class forwarding   : Disabled                 EnforceDSTELspFc  : Disabled
Default LSP        : Uknwn                    Multicast LSP     : None

=======================================================================
FC Mapping Table
=======================================================================
FC Name             LSP Name
-----------------------------------------------------------------------
No FC Mappings


-----------------------------------------------------------------------
Stp Service Destination Point specifics
-----------------------------------------------------------------------
Stp Admin State    : Down                     Stp Oper State    : Down
Core Connectivity  : Down
Port Role          : N/A                      Port State        : Forwarding
Port Number        : 0                        Port Priority     : 128
Port Path Cost     : 10                       Auto Edge         : Enabled
Admin Edge         : Disabled                 Oper Edge         : N/A
Link Type          : Pt-pt                    BPDU Encap        : Dot1d
```

```
Root Guard         : Disabled                 Active Protocol   : N/A
Last BPDU from     : N/A
Designated Bridge  : N/A                      Designated Port Id: N/A

Fwd Transitions    : 0                        Bad BPDUs rcvd    : 0
Cfg BPDUs rcvd     : 0                        Cfg BPDUs tx      : 0
TCN BPDUs rcvd     : 0                        TCN BPDUs tx      : 0
TC bit BPDUs rcvd  : 0                        TC bit BPDUs tx   : 0
RST BPDUs rcvd     : 0                        RST BPDUs tx      : 0
-----------------------------------------------------------------------
Number of SDPs : 1
-----------------------------------------------------------------------
=======================================================================


*A:Dut-C# show router tunnel-table sdp 17407
========================================================================
Tunnel Table (Router: Base)

========================================================================

Destination        Owner Encap TunnelId  Pref     Nexthop        Metric

------------------------------------------------------------------------

127.0.68.0/32      sdp   MPLS  17407     5        127.0.68.0     0

========================================================================


A:ALA-A>config>service# show router tunnel-table
===============================================================================
Tunnel Table ==================================================================
DestinationOwnerEncapTunnel IdPrefNexthopMetric
-------------------------------------------------------------------------------
10.0.0.1/32 sdp GRE 10 5 10.0.0.1 0
10.0.0.1/32 sdp GRE 21 5 10.0.0.1 0
10.0.0.1/32 sdp GRE 31 5 10.0.0.1 0
10.0.0.1/32 sdp GRE 41 5 10.0.0.1 0
===============================================================================
A:ALA-A>config>service#


A:ALA-A>config>service#  show router tunnel-table summary
===============================================================================
Tunnel Table Summary (Router: Base)
===============================================================================
                              Active                   Available
-------------------------------------------------------------------------------
LDP                           1                        1
SDP                           1                        1
===============================================================================
A:ALA-A>config>service#
```

L2TP Show Commands

l2tp

Syntax **l2tp**

Context show>router

Description This command enables the context to display L2TP related information.

group

Syntax **group** [*tunnel-group-name* [**statistics**]]

Context show>router>l2tp

Description This command displays L2TP group operational information.

Parameters *tunnel-group-name* — Displays information for the specified tunnel group.

statistics — Displays statistics for the specified tunnel group.

Sample Output

```
*A:Dut-C# show router l2tp group
===============================================================================
L2TP Groups
===============================================================================
Group Name       Ses Limit Ses Assign    State  Tun Active Ses Active
                                                          Tun Total  Ses Total
-------------------------------------------------------------------------------
isp1.group-1
                       131071    existingFirst active     1          1
                                                          1          1
isp1.group-2
                       131071    weighted      active     2          5
                                                          3          8
-------------------------------------------------------------------------------
No. of L2TP Groups: 2
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp group isp1.group-2
===============================================================================
Group Name: isp1.group-2
===============================================================================
Conn ID                       Loc-Tu-ID Rem-Tu-ID State              Ses Active
  Group                                                              Ses Total
    Assignment
-------------------------------------------------------------------------------
```

```
143523840                     2190      17525     established        2
  isp1.group-2                                                       3
    isp1.tunnel-3
236912640                     3615      58919     closedByPeer       0
  isp1.group-2                                                       2
    isp1.tunnel-2
658178048                     10043     33762     draining           3
  isp1.group-2                                                       3
    isp1.tunnel-2
-------------------------------------------------------------------------------
No. of tunnels: 3
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp group isp1.group-2 statistics
Group Name: isp1.group-2
-------------------------------------------------------------------------------
              Attempts   Failed     Failed-Aut            Active     Total
-------------------------------------------------------------------------------
Tunnels       3          0          0                     2          3
Sessions      8          0          N/A                   5          8
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
              Pkt-Ctl               Pkt-Err               Octets
-------------------------------------------------------------------------------
Rx            51                    0                     1224
Tx            51                    0                     2796
-------------------------------------------------------------------------------
*A:Dut-C#
```

peer

Syntax **peer** *ip-address*
peer *ip-address* **statistics**
peer [**draining**] [**unreachable**]

Context show>router>l2tp

Description This command displays L2TP peer operational information.

Parameters *ip-address* — Display information for the specified IP address of the peer.

draining — Displays peer objects set to **drain**.

unreachable — Displays peers that are deemed unreachable.

statistics — Displays the statistics for the given IP address.

Sample Output

```
*A:Dut-C# show router l2tp peer
===============================================================================
L2TP Peers
```

```
===============================================================================
Peer IP                                                   Tun Active Ses Active
                                       Drain Unreach Role Tun Total  Ses Total
-------------------------------------------------------------------------------
10.10.14.8                                                1          1
                                                     LAC  1          1
10.10.20.100                                              1          3
                                       drain         LAC  2          5
10.10.20.101                                              0          0
                                             unreach LAC  1          1
-------------------------------------------------------------------------------
No. of peers: 3
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp peer unreachable
===============================================================================
L2TP Peers
===============================================================================
Peer IP                                                   Tun Active Ses Active
                                       Drain Unreach Role Tun Total  Ses Total
-------------------------------------------------------------------------------
10.10.20.101                                              0          0
                                             unreach LAC  1          1
-------------------------------------------------------------------------------
No. of peers: 1
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp peer 10.10.20.101
===============================================================================
Peer IP: 10.10.20.101
===============================================================================
Role              : LAC                 Draining          : false
Tunnels           : 1                   Tunnels Active    : 0
Sessions          : 1                   Sessions Active   : 0
Unreachable       : true                Time Unreachable  : 04/17/2009 19:34:04
===============================================================================
Conn ID                       Loc-Tu-ID Rem-Tu-ID State              Ses Active
  Group                                                              Ses Total
    Assignment
-------------------------------------------------------------------------------
18284544                      279       0         closed             0
  isp1.group-2                                                       1
    isp1.tunnel-3
-------------------------------------------------------------------------------
No. of tunnels: 1
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp peer draining
===============================================================================
L2TP Peers
===============================================================================
Peer IP                                                   Tun Active Ses Active
                                       Drain Unreach Role Tun Total  Ses Total
```

```
-------------------------------------------------------------------------------
10.10.20.100                                              1          3
                                       drain         LAC  2          5
-------------------------------------------------------------------------------
No. of peers: 1
===============================================================================
*A:Dut-C#

*A:Fden-Dut2-BSA2# show router l2tp peer 10.0.0.1 statistics

===============================================================================
Peer IP: 10.0.0.1
===============================================================================
tunnels                                                   : 1
tunnels active                                            : 1
sessions                                                  : 1
sessions active                                           : 1

rx ctrl octets                                            : 541
rx ctrl packets                                           : 5
tx ctrl octets                                            : 272
tx ctrl packets                                           : 5
tx error packets                                          : 0
rx error packets                                          : 0
rx accepted msg                                           : 4
rx duplicate msg                                          : 0
rx out of window msg                                      : 0

acceptedMsgType
  StartControlConnectionRequest                           : 1
  StartControlConnectionConnected                         : 1
  IncomingCallRequest                                     : 1
  IncomingCallConnected                                   : 1
  ZeroLengthBody                                          : 1
originalTransmittedMsgType
  StartControlConnectionReply                             : 1
  IncomingCallReply                                       : 1
  ZeroLengthBody                                          : 3

last cleared time                                         : N/A
===============================================================================
```

session

Syntax **session connection-id** *connection-id* [**detail**]|

session [**detail**] [**session-id** *session-id* (v2)] [**state** *session-state*][**peer** *ip-address*] [**group** *group-name*] [**assignment-id** *assignment-id*] [**local-name***local-host-name*] [**remote-name** *remote-host-name*] [**tunnel-id** *tunnel-id (v2)*]|

session [**detail**] [**state** *session-state*] [**peer** *ip-address*] [**group** *group-name*] [**assignment-id** *assignment-id*] [**local-name** *local-host-name*] [**remote-name** *remote-host-name*] [**control-connection-id** *connection-id (v3*)]

Context show>router>l2tp

Description This command displays L2TP session operational information.

Parameters

connection-id *connection-id* **—** Specifies the identification number for a Layer Two Tunneling Protocol connection.

Values 1 — 429496729

detail — Displays detailed L2TP session information.

session-id *session-id* (v2) **—** Specifies the identification number for a Layer Two Tunneling Protocol session.

Values 1 — 65535

state *session-state* **—** Specifies the values to identify the operational state of the L2TP session.

Values closed, closed-by-peer, established, idle, wait-reply, wait-tunnel

peer *ip-address* **—** Specifies the IP address of the peer.

Values ipv4-address a.b.c.d (host bits must be 0)
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

group *group-name* **—** Specifies a string to identify a Layer Two Tunneling Protocol Tunnel group.

assignment-id *assignment-id* **—** Specifies a string that distinguishes this Layer Two Tunneling Protocol tunnel.

local-name *local-host-name* **—** Specifies the host name used by this system during the authentication phase of tunnel establishment.

remote-name *remote-host-name* **—** Specifies a string that is compared to the host name used by the tunnel peer during the authentication phase of tunnel establishment.

tunnel-id *tunnel-id (v2)* **—** Specifies the local identifier of this Layer Two Tunneling Protocol tunnel, when L2TP version 2 is used.

Values 1 — 65535

control-connection-id *connection-id (v3*) **—** Specifies an identification number for a Layer Two Tunneling Protocol session.

Values 1 — 429496729

Sample Output

```
*A:Dut-C# show router l2tp session
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
143524786           143523840           2190        946         established
143526923           143523840           2190        3083        established
143531662           143523840           2190        7822        closed
```

```
236926987           236912640           3615        14347       closed
236927915           236912640           3615        15275       closed
379407426           379387904           5789        19522       established
658187773           658178048           10043       9725        established
658198275           658178048           10043       20227       established
658210606           658178048           10043       32558       established
-------------------------------------------------------------------------------
No. of sessions: 9
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session state established
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
143524786           143523840           2190        946         established
143526923           143523840           2190        3083        established
379407426           379387904           5789        19522       established
658187773           658178048           10043       9725        established
658198275           658178048           10043       20227       established
658210606           658178048           10043       32558       established
-------------------------------------------------------------------------------
No. of sessions: 6
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session state closed detail
===============================================================================
L2TP Session Status
===============================================================================
Connection ID : 143531662
State         : closed
Tunnel Group  : isp1.group-2
Assignment ID : isp1.tunnel-3
Error Message : Terminated by PPPoE: RX PADT

Control Conn ID   : 143523840           Remote Conn ID    : 1148557524
Tunnel ID         : 2190                Remote Tunnel ID  : 17525
Session ID        : 7822                Remote Session ID : 39124
Time Started      : 04/17/2009 18:44:37
Time Established  : 04/17/2009 18:44:37 Time Closed       : 04/17/2009 18:44:50
CDN Result        : generalError        General Error     : noError
-------------------------------------------------------------------------------
===============================================================================
L2TP Session Status
===============================================================================
Connection ID : 236926987
State         : closed
Tunnel Group  : isp1.group-2
Assignment ID : isp1.tunnel-2
Error Message : tunnel was closed

Control Conn ID   : 236912640           Remote Conn ID    : 3861360381
Tunnel ID         : 3615                Remote Tunnel ID  : 58919
Session ID        : 14347               Remote Session ID : 44797
```

```
Time Started      : 04/17/2009 18:41:55
Time Established  : 04/17/2009 18:41:55 Time Closed       : 04/17/2009 18:43:20
CDN Result        : generalError        General Error     : noError
-------------------------------------------------------------------------------
===============================================================================
L2TP Session Status
===============================================================================
Connection ID : 236927915
State         : closed
Tunnel Group  : isp1.group-2
Assignment ID : isp1.tunnel-2
Error Message : tunnel was closed

Control Conn ID   : 236912640           Remote Conn ID    : 3861317210
Tunnel ID         : 3615                Remote Tunnel ID  : 58919
Session ID        : 15275               Remote Session ID : 1626
Time Started      : 04/17/2009 18:41:03
Time Established  : 04/17/2009 18:41:03 Time Closed       : 04/17/2009 18:43:20
CDN Result        : generalError        General Error     : noError
-------------------------------------------------------------------------------
No. of sessions: 3
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session session-id 946
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
143524786           143523840           2190        946         established
-------------------------------------------------------------------------------
No. of sessions: 1
===============================================================================
*A:Dut-C# show router l2tp session connection-id 143524786 detail
===============================================================================
L2TP Session Status
===============================================================================
Connection ID : 143524786
State         : established
Tunnel Group  : isp1.group-2
Assignment ID : isp1.tunnel-3
Error Message : N/A

Control Conn ID   : 143523840           Remote Conn ID    : 1148528691
Tunnel ID         : 2190                Remote Tunnel ID  : 17525
Session ID        : 946                 Remote Session ID : 10291
Time Started      : 04/17/2009 18:42:01
Time Established  : 04/17/2009 18:42:01 Time Closed       : N/A
CDN Result        : noError             General Error     : noError
-------------------------------------------------------------------------------
*A:Dut-C#


*A:Dut-C# show router l2tp session group isp1.group-2
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
143524786           143523840           2190        946         established
143526923           143523840           2190        3083        established
143531662           143523840           2190        7822        closed
236926987           236912640           3615        14347       closed
236927915           236912640           3615        15275       closed
658187773           658178048           10043       9725        established
658198275           658178048           10043       20227       established
658210606           658178048           10043       32558       established
-------------------------------------------------------------------------------
No. of sessions: 8
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session tunnel-id 2190 state closed detail
===============================================================================
L2TP Session Status
===============================================================================
Connection ID : 143531662
State         : closed
Tunnel Group  : isp1.group-2
Assignment ID : isp1.tunnel-3
Error Message : Terminated by PPPoE: RX PADT

Control Conn ID   : 143523840           Remote Conn ID    : 1148557524
Tunnel ID         : 2190                Remote Tunnel ID  : 17525
Session ID        : 7822                Remote Session ID : 39124
Time Started      : 04/17/2009 18:44:37
Time Established  : 04/17/2009 18:44:37 Time Closed       : 04/17/2009 18:44:50
CDN Result        : generalError        General Error     : noError
-------------------------------------------------------------------------------
No. of sessions: 1
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session assignment-id isp1.tunnel-2
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
236926987           236912640           3615        14347       closed
236927915           236912640           3615        15275       closed
658187773           658178048           10043       9725        established
658198275           658178048           10043       20227       established
658210606           658178048           10043       32558       established
-------------------------------------------------------------------------------
No. of sessions: 5
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session assignment-id isp1.tunnel-2 state established
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
658187773           658178048           10043       9725        established
658198275           658178048           10043       20227       established
658210606           658178048           10043       32558       established
-------------------------------------------------------------------------------
No. of sessions: 3
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session control-connection-id 658178048
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
658187773           658178048           10043       9725        established
658198275           658178048           10043       20227       established
658210606           658178048           10043       32558       established
-------------------------------------------------------------------------------
No. of sessions: 3
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session peer 10.10.20.100
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
236926987           236912640           3615        14347       closed
236927915           236912640           3615        15275       closed
658187773           658178048           10043       9725        established
658198275           658178048           10043       20227       established
658210606           658178048           10043       32558       established
-------------------------------------------------------------------------------
No. of sessions: 5
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session peer 10.10.20.100 state closed detail
===============================================================================
L2TP Session Status
===============================================================================
Connection ID : 236926987
State         : closed
Tunnel Group  : isp1.group-2
Assignment ID : isp1.tunnel-2
Error Message : tunnel was closed

Control Conn ID   : 236912640           Remote Conn ID    : 3861360381
Tunnel ID         : 3615                Remote Tunnel ID  : 58919
Session ID        : 14347               Remote Session ID : 44797
Time Started      : 04/17/2009 18:41:55
Time Established  : 04/17/2009 18:41:55 Time Closed       : 04/17/2009 18:43:20
CDN Result        : generalError        General Error     : noError
```

```
-------------------------------------------------------------------------------
===============================================================================
L2TP Session Status
===============================================================================
Connection ID : 236927915
State         : closed
Tunnel Group  : isp1.group-2
Assignment ID : isp1.tunnel-2
Error Message : tunnel was closed

Control Conn ID   : 236912640           Remote Conn ID    : 3861317210
Tunnel ID         : 3615                Remote Tunnel ID  : 58919
Session ID        : 15275               Remote Session ID : 1626
Time Started      : 04/17/2009 18:41:03
Time Established  : 04/17/2009 18:41:03 Time Closed       : 04/17/2009 18:43:20
CDN Result        : generalError        General Error     : noError
-------------------------------------------------------------------------------
No. of sessions: 2
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session local-name lac1.wholesaler.com
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
143524786           143523840           2190        946         established
143526923           143523840           2190        3083        established
143531662           143523840           2190        7822        closed
236926987           236912640           3615        14347       closed
236927915           236912640           3615        15275       closed
379407426           379387904           5789        19522       established
658187773           658178048           10043       9725        established
658198275           658178048           10043       20227       established
658210606           658178048           10043       32558       established
-------------------------------------------------------------------------------
No. of sessions: 9
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp session local-name lac1.wholesaler.com remote-name
lns.retailer1.net
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
379407426           379387904           5789        19522       established
-------------------------------------------------------------------------------
No. of sessions: 1
===============================================================================
*A:Dut-C#


*A:Fden-Dut2-BSA2# show router l2tp session connection-id 600407016
===============================================================================
L2TP Session Summary
===============================================================================
ID                  Control Conn ID     Tunnel-ID   Session-ID  State
-------------------------------------------------------------------------------
600407016           600375296           9161        31720       established
  simon@base.lac.base.lns
  interface: gi_base_lns_base_lac
  service-id: 100
  ip-address: 10.100.2.1
===============================================================================


*A:Fden-Dut2-BSA2# show router l2tp session connection-id 600407016 detail
===============================================================================
L2TP Session Status
===============================================================================

Connection ID: 600407016
State        : established
Tunnel Group : base_lns_base_lac
Assignment ID: t1
Error Message: N/A

Control Conn ID   : 600375296           Remote Conn ID    : 1026712216
Tunnel ID         : 9161                Remote Tunnel ID  : 15666
Session ID        : 31720               Remote Session ID : 25240
Time Started      : 02/02/2010 09:08:54
Time Established  : 02/02/2010 09:08:54 Time Closed       : N/A
CDN Result        : noError             General Error     : noError
-------------------------------------------------------------------------------

PPP information

Service Id           : 100
Interface            : gi_base_lns_base_lac
LCP State            : opened
IPCP State           : opened
IPv6CP State         : initial
PPP MTU              : 1492
PPP Auth-Protocol    : chap
PPP User-Name        : simon@base.lac.base.lns

Subscriber Origin    : radius
Strings Origin       : radius
IPCP Info Origin     : radius
IPv6CP Info Origin   : none

Subscriber           : "simon"
Sub-Profile-String   : "sub1"
SLA-Profile-String   : "sla1"
ANCP-String          : ""
Int-Dest-Id          : ""
App-Profile-String   : ""
Category-Map-Name    : ""

IP Address           : 10.100.2.1
Primary DNS          : N/A
Secondary DNS        : N/A
Primary NBNS         : N/A
```

```
Secondary NBNS       : N/A
Address-Pool         : N/A

IPv6 Prefix          : N/A
IPv6 Del.Pfx.        : N/A
Primary IPv6 DNS     : N/A
Secondary IPv6 DNS   : N/A

Circuit-Id           : (Not Specified)
Remote-Id            : (Not Specified)

Session-Timeout      : N/A
Radius Class         : (Not Specified)
Radius User-Name     : simon@base.lac.base.lns
```

statistics

Syntax **statistics**

Context show>router>l2tp

Description This command displays L2TP statistics.

Sample Output

```
*A:Dut-C# show router l2tp statistics
===============================================================================
L2TP Statistics
===============================================================================
Tunnels                                 Sessions
-------------------------------------------------------------------------------
Active             : 3                  Active             : 6

Setup history since 04/17/2009 18:38:41

Total              : 4                  Total              : 9
Failed             : 0                  Failed             : 0
Failed Auth        : 0
===============================================================================
*A:Dut-C#
```

tunnel

Syntax **tunnel** [**statistics**] [**detail**] [**peer** *ip-address*] [**state** *tunnel-state*] [**remote-connection-id** *remote-connection-id (v3)*] [**group** *group-name*] [**assignment-id** *assignment-id*] [**local-name** *host-name*] [**remote-name** *host-name*]|

tunnel [**statistics**] [**detail**] [**peer** *ip-address*] [**state** *tunnel-state*] [**remote-tunnel-id** *remote-tunnel-id (v2)*] [**group** *group-name*] [**assignment-id** *assignment-id*] [**local-name** *host-name*] [**remote-name** *host-name*]

tunnel tunnel-id *tunnel-id (v2)* [**statistics**] [**detail**]

tunnel connection-id *connection-id (v3)* [**statistics**] [**detail**]

Context show>router>l2tp

Description This command displays L2TP tunnel operational information.

Parameters **statistics —** Displays L2TP tunnel statistics.

detail — Displays detailed L2TP tunnel information.

peer i*p-address* **—** Displays information for the the IP address of the peer.

state *tunnel-state* **—** Displays the operational state of the tunnel.

remote-connection-id *remote-connection-id (v3)* **—** Displays information for the specified remote connection ID.

group *group-name* **—** Displays L2TP tunnel information for the specified tunnel group.

assignment-id *assignment-id* **—**

local-name *host-name* **—** Specifies a local host name used by this system.

remote-name *host-name* **—** Specifies a remote host name used by this system.

connection-id *connection-id* **—** Specifies the identification number for a Layer Two Tunneling Protocol connection.

Values 1 — 429496729

detail — Displays detailed L2TP session information.

session-id *session-id* (v2) **—** Displays information for the specified the L2TP session.

Values 1 — 65535

state *session-state* **—** Displays the operational state of the L2TP session.

Values closed, closed-by-peer, draining, drained, established, established-idle, idle, wait-reply, wait-conn

peer *ip-address* **—** Displays information for the specified peer IP address.

Values	ipv4-address	a.b.c.d (host bits must be 0)
	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

tunnel-id *tunnel-id (v2)* **—** Displays information for the specified ID of a L2TP tunnel.

In L2TP version 2, it is the 16-bit tunnel ID.

Values 1 — 65535

control-connection-id *connection-id (v3*) **—** Displays information for the specified ID of a L2TP tunnel. In L2TP version 3, it is the 32-bit control connection ID.

Values 1 — 429496729

Sample Output

```
*A:Dut-C# show router l2tp tunnel
===============================================================================
Conn ID                       Loc-Tu-ID Rem-Tu-ID State              Ses Active
  Group                                                              Ses Total
    Assignment
-------------------------------------------------------------------------------
143523840                     2190      17525     established        2
  isp1.group-2                                                       3
    isp1.tunnel-3
236912640                     3615      58919     closedByPeer       0
  isp1.group-2                                                       2
    isp1.tunnel-2
379387904                     5789      4233      established        1
  isp1.group-1                                                       1
    isp1.tunnel-1
658178048                     10043     33762     draining           3
  isp1.group-2                                                       3
    isp1.tunnel-2
-------------------------------------------------------------------------------
No. of tunnels: 4
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel state closed-by-peer detail
===============================================================================
L2TP Tunnel Status
===============================================================================
Connection ID : 236912640
State         : closedByPeer
IP            : 10.20.1.3
Peer IP       : 10.10.20.100
Name          : lac1.wholesaler.com
Remote Name   : lns2.retailer1.net
Assignment ID : isp1.tunnel-2
Group Name    : isp1.group-2
Error Message : Goodbye!

                                        Remote Conn ID    : 3861315584
Tunnel ID         : 3615                Remote Tunnel ID  : 58919
UDP Port          : 1701                Remote UDP Port   : 1701
Preference        : 100
Hello Interval (s): infinite
Idle TO (s)       : 60                  Destruct TO (s)   : 7200
Max Retr Estab    : 5                   Max Retr Not Estab: 5
Session Limit     : 1000                AVP Hiding        : never
Transport Type    : udpIp               Challenge         : never
Time Started      : 04/17/2009 18:41:03 Time Idle         : 04/17/2009 18:43:20
Time Established  : 04/17/2009 18:41:03 Time Closed       : 04/17/2009 18:43:20
Stop CCN Result   : generalReq          General Error     : noError
-------------------------------------------------------------------------------
No. of tunnels: 1
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel state established
```

```
===============================================================================
Conn ID                       Loc-Tu-ID Rem-Tu-ID State              Ses Active
  Group                                                              Ses Total
    Assignment
-------------------------------------------------------------------------------
143523840                     2190      17525     established        2
  isp1.group-2                                                       3
    isp1.tunnel-3
379387904                     5789      4233      established        1
  isp1.group-1                                                       1
    isp1.tunnel-1
-------------------------------------------------------------------------------
No. of tunnels: 2
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel tunnel-id 2190 statistics
===============================================================================
L2TP Tunnel Statistics
===============================================================================
Connection ID: 143523840
-------------------------------------------------------------------------------
              Attempts   Failed                           Active     Total
-------------------------------------------------------------------------------
Sessions      3          0                                2          3
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
              Rx                                          Tx
-------------------------------------------------------------------------------
Ctrl Packets  47                                          47
Ctrl Octets   954                                         1438
Error Packets 0                                           0
-------------------------------------------------------------------------------
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel connection-id 143523840 statistics
===============================================================================
L2TP Tunnel Statistics
===============================================================================
Connection ID: 143523840
-------------------------------------------------------------------------------
              Attempts   Failed                           Active     Total
-------------------------------------------------------------------------------
Sessions      3          0                                2          3
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
              Rx                                          Tx
-------------------------------------------------------------------------------
Ctrl Packets  48                                          48
Ctrl Octets   974                                         1450
Error Packets 0                                           0
-------------------------------------------------------------------------------
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel remote-tunnel-id 17525 detail
===============================================================================
L2TP Tunnel Status
===============================================================================
Connection ID : 143523840
State         : established
IP            : 10.20.1.3
Peer IP       : 10.10.20.101
Name          : lac1.wholesaler.com
Remote Name   : lns3.retailer1.net
Assignment ID : isp1.tunnel-3
Group Name    : isp1.group-2
Error Message : N/A

                                        Remote Conn ID    : 1148518400
Tunnel ID         : 2190                Remote Tunnel ID  : 17525
UDP Port          : 1701                Remote UDP Port   : 1701
Preference        : 100
Hello Interval (s): 300
Idle TO (s)       : 0                   Destruct TO (s)   : 7200
Max Retr Estab    : 5                   Max Retr Not Estab: 5
Session Limit     : 1000                AVP Hiding        : never
Transport Type    : udpIp               Challenge         : never
Time Started      : 04/17/2009 18:41:14 Time Idle         : N/A
Time Established  : 04/17/2009 18:41:14 Time Closed       : N/A
Stop CCN Result   : noError             General Error     : noError
-------------------------------------------------------------------------------
No. of tunnels: 1
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel remote-connection-id 1148518400 statistics
===============================================================================
L2TP Tunnel Statistics
===============================================================================
Connection ID: 143523840
-------------------------------------------------------------------------------
              Attempts   Failed                             Active     Total
-------------------------------------------------------------------------------
Sessions      3          0                                  2          3
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
              Rx                                            Tx
-------------------------------------------------------------------------------
Ctrl Packets  50                                            50
Ctrl Octets   1014                                          1474
Error Packets 0                                             0
-------------------------------------------------------------------------------
No. of tunnels: 1
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel peer 10.10.20.100 state closed-by-peer detail
===============================================================================
L2TP Tunnel Status
===============================================================================
Connection ID : 236912640
State         : closedByPeer
IP            : 10.20.1.3
```

```
Peer IP       : 10.10.20.100
Name          : lac1.wholesaler.com
Remote Name   : lns2.retailer1.net
Assignment ID : isp1.tunnel-2
Group Name    : isp1.group-2
Error Message : Goodbye!

                                        Remote Conn ID    : 3861315584
Tunnel ID         : 3615                Remote Tunnel ID  : 58919
UDP Port          : 1701                Remote UDP Port   : 1701
Preference        : 100
Hello Interval (s): infinite
Idle TO (s)       : 60                  Destruct TO (s)   : 7200
Max Retr Estab    : 5                   Max Retr Not Estab: 5
Session Limit     : 1000                AVP Hiding        : never
Transport Type    : udpIp               Challenge         : never
Time Started      : 04/17/2009 18:41:03 Time Idle         : 04/17/2009 18:43:20
Time Established  : 04/17/2009 18:41:03 Time Closed       : 04/17/2009 18:43:20
Stop CCN Result   : generalReq          General Error     : noError
-------------------------------------------------------------------------------
No. of tunnels: 1
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel group isp1.group-2
===============================================================================
Conn ID                       Loc-Tu-ID Rem-Tu-ID State               Ses Active
  Group                                                             Ses Total
    Assignment
-------------------------------------------------------------------------------
143523840                     2190      17525     established         2
  isp1.group-2                                                      3
    isp1.tunnel-3
236912640                     3615      58919     closedByPeer        0
  isp1.group-2                                                      2
    isp1.tunnel-2
658178048                     10043     33762     draining            3
  isp1.group-2                                                      3
    isp1.tunnel-2
-------------------------------------------------------------------------------
No. of tunnels: 3
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel assignment-id isp1.tunnel-3 state established sta-
tistics
===============================================================================
L2TP Tunnel Statistics
===============================================================================
Connection ID: 143523840
-------------------------------------------------------------------------------
              Attempts   Failed                            Active     Total
-------------------------------------------------------------------------------
Sessions      3          0                                 2          3
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
              Rx                                           Tx
```

```
-------------------------------------------------------------------------------
Ctrl Packets  66                                          66
Ctrl Octets   1310                                        1690
Error Packets 0                                           0
-------------------------------------------------------------------------------
No. of tunnels: 1
===============================================================================
*A:Dut-C#


*A:Dut-C# show router l2tp tunnel local-name lac1.wholesaler.com remote-name
lns2.retailer1.net state draining
===============================================================================
Conn ID                       Loc-Tu-ID Rem-Tu-ID State              Ses Active
  Group                                                              Ses Total
    Assignment
-------------------------------------------------------------------------------
658178048                     10043     33762     draining           3
  isp1.group-2                                                       3
    isp1.tunnel-2
-------------------------------------------------------------------------------
No. of tunnels: 1
===============================================================================
*A:Dut-C#


*A:Fden-Dut2-BSA2# show router l2tp tunnel connection-id 600375296 statistics
===============================================================================
L2TP Tunnel Statistics
===============================================================================

Connection ID: 600375296

-------------------------------------------------------------------------------
             Attempts   Failed                           Active     Total
-------------------------------------------------------------------------------
Sessions     1          0                                1          1
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
                Rx                                        Tx
-------------------------------------------------------------------------------
Ctrl Packets    6                                         6
Ctrl Octets     553                                       292
Error Packets   0                                         0
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
             Accepted   Duplicate                        Out-Of-Wnd
-------------------------------------------------------------------------------
Fsm Messages 4          0                                0
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
             Unsent Max Unsent Cur                       Ack Max    Ack Cur
-------------------------------------------------------------------------------
Q Length     1          0                                1          0
-------------------------------------------------------------------------------
```

```
Window Size Cur                                          : 4
acceptedMsgType
  StartControlConnectionRequest                          : 1
  StartControlConnectionConnected                        : 1
  IncomingCallRequest                                    : 1
  IncomingCallConnected                                  : 1
  ZeroLengthBody                                         : 3
originalTransmittedMsgType
  StartControlConnectionReply                            : 1
  Hello                                                  : 2
  IncomingCallReply                                      : 1
  ZeroLengthBody                                         : 3

last cleared time                                        : N/A
===============================================================================
```

Clear Commands

router

Syntax **router** *router-instance*

Context clear>router

Description This command clears for a the router instance in which they are entered.

Parameters *router-instance* — Specify the router name or service ID.

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

Default Base

arp

Syntax **arp** {**all** | *ip-addr* | **interface** {*ip-int-name* **|** *ip-addr*}}

Context clear>router

Description This command clears all or specific ARP entries.

The scope of ARP cache entries cleared depends on the command line option(s) specified.

Parameters **all —** Clears all ARP cache entries.

ip-addr — Clears the ARP cache entry for the specified IP address.

interface *ip-int-name* **—** Clears all ARP cache entries for the IP interface with the specified name.

interface *ip-addr* **—** Clears all ARP cache entries for the specified IP interface with the specified IP address.

bfd

Syntax **bfd src-ip** *ip-address* **dst-ip** *ip-address*
bfd all

Context clear>router

Description This command enables the context to clear bi-directional forwarding (BFD) sessions and statistics.

session

Syntax **session src-ip** *ip-address* **dst-ip** *ip-address*

Context clear>router>bfd

Description This command clears BFD sessions.

Parameters **src-ip** *ip-address* **—** Specifies the address of the local endpoint of this BFD session.

dst-ip *ip-address* **—** Specifies the address of the remote endpoint of this BFD session.

statistics

Syntax **statistics src-ip** *ip-address* **dst-ip** *ip-address*
statistics all

Context clear>router>bfd

Description This command clears BFD statistics.

Parameters **src-ip** *ip-address* **—** Specifies the address of the local endpoint of this BFD session.

dst-ip *ip-address* **—** Specifies the address of the remote endpoint of this BFD session.

all — Clears statistics for all BFD sessions.

dhcp

Syntax **dhcp**

Context clear>router

Description This command enables the context to clear DHCP related information.

dhcp6

Syntax **dhcp6**

Context clear>router

Description This command enables the context to clear DHCP6 related information.

forwarding-table

Syntax **forwarding-table** [*slot-number*]

Context clear>router

Description This command clears entries in the forwarding table (maintained by the IOMs).

If the slot number is not specified, the command forces the route table to be recalculated.

Parameters *slot-number* — Clears the specified card slot.

Default all IOMs

Values 1 — 10

grt-lookup

Syntax **grt-lookup**

Context clear>router

Description This command re-evaluates route policies for GRT.

icmp-redirect-route

Syntax **icmp-redirect-route** {**all** | *ip-address*}

Context clear>router

Description This command deletes routes created as a result of ICMP redirects received on the management interface.

Parameters **all —** Clears all routes.

ip-address — Clears the routes associated with the specified IP address.

icmp6

Syntax **icmp6 all**
icmp6 global
icmp6 interface *interface-name*

Context clear>router

Description This command clears ICMP statistics.

Parameters **all —** Clears all statistics.

global — Clears global statistics.

interface-name — Clears ICMP6 statistics for the specified interface.

interface

Syntax **interface** [*ip-int-name* **|** *ip-addr*] [**icmp**] [urpf-stats] [statistics]

Context clear>router

Description This command clears IP interface statistics.

If no IP interface is specified either by IP interface name or IP address, the command will perform the clear operation on all IP interfaces.

Parameters *ip-int-name* | *ip-addr* — The IP interface name or IP interface address.

Default All IP interfaces.

icmp — Specifies to reset the ICMP statistics for the IP interface(s) used for ICMP rate limiting.

urpf-stats — - Resets the statistics associated with uRPF failures.

statistics — - Resets the IP interface traffic statistics.

l2tp

Syntax **l2pt**

Context clear>router

Description This command enables the context to clear L2PT data.

group

Syntax **group** *tunnel-group-name*

Context clear>router>l2tp

Description This command clears L2PT data.

Parameters *tunnel-group-name* — Specifies a Layer Two Tunneling Protocol Tunnel Group name.

tunnel

Syntax **tunnel** *tunnel-id*

Context clear>router>l2tp

Description This command clears L2PT data.

Parameters *tunnel-group-name* — Clears L2TP tunnel statistics.

statistics

Syntax **statistics**

Context clear>router>l2tp
clear>router>l2tp>group
clear>router>l2tp> tunnel

Description This command clears statistics for the specified context.

statistics

Syntax **statistics** [*ip-address* | *ip-int-name*]

Context clear>router>dhcp
clear>router>dhcp6

Description This command clear statistics for DHCP and DHCP6and DHCP6 relay and snooping statistics.

If no IP address or interface name is specified, then statistics are cleared for all configured interfaces.

If an IP address or interface name is specified, then only data regarding the specified interface is cleared.

Parameters *ip-address* | *ip-int-name* — Displays statistics for the specified IP interface.

neighbor

Syntax **neighbor** {**all** | *ip-address*}
neighbor [**interface** *ip-int-name* | *ip-address*]

Context clear>router

Description This command clears IPv6 neighbor information.

Parameters **all —** Clears IPv6 neighbors.

ip-int-name — Clears the specified neighbor interface information.

Values	32 characters maximum

ip-address — Clears the specified IPv6 neighbors.

Values	ipv6-address:	x:x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D

router-advertisement

Syntax **router-advertisement all**
router-advertisement [**interface** *interface-name*]

Context clear>router

Description This command clears all router advertisement counters.

Parameters *all* — Clears all router advertisement counters for all interfaces.

interface *interface-name* — Clear router advertisement counters for the specified interface.

Debug Commands

destination

Syntax **destination** *trace-destination*

Context debug>trace

Description This command specifies the destination to send trace messages.

Parameters *trace-destination* — The destination to send trace messages.

Values stdout, console, logger, memory

enable

Syntax [**no**] **enable**

Context debug>trace

Description This command enables the trace.

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

trace-point

Syntax [**no**] **trace-point** [**module** *module-name*] [**type** *event-type*] [**class** *event*-class] [**task** *task-name*] [**function** *function-name*]

Context debug>trace

Description This command adds trace points.

The **no** form of the command removes the trace points.

router

Syntax **router** *router-instance*

Context debug

Description This command configures debugging for a router instance.

Parameters *router-instance* — Specify the router name or service ID.

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

Default Base

ip

Syntax **ip**

Context debug>router

Description This command configures debugging for IP.

arp

Syntax **arp**

Context debug>router>ip

Description This command configures route table debugging.

icmp

Syntax [**no**] **icmp**

Context **debug>router>ip**

Description This command enables ICMP debugging.

icmp6

Syntax **icmp6** [*ip-int-name*]
no icmp6

Context debug>router>ip

Description This command enables ICMP6 debugging.

interface

Syntax [**no**] **interface** [*ip-int-name* **|** *ip-address* **|** *ipv6-address* **|** *ipv6-address*]

Context debug>router>ip

Description This command displays the router IP interface table sorted by interface index.

Parameters *ip-address* — Only displays the interface information associated with the specified 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

ip-int-name — Only displays the interface information associated with the specified IP interface name.

Values 32 characters maximum

packet

Syntax **packet** [*ip-int-name* **|** *ip-address*] [**headers**] [*protocol-id*]
no packet [*ip-int-name* **|** *ip-address*]

Context debug>router>ip

Description This command enables debugging for IP packets.

Parameters *ip-int-name* — Only displays the interface information associated with the specified IP interface name.

Values 32 characters maximum

ip-address — Only displays the interface information associated with the specified IP address.

headers — Only displays information associated with the packet header.

protocol-id — Specifies the decimal value representing the IP protocol to debug. Well known protocol numbers include ICMP(1), TCP(6), UDP(17). The **no** form the command removes the protocol from the criteria.

Values 0 — 255 (values can be expressed in decimal, hexidecimal, or binary)

route-table

Syntax **route-table** [*ip-prefix*/*prefix-length*]
route-table *ip-prefix*/*prefix-length* **longer**
no route-table

Context debug>router>ip

Description This command configures route table debugging.

Parameters *ip-prefix* — The IP prefix for prefix list entry in dotted decimal notation.

Values

ipv4-prefix	a.b.c.d (host bits must be 0)
ipv4-prefix-length	0 — 32
ipv6-prefix	x:x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:x:d.d.d.d x: [0 — FFFF]H

	d:	[0 — 255]D
ipv6-prefix-length	0 — 128	

longer — Specifies the prefix list entry matches any route that matches the specified *ip-prefix* and prefix *mask* length values greater than the specified *mask*.

tunnel-table

Syntax **tunnel-table** [*ip-address*] [**ldp | rsvp** [**tunnel-id** *tunnel-id*]**| sdp** [**sdp-id** *sdp-id*]]

Context debug>router>ip

Description This command enables debugging for tunnel tables.

mtrace

Syntax [**no**] **mtrace**

Context debug>router

Description This command configures debugging for mtrace.

tms

Syntax [**no**] **tms [interface** <*tms-interface*>**] api [detail]** <*tms-interface*>

Context debug>router

Description This command configures debugging for Threat Management Services.

misc

Syntax [**no**] **misc**

Context debug>router>mtrace

Description This command enables debugging for mtrace miscellaneous.

packet

Syntax [**no**] **packet** [**query | request | response**]

Context debug>router>mtrace

Description This command enables debugging for mtrace packets.

VRRP

In This Chapter

This chapter provides information about configuring Virtual Router Redundancy Protocol (VRRP) parameters. Topics in this chapter include:

VRRP Overview

The Virtual Router Redundancy Protocol (VRRP) for IPv4 is defined in the IETF RFC 3768, *Virtual Router Redundancy Protocol*. VRRP for IPv6 is specified in *draft-ietf-vrrp-unified-spec-02.txt*. VRRP describes a method of implementing a redundant IP interface shared between two or more routers on a common LAN segment, allowing a group of routers to function as one virtual router. When this IP interface is specified as a default gateway on hosts directly attached to this LAN, the routers sharing the IP interface prevent a single point of failure by limiting access to this gateway address. VRRP can be implemented on IES service interfaces and on core network IP interfaces.

If the master virtual router fails, the backup router configured with the highest acceptable priority becomes the master virtual router. The new master router assumes the normal packet forwarding for the local hosts.

Figure 12 displays an example of a VRRP configuration.

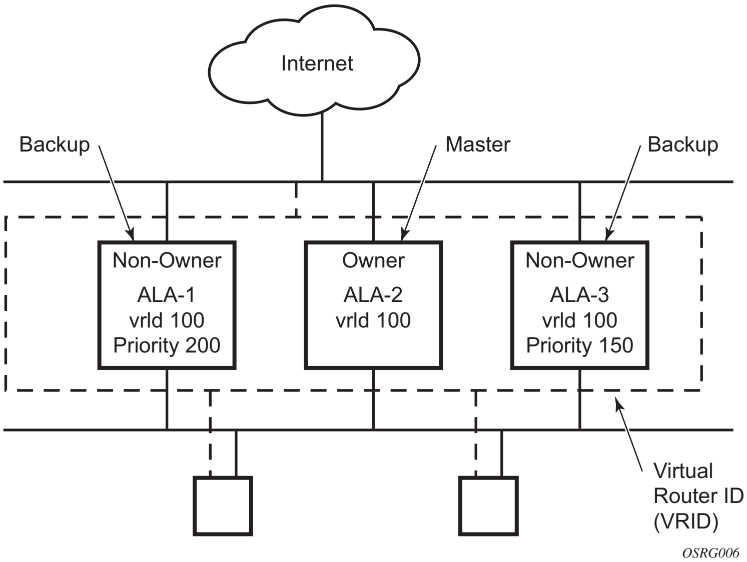


Figure 12: VRRP Configuration

VRRP Components

VRRP consists of the following components:

- Virtual Router on page 315
- IP Address Owner on page 315
- Primary and Secondary IP Addresses on page 316
- Virtual Router Master on page 316
- Virtual Router Backup on page 317
- Owner and Non-Owner VRRP on page 317

Virtual Router

A virtual router is a logical entity managed by VRRP that acts as a default router for hosts on a shared LAN. It consists of a Virtual Router Identifier (VRID) and a set of associated IP addresses (or address) across a common LAN. A VRRP router can backup one or more virtual routers.

The purpose of supporting multiple IP addresses within a single virtual router is for multi-netting. This is a common mechanism that allows multiple local subnet attachment on a single routing interface. Up to four virtual routers are possible on a single Alcatel-Lucent IP interface. The virtual routers must be in the same subnet. Each virtual router has its own VRID, state machine and messaging instance.

IP Address Owner

VRRP can be configured in either an owner or non-owner mode. The owner is the VRRP router whose virtual router IP address is the same as the real interface IP address. This is the router that responds to packets addressed to one of the IP addresses for ICMP pings, TCP connections, etc. All other virtual router instances participating in this message domain must have the same VRID configured and cannot be configured as owner.

Alcatel-Lucent routers allow the virtual routers to be configured as non-owners of the IP address. VRRP on a router can be configured to allow non-owners to respond to ICMP echo requests when they become the virtual router master for the virtual router. Telnet and other connection-oriented protocols can also be configured for non-owner master response. However, the individual application conversations (connections) will not survive a VRRP failover. A non-owner VRRP router operating as a backup will not respond to any packets addressed to any of the virtual router IP addresses.

Primary and Secondary IP Addresses

A primary address is an IP address selected from the set of real interface address. VRRP advertisements are always sent using the primary IP address as the source of the IP packet.

An IP interface must always have a primary IP address assigned for VRRP to be active on the interface. Alcatel-Lucent routers supports both primary and secondary IP addresses (multi-netting) on the IP interface. The virtual router's VRID primary IP address is always the primary address on the IP interface. VRRP uses the primary IP address as the IP address placed in the source IP address field of the IP header for all VRRP messages sent on that interface.

Virtual Router Master

The VRRP router which controls the IP address(es) associated with a virtual router is called the master. The master is responsible for forwarding packets sent to the VRRP IP addresses. An election process provides dynamic failover of the forwarding responsibility if the master becomes unavailable. This allows any of the virtual router IP addresses on the LAN to be used as the default first hop router by end hosts. This enables a higher availability default path without requiring configuration of dynamic routing or router discovery protocols on every end host.

If the master is unavailable, each backup virtual router for the VRID compare the configured priority values to determine the master role. In case of a tie, the virtual router with the highest primary IP address becomes master.

The `preempt` parameter can be set to `false` to prevent a backup virtual router with a better priority value from becoming master when an existing non-owner virtual router is the current master. This is determined on a first-come, first-served basis.

While master, a virtual router routes and originates all IP packets into the LAN using the physical MAC address for the IP interface as the Layer 2 source MAC address, not the VRID MAC address. ARP packets also use the parent IP interface MAC address as the Layer 2 source MAC address while inserting the virtual router MAC address in the appropriate hardware address field. VRRP messages are the only packets transmitted using the virtual router MAC address as the Layer 2 source MAC.

Virtual Router Backup

A new virtual router master is selected from the set of VRRP routers available to assume forwarding responsibility for a virtual router should the current master fail.

Owner and Non-Owner VRRP

The owner controls the IP address of the virtual router and is responsible for forwarding packets sent to this IP address. The owner assumes the role of the master virtual router. Only one virtual router in the domain can be configured as owner. All other virtual router instances participating in this message domain must have the same VRID configured.

The most important parameter to be defined on a non-owner virtual router instance is the priority. The priority defines a virtual router's selection order in the master election process. The priority value and the preempt mode determine the virtual router with the highest priority to become the master virtual router.

The base priority is used to derive the in-use priority of the virtual router instance as modified by any optional VRRP priority control policy. VRRP priority control policies can be used to either override or adjust the base priority value depending on events or conditions within the chassis.

For information about non-owner access parameters, refer to VRRP Non-Owner Accessibility on page 334.

Configurable Parameters

In addition to backup IP addresses, to facilitate configuration of a virtual router on Alcatel-Lucent routers, the following parameters can be defined in owner configurations:

- Virtual Router ID (VRID) on page 318
- Message Interval and Master Inheritance on page 320
- VRRP Message Authentication on page 322
- Authentication Data on page 324
- Virtual MAC Address on page 324

The following parameters can be defined in non-owner configurations:

- Virtual Router ID (VRID) on page 318
- Priority on page 318
- Message Interval and Master Inheritance on page 320
- Master Down Interval on page 321
- Preempt Mode on page 321
- VRRP Message Authentication on page 322
- Authentication Data on page 324
- Virtual MAC Address on page 324
- Inherit Master VRRP Router’s Advertisement Interval Timer on page 325
- Policies on page 325

Virtual Router ID (VRID)

The VRID must be configured with the same value on each virtual router associated with the redundant IP address (IP addresses). It is placed in all VRRP advertisement messages sent by each virtual router.

Priority

The priority value affects the interaction between this VRID and the same VRID of other virtual routers participating on the same LAN. A higher priority value defines a greater priority in becoming the virtual router master for the VRID. The priority value can only be configured when the defined IP address on the IP interface is different than the virtual router IP address (non-owner mode).

When the IP address on the IP interface matches the virtual router IP address (owner mode), the priority value is fixed at 255, the highest value possible. This virtual router member is considered the owner of the virtual router IP address. There can only be one owner of the virtual router IP address for all virtual router members.

The priority value 0 is reserved for VRRP advertisement message purposes. It is used to tell other virtual routers in the same VRID that this virtual router is no longer acting as master, triggering a new election process. When this happens, each backup virtual router sets its master down timer equal to the skew time value. This shortens the time until one of the backup virtual routers becomes master.

The current master virtual router must transmit a VRRP advertisement message immeediately upon receipt of a VRRP message with priority set to 0. This prevents another backup from becoming master for a short period of time.

Non-owner virtual routers may be configured with a priority of 254 through 1. The default value is 100. Multiple non-owners can share the same priority value. When multiple non-owner backup virtual routers are tied (transmit VRRP advertisement messages simultaneously) in the election process, both become master simultaneously, the one with the best priority will win the election. If the priority value in the message is equal to the master’s local priority value, then the primary IP address of the local master and the message is evaluated as the tie breaker. The higher IP address becomes master. (The primary IP address is the source IP address of the VRRP advertisement message.)

The priority is also used to determine when to preempt the existing master. If the preempt mode value is true, VRRP advertisement messages from inferior (lower priority) masters are discarded, causing the master down timer to expire and the transition to master state.

The priority value also dictates the skew time added to the master timeout period.

IP Addresses

Each virtual router participating in the same VRID should be defined with the same set of IP addresses. These are the IP addresses being used by hosts on the LAN as gateway addresses. Multi-netting supports 16 IP addresses on the IP interface, up to 16 addresses can be assigned to a specific a virtual router instance.

Message Interval and Master Inheritance

Each virtual router is configured with a message interval per VRID within which it participates. This parameter must be the same for every virtual router on the VRID.

For IPv4, the default advertisement interval is 1 second and can be configured between 100 milliseconds and 255 seconds 900 milliseconds. For IPv6, the default advertisement interval is 1 second and can be configured between 100 milliseconds and 40 seconds 950 milliseconds.

As specified in the RFC, the advertisement interval field in every received VRRP advertisement message must match the locally configured advertisement interval. If a mismatch occurs, depending on the inherit configuration, the current master's advertisement interval setting can be used to operationally override the locally configured advertisement interval setting. If the current master changes, the new master setting is used. If the local virtual router becomes master, the locally configured advertisement interval is enforced.

If a VRRP advertisement message is received with an advertisement interval set to a value different than the local value and the inherit parameter is disabled, the message is discarded without processing.

The master virtual router on a VRID uses the advertisement interval to load the advertisement timer, specifying when to send the next VRRP advertisement message. Each backup virtual router on a VRID uses the advertisement interval (with the configured local priority) to derive the master down timer value.

VRRP advertisements messages that are fragmented, contain IP options (IPv4), or contain extension headers (IPv6) require a longer message interval to be configured.

Skew Time

The skew time is used to add a time period to the master down interval. This is not a configurable parameter. It is derived from the current local priority of the virtual router’s VRID. To calculate the skew time, the virtual router evaluates the following formula:

For IPv4: Skew Time = ((256 - priority) / 256) seconds

For IPv6: Skew Time = (((256 - priority) * Master_Adver_Interval) / 256) centiseconds

The higher priority value, the smaller the skew time will be. This means that virtual routers with a lower priority will transition to master slower than virtual routers with higher priorities.

Master Down Interval

The master down interval is a calculated value used to load the master down timer. When the master down timer expires, the virtual router enters the master state. To calculate the master down interval, the virtual router evaluates the following formula:

Master Down Interval = (3 x Operational Advertisement Interval) + Skew Time

The operational advertisement interval is dependent upon the state of the inherit parameter. When the inherit parameter is enabled, the operational advertisement interval is derived from the current master's advertisement interval field in the VRRP advertisement message. When inherit is disabled, the operational advertisement interval must be equal to the locally configured advertisement interval.

The master down timer is only operational when the local virtual router is operating in backup mode.

Preempt Mode

Preempt mode is a true or false configured value which controls whether a specific backup virtual router preempts a lower priority master. The IP address owner will always become master when available. Preempt mode cannot be set to false on the owner virtual router. The default value for preempt mode is true.

When preempt mode is true, the advertised priority from the incoming VRRP advertisement message from the current master is compared to the local configured priority. If the local priority is higher, the received VRRP advertisement message is discarded. This will result in the eventual expiration of the master down timer causing a transition to the master state. If the received priority is equal to the local priority, the message is not discarded and the current master will not be discarded. Note that when in the backup state, the received primary IP address is not part of the decision to preempt and is not used as a tie breaker when the received and local priorities are equal.

When `preempt` is enabled, the virtual router instance overrides any non-owner master with an in-use message priority value less than the virtual router instance in-use priority value. If `preempt` is disabled, the virtual router only becomes master if the master down timer expires before a VRRP advertisement message is received from another virtual router.

VRRP Message Authentication

The authentication type parameter defines the type of authentication used by the virtual router in VRRP advertisement message authentication. VRRP message authentication is applicable to IPv4 only. The current master uses the configured authentication type to indicate any egress message manipulation that must be performed in conjunction with any supporting authentication parameters before transmitting a VRRP advertisement message. The configured authentication type value is transmitted in the message authentication type field with the appropriate authentication data field filled in. Backup routers use the authentication type message field value in interpreting the contained authentication data field within received VRRP advertisement messages.

VRRP supports three message authentication methods which provide varying degrees of security. The supported authentication types are:

0 – No Authentication

1 – Simple Text Password

2 – IP Authentication Header

Authentication Type 0 – No Authentication

The use of type 0 indicates that VRRP advertisement messages are not authenticated (provides no authentication). The master transmitting VRRP advertisement messages will transmit the value 0 in the egress messages authentication type field and the authentication data field. Backup virtual routers receiving VRRP advertisement messages with the authentication type field equal to 0 will ignore the authentication data field in the message.

All compliant VRRP advertisement messages are accepted. The following fields within the received VRRP advertisement message are checked for compliance (the VRRP specification may require additional checks).

- IP header checks specific to VRRP
  - → IP header destination IP address – Must be 224.0.0.18
  - → IP header TTL field – Must be equal to 255, the packet must not have traversed any IP routed hops
  - → IP header protocol field – must be 112 (decimal)

- VRRP message checks
  - → Version field – Must be set to the value 2
  - → Type field – Must be set to the value of 1 (advertisement)
  - → Virtual router ID field – Must match one of the configured VRID on the ingress IP interface (All other fields are dependent on matching the virtual router ID field to one of the interfaces configured VRID parameters)
  - → Priority field – Must be equal to or greater than the VRID in-use priority or be equal to 0 (Note, equal to the VRID in-use priority and 0 requires further processing regarding master/backup and senders IP address to determine validity of the message)
  - → Authentication type field – Must be equal to 0
  - → Advertisement interval field – Must be equal to the VRID configured advertisement interval
  - → Checksum field – Must be valid
  - → Authentication data fields – Must be ignored.

VRRP messages not meeting the criteria are silently dropped.

Authentication Type 1 – Simple Text Password

The use of type 1 indicates that VRRP advertisement messages are authenticated with a clear (simple) text password. All virtual routers participating in the virtual router instance must be configured with the same 8 octet password. Transmitting virtual routers place a value of 1 in the VRRP advertisement message authentication type field and put the configured simple text password into the message authentication data field. Receiving virtual routers compare the message authentication data field with the local configured simple text password based on the message authentication type field value of 1.

The same checks are performed for type 0 with the following exceptions (the VRRP specification may require additional checks):

- VRRP message checks
  - → Authentication type field – Must be equal to 1
  - → Authentication data fields – Must be equal to the VRID configured simple text password

Any VRRP message not meeting the type 0 verification checks with the exceptions above are silently discarded.

Authentication Failure

Any received VRRP advertisement message that fails authentication must be silently discarded with an invalid authentication counter incremented for the ingress virtual router instance.

Authentication Data

This feature is different than the VRRP advertisement message field with the same name. This is any required authentication information that is pertinent to the configured authentication type. The type of authentication data used for each authentication type is as follows:

Authentication Type	Authentication Data
0	None, authentication is not performed
1	Simple text password consisting of 8 octets

Virtual MAC Address

The MAC address can be used instead of an IP address in ARP responses when the virtual router instance is master. The MAC address configuration must be the same for all virtual routers participating as a virtual router or indeterminate connectivity by the attached IP hosts will result. All VRRP advertisement messages are transmitted with *ieee-mac-addr* as the source MAC.

VRRP Advertisement Message IP Address List Verification

VRRP advertisement messages contain an IP address count field that indicates the number of IP addresses listed in the sequential IP address fields at the end of the message.

The Alcatel-Lucent routersimplementation always logs mismatching events. The decision on where and whether to forward the generated messages depends on the configuration of the event manager.

To facilitate the sending of mismatch log messages, each virtual router instance keeps the mismatch state associated with each source IP address in the VRRP master table. Whenever the state changes, a mismatch log message is generated indicating the source IP address within the message, the mismatch or match event and the time of the event.

With secondary IP address support, multiple IP addresses may be found in the list and it should match the IP address on the virtual router instance. Owner and non-owner virtual router instances have the supported IP addresses explicitly defined, making mismatched supported IP address within the interconnected virtual router instances a provisioning issue.

Inherit Master VRRP Router’s Advertisement Interval Timer

The virtual router instance can inherit the master VRRP router’s advertisement interval timer which is used by backup routers to calculate the master down timer.

The inheritance is only configurable in the non-owner nodal context. It is used to allow the current virtual router instance master to dictate the master down timer for all backup virtual routers.

IPv6 Virtual Router Instance Operationally Up

Once the IPv6 virtual router is properly configured with a minimum of one link-local backup address, the parent interface’s router advertisement must be configured to use the virtual MAC address for the virtual router to be considered operationally up.

Policies

Policies can be configured to control VRRP priority with the virtual router instance. VRRP priority control policies can be used to override or adjust the base priority value depending on events or conditions within the chassis.

The policy can be associated with more than one virtual router instance. The priority events within the policy override or diminish the base priority dynamically affecting the in-use priority. As priority events clear in the policy, the in-use priority can eventually be restored to the base priority value.

Policies can only be configured in the non-owner VRRP context. For non-owner virtual router instances, if policies are not configured, then the base priority is used as the in-use priority.

VRRP Priority Control Policies

This implementation of VRRP supports control policies to manipulate virtual router participation in the VRRP master election process and master self-deprecation. The local priority value for the virtual router instance is used to control the election process and master state.

VRRP Virtual Router Policy Constraints

Priority control policies can only be applied to non-owner VRRP virtual router instances. Owner VRRP virtual routers cannot be controlled by a priority control policy because they are required to have a priority value of 255 that cannot be diminished. Only one VRRP priority control policy can be applied to a non-owner virtual router instance.

Multiple VRRP virtual router instances may be associated with the same IP interface, allowing multiple priority control policies to be associated with the IP interface.

An applied VRRP priority control policy only affects the in-use priority on the virtual router instance when the preempt mode has been enabled. A virtual router instance with preempt mode disabled will always use the base priority as the in-use priority, ignoring any configured priority control policy.

VRRP Virtual Router Instance Base Priority

Non-owner virtual router instances must have a base priority value between 1 and 254. The value 0 is reserved for master termination. The value 255 is reserved for owners. The default base priority for non-owner virtual router instances is the value 100.

The base priority is the starting priority for the VRRP instance. The actual in-use priority for the VRRP instance is derived from the base priority and an optional VRRP priority control policy.

VRRP Priority Control Policy Delta In-Use Priority Limit

A VRRP priority control policy enforces an overall minimum value that the policy can inflict on the VRRP virtual router instance base priority. This value provides a lower limit to the delta priority events manipulation of the base priority.

A delta priority event is a conditional event defined in the priority control policy that subtracts a given amount from the current, in-use priority for all VRRP virtual router instances to which the policy is applied. Multiple delta priority events can apply simultaneously, creating a dynamic priority value. The base priority for the instance, less the sum of the delta values derives the actual priority value in-use.

An explicit priority event is a conditional event defined in the priority control policy that explicitly defines the in-use priority for the virtual router instance. The explicitly defined values are not affected by the delta in-use priority limit. When multiple explicit priority events happen simultaneously, the lowest value is used for the in-use priority. The configured base priority is not a factor in explicit priority overrides of the in-use priority.

The allowed range of the Delta In-Use Priority Limit is 1 to 254. The default is 1, which prevents the delta priority events from operationally disabling the virtual router instance.

VRRP Priority Control Policy Priority Events

The main function of a VRRP priority control policy is to define conditions or events that impact the system's ability to communicate with outside hosts or portions of the network. When one or multiple of these events are true, the base priority on the virtual router instance is either overwritten with an explicit value, or a sum of delta priorities is subtracted from the base priority. The result is the in-use priority for the virtual router instance. Any priority event may be configured as an explicit event or a delta event.

Explicit events override all delta events. When multiple explicit events occur, the event with the lowest priority value is assigned to the in-use priority. As events clear, the in-use priority is reevaluated accordingly and adjusted dynamically.

Delta priority events also have priority values. When no explicit events have occurred within the policy, the sum of the occurring delta events priorities is subtracted from the base priority of each virtual router instance. If the result is lower than the delta in-use priority limit, the delta in-use priority limit is used as the in-use priority for the virtual router instance. Otherwise, the in-use priority is set to the base priority less the sum of the delta events.

Each event generates a VRRP priority event message indicating the policy-id, the event type, the priority type (delta or explicit) and the event priority value. Another log message is generated when the event is no longer true, indicating that it has been cleared.

Priority Event Hold-Set Timers

Hold-set timers are used to dampen the effect of a flapping event. A flapping event is where the event continually transitions between clear and set. The hold-set value is loaded into a hold set timer that prevents a set event from transitioning to the cleared state until it expires.

Each time an event transitions between cleared and set, the timer is loaded and begins to count down to zero. If the timer reaches zero, the event will be allowed to enter the cleared state once more. Entering the cleared state is always dependent on the object controlling the event conforming to the requirements defined in the event itself. It is possible, on some event types, to have a further set action reload the hold set timer. This extends the amount of time that must expire before entering the cleared state.

For an example of a hold-set timer setting, refer to LAG Degrade Priority Event on page 329.

Port Down Priority Event

The port down priority event is tied to either a physical port or a SONET/SDH channel. The port or channel operational state is evaluated to determine a port down priority event or event clear.

When the port or channel operational state is up, the port down priority event is considered false or cleared. When the port or channel operational state is down, the port down priority event is considered true or set.

LAG Degrade Priority Event

The LAG degrade priority event is tied to an existing Link Aggregation Group (LAG). The LAG degrade priority event is conditional to percentage of available port bandwidth on the LAG. Multiple bandwidth percentage thresholds may be defined, each with its own priority value.

If the LAG transitions from one threshold to the next, the previous threshold priority value is subtracted from the total delta sum while the new threshold priority value is added to the sum. The new sum is then subtracted from the base priority and compared to the delta in-use priority limit to derive the new in-use priority on the virtual router instance.

The following example illustrates a LAG priority event and it's interaction with the hold set timer in changing the in-use priority.

The following state and timer settings are used for the LAG events displayed in Table 6:

- User-defined thresholds: 2 ports down 4 ports down 6 ports down
- LAG configured ports: 8 ports
- Hold set timer (hold-set): 5 seconds

Table 6: LAG Events

Time	LAG Port State	Parameter	State	Comments
0	All ports down	Event State	Set - 8 ports down	
		Event Threshold	6 ports down	
		Hold Set Timer	5 seconds	Set to **hold-set** parameter

Table 6: LAG Events (Continued)

Time	LAG Port State	Parameter	State	Comments
1	One port up	Event State	Set - 8 ports down	Cannot change until Hold Set Timer expires
		Event Threshold	6 ports down	
		Hold Set Timer	5 seconds	Event does not affect timer
2	All ports up	Event State	Set - 8 ports down	Still waiting for Hold Set Timer expires
		Event Threshold	6 ports down	
		Hold Set Timer	3 seconds	
5	All ports up	Event State	Cleared - All ports up	
		Event Threshold	None	Event cleared
		Hold Set Timer	Expired	
100	Five ports down	Event State	Set - 5 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	Expired	Set to **hold-set** parameter
102	Three ports down	Event State	Set - 5 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	3 seconds	
103	All ports up	Event State	Set - 5 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	2 second	
104	Two ports down	Event State	Set - 5 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	1 second	Current threshold is 5, so 2 down has no effect
105	Two ports down	Event State	Set - 2 ports down	
		Event Threshold	2 ports down	
		Hold Set Timer	Expired	
200	Four ports down	Event State	Set - 2 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	5 seconds	Set to **hold-set** parameter

Table 6: LAG Events (Continued)

Time	LAG Port State	Parameter	State	Comments
1	One port up	Event State	Set - 8 ports down	Cannot change until Hold Set Timer expires
		Event Threshold	6 ports down	
		Hold Set Timer	5 seconds	Event does not affect timer
2	All ports up	Event State	Set - 8 ports down	Still waiting for Hold Set Timer expires
		Event Threshold	6 ports down	
		Hold Set Timer	3 seconds	
5	All ports up	Event State	Cleared - All ports up	
		Event Threshold	None	Event cleared
		Hold Set Timer	Expired	
100	Five ports down	Event State	Set - 5 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	Expired	Set to **hold-set** parameter
102	Three ports down	Event State	Set - 5 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	3 seconds	
103	All ports up	Event State	Set - 5 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	2 second	
104	Two ports down	Event State	Set - 5 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	1 second	Current threshold is 5, so 2 down has no effect
105	Two ports down	Event State	Set - 2 ports down	
		Event Threshold	2 ports down	
		Hold Set Timer	Expired	
200	Four ports down	Event State	Set - 2 ports down	
		Event Threshold	4 ports down	
		Hold Set Timer	5 seconds	Set to **hold-set** parameter

Table 6: LAG Events (Continued)

Time	LAG Port State	Parameter	State	Comments
202	Seven ports down	Event State	Set - 7 ports down	Changed due to increase
		Event Threshold	6 ports down	
		Hold Set Timer	5 seconds	Set to **hold-set** due to threshold increase
206	All ports up	Event State	Set - 7 ports down	
		Event Threshold	6 ports down	
		Hold Set Timer	1 second	
207	All ports up	Event State	Cleared - All ports up	
		Event Threshold	None	Event cleared
		Hold Set Timer	Expired	

Host Unreachable Priority Event

The host unreachable priority event creates a continuous ping task that is used to test connectivity to a remote host. The path to the remote host and the remote host itself must be capable and configured to accept ICMP echo request and replies for the ping to be successful.

The ping task is controlled by interval and size parameters that define how often the ICMP request messages are transmitted and the size of each message. A historical missing reply parameter defines when the ping destination is considered unreachable.

When the host is unreachable, the host unreachable priority event is considered true or set. When the host is reachable, the host unreachable priority event is considered false or cleared.

Route Unknown Priority Event

The route unknown priority event defines a task that monitors the existence of a given route prefix in the system’s routing table.

The route monitoring task can be constrained by a condition that allows a prefix that is less specific than the defined prefix to be considered as a match. The source protocol can be defined to indicate the protocol the installed route must be populated from. To further define match criteria when multiple instances of the route prefix exist, an optional next hop parameter can be defined.

When a route prefix exists within the active route table that matches the defined match criteria, the route unknown priority event is considered false or cleared. When a route prefix does not exist within the active route table matching the defined criteria, the route unknown priority event is considered true or set.

VRRP Non-Owner Accessibility

Although the RFC states that only VRRP owners can respond to ping and other management-oriented protocols directed to the VRID IP addresses, the routers allow an override of this restraint on a per VRRP virtual router instance basis.

Non-Owner Access Ping Reply

When non-owner access ping reply is enabled on a virtual router instance, ICMP echo request messages destined to the non-owner virtual router instance IP addresses are not discarded at the IP interface when operating in master mode. ICMP echo request messages are always discarded in backup mode.

When non-owner access ping reply is disabled on a virtual router instance, ICMP echo request messages destined to the non-owner virtual router instance IP addresses are silently discarded in both the master and backup modes.

Non-Owner Access Telnet

When non-owner access Telnet is enabled on a virtual router instance, authorized Telnet sessions may be established that are destined to the virtual router instance IP addresses when operating in master mode. Telnet sessions are always discarded at the IP interface when destined to a virtual router IP address operating in backup mode. Enabling non-owner access Telnet does not guarantee Telnet access, proper management and security features must be enabled to allow Telnet on this interface and possibly from the given source IP address.

When non-owner access Telnet is disabled on a virtual router instance, Telnet sessions destined to the non-owner virtual router instance IP addresses are silently discarded in both master and backup modes.

Non-Owner Access SSH

When non-owner access SSH is enabled on a virtual router instance, authorized SSH sessions may be established that are destined to the virtual router instance IP addresses when operating in master mode. SSH sessions are always discarded at the IP interface when destined to a virtual router IP address operating in backup mode. Enabling non-owner access SSH does not guarantee SSH access, proper management and security features must be enabled to allow SSH on this interface and possibly from the given source IP address. SSH is applicable to IPv4 VRRP only.

When non-owner access SSH is disabled on a virtual router instance, SSH sessions destined to the non-owner virtual router instance IP addresses are silently discarded in both master and backup modes.

VRRP Configuration Process Overview

Figure 13 displays the process to provision VRRP parameters.

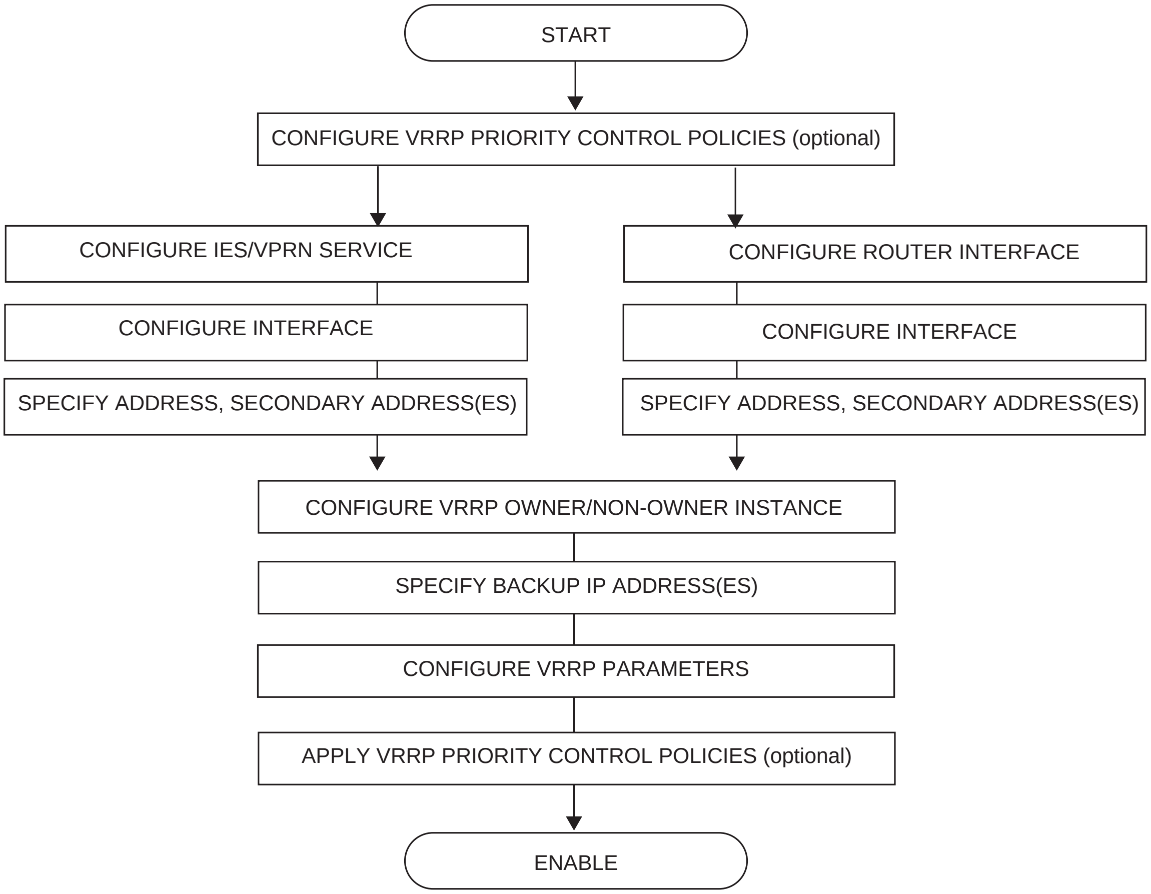

START
CONFIGURE VRRP PRIORITY CONTROL POLICIES (optional)
CONFIGURE IES/VPRN SERVICE
CONFIGURE INTERFACE
SPECIFY ADDRESS, SECONDARY ADDRESS(ES)
CONFIGURE ROUTER INTERFACE
CONFIGURE INTERFACE
SPECIFY ADDRESS, SECONDARY ADDRESS(ES)
CONFIGURE VRRP OWNER/NON-OWNER INSTANCE
SPECIFY BACKUP IP ADDRESS(ES)
CONFIGURE VRRP PARAMETERS
APPLY VRRP PRIORITY CONTROL POLICIES (optional)
ENABLE

Figure 13: VRRP Configuration and Implementation Flow

Configuration Notes

This section describes VRRP configuration caveats.

General

- Creating and applying VRRP policies are optional.
- Backup command:
  - → The backup IP address(es) must be on the same subnet. The backup addresses explicitly define which IP addresses are in the VRRP advertisement message IP address list.
  - → In the owner mode, the backup IP address must be identical to one of the interface’s IP addresses. The backup address explicitly defines which IP addresses are in the VRRP advertisement message IP address list.
  - → For IPv6, one of the backup addresses configured must be the link-local address of the owner VRRP instance.

Configuring VRRP with CLI

This section provides information to configure VRRP using the command line interface.

Topics in this section include:

VRRP Configuration Overview

Configuring VRRP policies and configuring VRRP instances on interfaces and router interfaces is optional. The basic owner and non-owner VRRP configurations on an IES or router interface must specify the **backup** *ip-address* parameter.

VRRP helps eliminate the single point of failure in a routed environment by using virtual router IP address shared between two or more routers connecting the common domain. VRRP provides dynamic fail over of the forwarding responsibility if the master becomes unavailable.

The VRRP implementation allows one master per IP subnet. All other VRRP instances in the same domain must be in backup mode.

Preconfiguration Requirements

VRRP policies:

- VRRP policies must be configured before they can be applied to an interface or IES or VPRN VRRP instance. VRRP policies are configured in the **config>vrrp** context.

Configuring VRRP on an IES or VPRN service interface:

- The service customer account must be created prior to configuring an IES or VPRN VRRP instance.
- The interface address must be specified in the both the owner and non-owner IES, VPRN or router interface instances.

Basic VRRP Configurations

Configure VRRP parameters in the following contexts:

- VRRP Policy on page 341
- VRRP IES Service Parameters on page 342
- VRRP Router Interface Parameters on page 344

VRRP Policy

Configuring and applying VRRP policies are optional. There are no default VRRP policies. Each policy must be explicitly defined. A VRRP configuration must include the following:

- Policy ID
- Define at least one of the following priority events:
  - → Port down
  - → LAG port down
  - → Host unreachable
  - → Route unknown

The following example displays a sample configuration of a VRRP policy.

```
A:SR2>config>vrrp>policy# info
----------------------------------------------
            delta-in-use-limit 50
            priority-event
                port-down 4/1/2
                    hold-set 43200
                    priority 100 delta
                exit
                port-down 4/1/3
                    priority 200 explicit
                exit
                lag-port-down 1
                    number-down 3
                        priority 50 explicit
                    exit
                exit
                host-unreachable 10.10.24.4
                    drop-count 25
                exit
                route-unknown 10.10.0.0/32
                   priority 50 delta
                   protocol bgp
                exit
            exit
----------------------------------------------
```

VRRP IES Service Parameters

VRRP parameters are configured within an IES service with two contexts, owner or non-owner. The status is specified when the VRRP configuration is created. When configured as owner, the virtual router instance owns the backup IP addresses. All other virtual router instances participating in this message domain must have the same **vrid** configured and cannot be configured as owner.

For IPv4, up to 4 virtual routers IDs (vrid) can be configured on an IES service interface. Each virtual router instance can manage up to 16 backup IP addresses. For IPv6, only one virtual router instance can be configured on an IES service interface.

VRRP parameters configured within an IES service must include the following:

- VRID
- Backup IP address(es)

The following example displays a sample configuration of a IES service owner and non-owner VRRP configurations.

```
A:SR2>config>service>ies# info
----------------------------------------------
            interface "tuesday" create
                address 10.10.36.2/24
                sap 7/1/1.2.2 create
                vrrp 19 owner
                    backup 10.10.36.2
                    authentication-type password
                    authentication-key "testabc"
                exit
            exit
            interface "testing" create
                address 10.10.10.16/24
                sap 1/1/55:0 create
                vrrp 12
                    backup 10.10.10.15
                    policy 1
                    authentication-type password
                    authentication-key "testabc"
                exit
            exit
            no shutdown
----------------------------------------------
A:SR2>config>service>ies#
```

Configure VRRP for IPv6

The following output shows a VRRP for IPV6 configuration example. The interface must be configured first.

```
*A:nlt7750-3>config>router>router-advert# info
----------------------------------------------
            interface "DSC-101-Application"
                use-virtual-mac
                no shutdown
            exit
...
----------------------------------------------
*A:nlt7750-3>config>router>router-advert#
```

```
*A:nlt7750-3>config>service>ies# info
----------------------------------------------
            description "VLAN 921 for DSC-101 Application"
            interface "DSC-101-Application" create
                address 10.152.2.220/28
                vrrp 217
                    backup 10.152.2.222
                    priority 254
                    ping-reply
                exit
                ipv6
                    address FD10:D68F:1:221::FFFD/64
                    link-local-address FE80::D68F:1:221:FFFD preferred
                    vrrp 219
                        backup FE80::D68F:1:221:FFFF
                        priority 254
                        ping-reply
                    exit
                exit
                sap ccag-1.a:921 create
                    description "cross connect to VPLS 921"
                exit
            exit
            no shutdown
----------------------------------------------
*A:nlt7750-3>config>service>ies#
```

VRRP Router Interface Parameters

VRRP parameters are configured on a router interface with two contexts, owner or non-owner. The status is specified when the VRRP configuration is created. When configured as owner, the virtual router instance owns the backed up IP addresses. All other virtual router instances participating in this message domain must have the same `vrid` configured and cannot be configured as owner.

For IPv4, up to 4 virtual routers IDs (vrid) can be configured on a router interface. Each virtual router instance can manage up to 16 backup IP addresses. For IPv6, only one virtual router instance can be configured on a router interface.

VRRP parameters configured on a router interface must include the following:

- VRID
- Backup IP address(es)

The following example displays a sample configuration of a router interface owner and non-owner VRRP configurations.

```
A:SR4>config>router# info
#------------------------------------------
echo "IP Configuration "
#------------------------------------------
        interface "system"
            address 10.10.0.4/32
        exit
        interface "test1"
            address 10.10.14.1/24
            secondary 10.10.16.1/24
            secondary 10.10.17.1/24
            secondary 10.10.18.1/24
        exit
        interface "test2"
            address 10.10.10.23/24
            vrrp 1 owner
                backup 10.10.10.23
                authentication-type password
                authentication-key "testabc"
            exit
        exit
#------------------------------------------
A:SR4>config>router#
```

Common Configuration Tasks

This section provides a brief overview of the tasks that must be performed to configure VRRP and provides the CLI commands.

VRRP parameters are defined under a service interface or a router interface context. An IP address must be assigned to each IP interface. Only one IP address can be associated with an IP interface but several secondary IP addresses also be associated.

Owner and non-owner configurations must include the following parameters:

- All participating routers in a VRRP instance must be configured with the same *vrid*.
- All participating *non-owner* routers can specify up to 16 backup IP addresses (IP addresses the master is representing). The *owner* configuration must include at least one backup IP address.
- For IPv6, all participating routers must be configured with the same link-local backup address (the one configured for the owner instance.)

Other owner and non-owner configurations include the following optional commands:

- authentication-type
- authentication-key
- MAC
- message-interval

In addition to the common parameters, the following *non-owner* commands can be configured:

- master-int-inherit
- priority
- policy
- ping-reply
- preempt
- telnet-reply
- ssh-reply (IPv4 only)
- [no] shutdown

Creating Interface Parameters

If you have multiple subnets configured on an Ethernet interface, you can configure VRRP on each subnet.

The following displays an IP interface configuration example:

```
A:SR1>config>router# info
#------------------------------------------
echo "IP Configuration "
#------------------------------------------
        interface "system"
            address 10.10.0.1/32
        exit
        interface "testA"
            address 123.123.123.123/24
        exit
        interface "testB"
            address 10.10.14.1/24
            secondary 10.10.16.1/24
            secondary 10.10.17.1/24
            secondary 10.10.18.1/24
        exit
        router-id 10.10.0.1
#------------------------------------------
A:SR1>config>router#
```

Configuring VRRP Policy Components

The following displays a VRRP policy configuration example:

```
A:SR1>config>vrrp# info
----------------------------------------------
        policy 1
            delta-in-use-limit 50
            priority-event
                port-down 1/1/2
                    hold-set 43200
                    priority 100 delta
                exit
                route-unknown 0.0.0.0/0
                    protocol isis
                exit
            exit
        exit
----------------------------------------------
A:SR1>config>vrrp#
```

Configuring Service VRRP Parameters

VRRP parameters can be configured on an interface in aservice to provide virtual default router support which allows traffic to be routed without relying on a single router in case of failure. VRRP can be configured the following ways:

- Non-Owner VRRP Example on page 348
- Owner Service VRRP on page 349

Non-Owner VRRP Example

The following displays a basic non-owner VRRP configuration example:

```
A:SR2>config>service>ies# info
----------------------------------------------
...
            interface "testing" create
                address 10.10.10.16/24
                sap 1/1/55:0 create
                vrrp 12
                    backup 10.10.10.15
                    policy 1
                    authentication-type password
                    authentication-key "testabc"
                exit
            exit
            no shutdown
----------------------------------------------
A:SR2>config>service>ies#
```

Owner Service VRRP

The following displays the owner VRRP configuration example:

```
A:SR4>config>router# info
#------------------------------------------
echo "IP Configuration "
#------------------------------------------
...
        interface "test2"
            address 10.10.10.23/24
            vrrp 1 owner
                backup 10.10.10.23
                authentication-type password
                authentication-key "testabc"
            exit
        exit
#------------------------------------------
A:SR4>config>router#
```

Configuring Router Interface VRRP Parameters

VRRP parameters can be configured on an interface in an interface to provide virtual default router support which allows traffic to be routed without relying on a single router in case of failure.

VRRP can be configured the following ways:

- Router Interface VRRP Non-Owner on page 350

Router Interface VRRP Non-Owner

The following displays a non-owner interface VRRP configuration example:

```
A:SR2>config># info
#------------------------------------------
      interface "if-test"
            address 10.20.30.40/24
            secondary 10.10.50.1/24
            secondary 10.10.60.1/24
            secondary 10.10.70.1/24
            vrrp 1
                backup 10.10.50.2
                backup 10.10.60.2
                backup 10.10.70.2
                backup 10.20.30.41
                ping-reply
                telnet-reply
                authentication-type password
                authentication-key "testabc"
            exit
        exit
#------------------------------------------
A:SR2>config>#
```

Router Interface VRRP Owner

The following displays router interface owner VRRP configuration example:

```
A:SR2>config>router# info
#------------------------------------------
     interface "vrrpowner"
            address 10.10.10.23/24
            vrrp 1 owner
                backup 10.10.10.23
                authentication-type password
                authentication-key "testabc"
            exit
        exit
#------------------------------------------
A:SR2>config>router#
```

VRRP Configuration Management Tasks

This section discusses the following VRRP configuration management tasks:

- Modifying a VRRP Policy on page 352
- Deleting a VRRP Policy on page 353
- Modifying Service and Interface VRRP Parameters on page 354
  - → Modifying Non-Owner Parameters on page 354
  - → Modifying Owner Parameters on page 354
  - → Deleting VRRP on an Interface or Service on page 354

Modifying a VRRP Policy

To access a specific VRRP policy, you must specify the policy ID. To display a list of VRRP policies, use the `show vrrp policy` command.

The following example displays the modified VRRP policy configuration:

```
A:SR2>config>vrrp>policy# info
----------------------------------------------
            delta-in-use-limit 50
            priority-event
                port-down 1/1/2
                    hold-set 43200
                    priority 100 delta
                exit
                port-down 1/1/3
                    priority 200 explicit
                exit
                host-unreachable 10.10.24.4
                    drop-count 25
                exit
            exit
----------------------------------------------
A:SR2>config>vrrp>policy#
```

Deleting a VRRP Policy

Policies are only applied to non-owner VRRP instances. A VRRP policy cannot be deleted if it is applied to an interface or to an IES service. Each instance in which the policy is applied must be deleted.

The `Applied` column in the following example displays whether or not the VRRP policies are applied to an entity.

```
A:SR2#
===============================================================================
VRRP Policies
===============================================================================
Policy    Current             Current      Current      Delta       Applied
Id        Priority & Effect   Explicit     Delta Sum    Limit
-------------------------------------------------------------------------------
1        200 Explicit        200          100          50          Yes
15       254                 None         None         1           No
32       100                 None         None         1           No
===============================================================================
A:SR2#
```

Modifying Service and Interface VRRP Parameters

Modifying Non-Owner Parameters

Once a VRRP instance is created as non-owner, it cannot be modified to the `owner` state. The `vrid` must be deleted and then recreated with the `owner` keyword to invoke IP address ownership.

Modifying Owner Parameters

Once a VRRP instance is created as `owner`, it cannot be modified to the non-owner state. The `vrid` must be deleted and then recreated *without* the `owner` keyword to remove IP address ownership.

Entering the `owner` keyword is optional when entering the `vrid` for modification purposes.

Deleting VRRP on an Interface or Service

The *vrid* does not need to be shutdown to remove the virtual router instance from an interface or service.

Example:

```
config>router#interface
config>router# interface if-test
config>router>if# shutdown
config>router>if# exit
config>router# no interface if-test
config>router#
```

The following example displays the command usage to delete a VRRP instance from an interface or IES service:

Example:

```
config>service#ies 10
config>service>ies# interface “test”
config>service>ies>if# vrrp 1
config>service>ies>if>vrrp# shutdown
config>service>ies>if>vrrp# exit
config>service>ies>if# no vrrp 1
config>service>ies>if# exit all
```

VRRP Command Reference

Command Hierarchies

Configuration Commands

- VRRP Network Interface Commands on page 356
- Router Interface IPv6 Commands on page 357
- Router Interface IPv6 VRRP Commands on page 358
- VRRP Priority Control Event Policy Commands on page 358
- Show Commands on page 360
- Clear Commands on page 360

VRRP Network Interface Commands

```
config
    — router
        — [no] interface interface-name
            — address {ip-address/mask | ip-address  netmask} [broadcast all-ones | host-ones]
            — no address
            — [no] allow-directed-broadcasts
            — arp-timeout seconds
            — no arp-timeout
            — description description-string
            — no description
            — secondary {ip-address/mask | ip-address netmask} [broadcast all-ones | host-
              ones] [igp-inhibit]
            — no secondary {ip-address/mask | ip-address netmask}
            — [no] shutdown
            —  static-arp ip-address ieee-address
            — [no] static-arp ip-address
            — tos-marking-state {trusted | untrusted}
            — no tos-marking-state
            — unnumbered [ip-int-name | ip-address]
            — no unnumbered
            — vrrp virtual-router-id [owner] *
            — no vrrp virtual-router-id
                — authentication-key [authentication-key | hash-key] [hash | hash2]
                — no authentication-key
                — [no] backup ip-address
                — [no] bfd-enable service-id interface interface-name dst-ip ip-address
                — [no] bfd-enable interface interface-name dst-ip ip-address
                — init-delay seconds
                — no init-delay
                — mac mac-address
                — no mac
                — [no] master-int-inherit
                — message-interval {[seconds] [milliseconds milliseconds]}
                — no message-interval
                — [no] ping-reply
                — policy policy-id
                — no policy
                — [no] preempt
                — priority priority
                — no priority
                — [no] ssh-reply
                — [no] standby-forwarding
                — [no] telnet-reply
                — [no] shutdown
                — [no] traceroute-reply
```

* Note that VRRP commands are applicable to router interfaces, IES interfaces and VPRN,
The **authentication-key**, **authentication-type**, **bfd-enable**, and **ssh-reply** commands are applicable only to IPv4 contexts, not IPv6.

Router Interface IPv6 Commands

```
config
    — router [router-name]
        — [no] interface ip-int-name
            — [no] ipv6
                — address ipv6-address/prefix-length [eui-64]
                — no address ipv6-address/prefix-length
                — icmp6
                    — packet-too-big [number seconds]
                    — no packet-too-big
                    — param-problem [number seconds]
                    — no param-problem
                    — redirects [number seconds]
                    — no redirects
                    — time-exceeded[number seconds]
                    — no time-exceeded
                    — unreachables [number seconds]
                    — no unreachables
                — link-local-address ipv6-address [preferred]
                — no link-local-address
                — [no] local-proxy-nd
                — neighbor ipv6-address [mac-address]
                — no neighbor ipv6-address
                — proxy-nd-policy policy-name [ policy-name...(up to 5 max)]
                — no proxy-nd-policy
```

Router Interface IPv6 VRRP Commands

```
config
     — router [router-name]
               — [no] interface ip-int-name
                         — [no] ipv6
                                   — vrrp virtual-router-id [owner]
                                   — no vrrp virtual-router-id
                                             — [no] backup ipv6-address
                                             — [no] bfd-enable service-id interface interface-name dst-ip ip-
                                                address
                                             — [no] bfd-enable interface interface-name dst-ip ip-address
                                             — init-delay seconds
                                             — no init-delay
                                             — mac mac-address
                                             — no mac
                                             — [no] master-int-inherit
                                             — message-interval {[seconds] [milliseconds milliseconds]}
                                             — no message-interval
                                             — [no] ping-reply
                                             — policy vrrp-policy-id
                                             — no policy
                                             — [no] preempt
                                             — priority priority
                                             — no priority
                                             — [no] shutdown
                                             — [no] standby-forwarding
                                             — [no] telnet-reply
                                             — [no] traceroute-reply
```

VRRP Priority Control Event Policy Commands

```
config
     — vrrp
               — [no] policy policy-id [context service-id]
                         — delta-in-use-limit limit
                         — no delta-in-use-limit
                         — description description string
                         — no description
                         — [no] priority-event
                                   — [no] host-unreachable ip-address
                                   — [no] host-unreachable ipv6-address
                                             — drop-count consecutive-failures
                                             — no drop-count
                                             — hold-clear seconds
                                             — no hold-clear
                                             — hold-set seconds
                                             — no hold-set
                                             — interval seconds
                                             — no interval
                                             — padding-size size
                                             — no padding-size
                                             — priority priority-level [{delta | explicit}]
                                             — no priority
                                             — timeout seconds
```

```
          — no timeout
— [no] lag-port-down lag-id
          — hold-clear seconds
          — no hold-clear
          — hold-set seconds
          — no hold-set
          — [no] number-down number-of-lag-ports-down
                    — priority priority-level [delta | explicit]
                    — no priority
— mc-ipsec-non-forwarding tunnel-grp-id
— [no] port-down port-id
          — hold-clear seconds
          — no hold-clear
          — hold-set seconds
          — no hold-set
          — priority priority-level [delta | explicit]
          — no priority
— [no] route-unknown ip-prefix/mask
          — hold-clear seconds
          — no hold-clear
          — hold-set seconds
          — no hold-set
          — less-specific [allow-default]
          — no less-specific
          — [no] next-hop ip-address
          — priority priority-level [delta | explicit]
          — no priority
          — protocol protocol
          — no protocol[protocol]
          — [no] protocol bgp
          — [no] protocol bgp -vpn
          — [no] protocol ospf
          — [no] protocol isis
          — [no] protocol rip
          — [no] protocol static
```

Show Commands

```
show
    — vrrp
            — policy [policy-id [event event-type specific-qualifier]]
    — router
            — vrrp
                    — instance
                    — instance [interface interface-name [vrid virtual-router-id]]
                    — instance interface interface-name vrid virtual-router-id ipv6
                    — statistics
```

Monitor Commands

```
monitor
    — router
            — vrrp
                    — instance interface interface-name vr-id virtual-router-id [ipv6] [interval seconds] [repeat repeat] [absolute | rate]
```

Clear Commands

```
clear
    — vrrp
                    — statistics
    — router
            — vrrp
                    — interface ip-int-name [vrid virtual-router-id]
                    — interface ip-int-name vrid virtual-router-id ipv6
                    — statistics interface interface-name [vrid virtual-router-id]
                    — statistics
                    — statistics interface interface-name vrid virtual-router-id ipv6
```

Debug Commands

```
debug
    — router
            — vrrp
                    — events
                    — events interface ip-int-name [vrid virtual-router-id]
                    — events interface ip-int-name vrid virtual-router-id ipv6
                    — no events
                    — no events interface ip-int-name [vrid virtual-router-id]
                    — no events interface ip-int-name vrid virtual-router-id ipv6
                    — packets
                    — packets interface ip-int-name [vrid virtual-router-id]
                    — packets interface ip-int-name vrid virtual-router-id ipv6
                    — no packets
```

— **no packets interface** *ip-int-name* [**vrid** *virtual-router-id*]
— **no packets interface** *ip-int-name* **vrid** *virtual-router-id* **ipv6**

Configuration Commands

Interface Configuration Commands

authentication-key

Syntax **authentication-key** [*authentication-key* **|** *hash-key*] [**hash | hash2**]
no authentication-key

Context config>router>if>vrrp

Description This command sets the simple text authentication key used to generate master VRRP advertisement messages and validates VRRP advertisements.

If simple text password authentication is not required, the **authenticaton-key** command is not required.

The command is configurable in both non-owner and owner **vrrp** nodal contexts.

The *key* parameter identifies the simple text password to be used when VRRP Authentication Type 1 is enabled on the virtual router instance. Type 1 uses an eight octet long string that is inserted into all transmitted VRRP advertisement messages and is compared against all received VRRP advertisement messages. The authentication data fields are used to transmit the *key.*

The *key* string is case sensitive and is left justified in the VRRP advertisement message authentication data fields. The first field contains the first four characters with the first octet (starting with IETF RFC bit position 0) containing the first character. The second field similarly holds the fifth through eighth characters. Any unspecified portion of the authentication data field is padded with a 0 value in the corresponding octet.

If the command is re-executed with a different password key defined, the new key is used ediately.

The **authentication-key** command can be executed at anytime.

To change the current in-use password key on multiple virtual router instances:

1. Identify the current master.
2. Shutdown the virtual router instance on all backups.
3. Execute the **authentication-key** command on the master to change the password key.
4. Execute the **authentication-key** command and **no shutdown** command on each backup.

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

Default no authentication-key — The authentication key value is the null string.

Parameters *authentication-key* — The authentication key. Allowed values are any string up to 8 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.

hash-key — The hash key. The key can be any combination of ASCII characters up to 22 (hash-key1) or 121 (hash-key2) characters in length (encrypted). If spaces are used in the string, enclose the entire string in quotation marks (“ ”).

This is useful when a user must configure the parameter, but for security purposes, the actual unencrypted key value is not provided.

hash — Specifies the key is entered in an encrypted form. If the **hash** parameter is not used, the key is assumed to be in a non-encrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the **hash** parameter specified.

hash2 — Specifies the key is entered in a more complex encrypted form. If the **hash2** parameter is not used, the less encrypted **hash** form is assumed.

backup

Syntax [**no**] **backup** *ip-address*

Context config>router>if>vrrp

Description This command associates router IP addresses with the parental IP interface IP addresses.

The **backup** command has two distinct functions when used in an **owner** or a **non-owner** context of the virtual router instance.

Non-owner virtual router instances actually create a routable IP interface address that is operationally dependent on the virtual router instance mode (master or backup). The **backup** command in **owner** virtual router instances does not create a routable IP interface address; it simply defines the existing parental IP interface IP addresses that are advertised by the virtual router instance.

For **owner** virtual router instances, the **backup** command defines the IP addresses that are advertised within VRRP advertisement messages. This communicates the IP addresses that the master is representing to backup virtual routers receiving the messages. Advertising a correct list is important. The specified *ip-addr* must be equal to one of the existing parental IP interface IP addresses (primary or secondary) or the **backup** command will fail.

For non-owner virtual router instances, the **backup** command actually creates an IP interface IP address used for routing IP packets and communicating with the system when the access commands are defined (**ping-reply**, **telnet-reply**, and **ssh-reply**). The specified *ip-addr* must be an IP address that is within one of the parental IP interface local subnets created with the **address** or **secondary** commands. If a local subnet does not exist that includes the specified *ip-addr* or if *ip-addr* is the same IP address as the parental IP interface IP address, the **backup** command will fail.

The new interface IP address created with the **backup** command assumes the mask and parameters of the corresponding parent IP interface IP address. The *ip-addr* is only active when the virtual router instance is operating in the master state. When not operating as master, the virtual router instance acts as if it is operationally down. It will not respond to ARP requests to *ip-addr*, nor will it route packets received with its *vrid* derived source MAC address. A non-master virtual router instance always silently discards packets destined to *ip-addr*. A single virtual router instance may only have a single virtual router IP address from a given parental local subnet. Multiple virtual router instances can define a virtual router IP address from the same local subnet as long as each is a different IP address.

In IPv4, up to sixteen **backup** *ip-addr* commands can be executed within the same virtual router instance. Executing **backup** multiple times with the same *ip-addr* results in no operation performed and no error generated. At least one successful **backup** *ip-addr* command must be executed before the virtual router instance can enter the operational state.

When operating as (non-owner) master, the default functionality associated with *ip-addr* is ARP response to ARP requests to *ip-addr*, routing of packets destined to the virtual router instance source MAC address and silently discarding packets destined to *ip-addr*. Enabling the non-owner-access parameters selectively allows ping, Telnet and SSH connectivity to *ip-addr* when the virtual router instance is operating as master.

The **no** form of the command removes the specified virtual router IP address from the virtual router instance. For non-owner virtual router instances, this causes all routing and local access associated with the *ip-addr* to cease. For **owner** virtual router instances, the **no backup** command only removes *ip-addr* from the list of advertised IP addresses. If the last *ip-addr* is removed from the virtual router instance, the virtual router instance will enter the operationally down state

Special Cases

Assigning the Virtual Router ID IP Address — Once the *vrid* is created on the parent IP interface, IP addresses need to be assigned to the virtual router instance. If the *vrid* was created with the keyword **owner**, the virtual router instance IP addresses must have one or more of the parent IP interface defined IP addresses (primary and secondary). For non-owner virtual router instances, the virtual router IP addresses each must be within one of the parental IP interface IP address defined local subnets. For both **owner** and non-owner virtual router instances, the virtual router IP addresses must be explicitly defined using the **backup** *ip-addr* command.

Virtual Router Instance IP Address Assignment Conditions — The RFC does not specify that the assigned IP addresses to the virtual router instance must be in the same subnet as the parent IP interface primary IP address or secondary IP addresses. The only requirement is that all virtual routers participating in the same virtual router instance have the same virtual router IP addresses assigned. To avoid confusion, the assigned virtual router IP addresses must be in a local subnet of one of the parent IP interfaces IP addresses. For **owner** virtual router instances the assigned virtual router IP address must be the same as one of the parental IP interface primary or secondary IP addresses.

The following rules apply when adding, changing, or removing parental and virtual router IP addresses:

Owner Virtual Router IP Address Parental Association — When an IP address is assigned to an **owner** virtual router instance, it must be associated with one of the parental IP interface-assigned IP addresses. The virtual router IP address must be equal to the primary or one of the secondary IP addresses within the parental IP interface.

Example - Owner Virtual Router Instance

Parent IP addresses:	10.10.10.10/24 11.11.11.11/24	
Virtual router IP addresses:	10.10.10.11	Invalid (not equal to parent IP address)
	10.10.10.10	Associated (same as parent IP address 10.10.10.10)
	10.10.11.11	Invalid (not equal to parent IP address)

	11.11.11.254	Invalid (not equal to parent IP address)
	11.11.11.255	Invalid (not equal to parent IP address)

Non-Owner Virtual Router IP Address Parental Association — When an IP address is assigned to a non-owner virtual router instance, it must be associated with one of the parental IP interface assigned IP addresses. The virtual router IP address must be a valid IP address within one of the parental IP interfaces local subnet. Local subnets are created by the primary or secondary IP addresses in conjunction with the IP addresses mask. If the defined virtual router IP address is equal to the associated subnet's broadcast address, it is invalid. Virtual router IP addresses for non-owner virtual router instances that are equal to a parental IP interface IP address are also invalid.

The same virtual router IP address may not be assigned to two separate virtual router instances. If the virtual router IP address already exists on another virtual router instance, the virtual router IP address assignment will fail.

Example - Non-Owner Virtual Router Instance

Parent IP addresses:	10.10.10.10/24 11.11.11.11/24	
Virtual router IP addresses:	10.10.10.11	Associated with 10.10.10.10 (in subnet)
	10.10.10.10	Invalid (same as parent IP address)
	10.10.11.11	Invalid (outside of all Parent IP subnets)
	11.11.11.254	Associated with 11.11.11.11 (in subnet)
	11.11.11.255	Invalid (broadcast address of 11.11.11.11/ 24)

Virtual Router IP Address Assignment without Parent IP Address — When assigning an IP address to a virtual router instance, an associated IP address (see **Owner Virtual Router IP Address Parental Association** and **Non-Owner Virtual Router IP Address Parental Association**) on the parental IP interface must already exist. If an associated IP address on the parental IP interface is not configured, the virtual router IP address assignment fails.

Parent Primary IP Address Changed — When a virtual router IP address is set and the associated parent IP interface IP address is changed, the new parent IP interface IP address is evaluated to ensure it meets the association rules defined in **Owner Virtual Router IP Address Parental Association** or **Non-Owner Virtual Router IP Address Parental Association**. If the association check fails, the parental IP address change is not allowed. If the parental IP address change fails, the previously configured IP address definition remains in effect.

Only the primary parent IP address can be changed. Secondary addresses must be removed before the new IP address can be added. **Parent Primary or Secondary IP Address Removal** explains IP address removal conditions.

Parent Primary or Secondary IP Address Removal — When a virtual router IP address is successfully set, but removing the associated parent IP interface IP address is attempted and fails. All virtual router IP addresses associated with the parental IP interface IP address must be deleted prior to removing the parental IP address. This includes virtual router IP address associations from multiple virtual router instances on the IP interface.

Default no backup — No virtual router IP address is assigned.

Parameters *ip-address* — The virtual router IP address expressed in dotted decimal notation. The IP virtual router IP address must be in the same subnet of the parental IP interface IP address or equal to one of the primary or secondary IP addresses for **owner** virtual router instances.

Values 1.0.0.1 - 223.255.255.254

backup

Syntax config>router>if>ipv6>vrrp

Description This command associates router IPv6 addresses with the parental IP interface IP addresses.

The **backup** command has two distinct functions when used in an **owner** or a **non-owner** context of the virtual router instance.

Non-owner virtual router instances actually create a routable IP interface address that is operationally dependent on the virtual router instance mode (master or backup). The **backup** command in **owner** virtual router instances does not create a routable IP interface address; it simply defines the existing parental IP interface IP addresses that are advertised by the virtual router instance.

For **owner** virtual router instances, the **backup** command defines the IP addresses that are advertised within VRRP advertisement messages. This communicates the IP addresses that the master is representing to backup virtual routers receiving the messages. Advertising a correct list is important. The specified *ipv6-addr* must be equal to one of the existing parental IP interface IP addresses (link-local or global) or the **backup** command will fail.

For non-owner virtual router instances, the **backup** command actually creates an IP interface IP address used for routing IP packets and communicating with the system when the access commands are defined (**ping-reply**, **telnet-reply**, and **ssh-reply**). The specified *ipv6-addr* must be an IP address that is within one of the parental IP interface local subnets created with the **link-local-address or address** commands. If a local subnet does not exist that includes the specified *ipv6-addr* or if *ipv6-addr* is the same IP address as the parental IP interface IP address, the **backup** command will fail.

The new interface IP address created with the **backup** command assumes the mask and parameters of the corresponding parent IP interface IP address. The *ipv6-addr* is only active when the virtual router instance is operating in the master state. For IPv6 VRRP, the parental interface's IP address that is in the same subnet as the backup address must be manually-configured, non EUI-64 and configured to be in the preferred state.

When not operating as master, the virtual router instance acts as if it is operationally down. It will not respond to ARP requests to *ipv6-addr*, nor will it route packets received with its *vrid* derived source MAC address. A non-master virtual router instance always silently discards packets destined to *ipv6-addr*. A single virtual router instance may only have a single virtual router IP address from a given parental local subnet. Multiple virtual router instances can define a virtual router IP address from the same local subnet as long as each is a different IP address.

Executing **backup** multiple times with the same *ipv6-addr* results in no operation performed and no error generated. At least one successful **backup** *ipv6-addr* command must be executed before the virtual router instance can enter the operational state.

When operating as (non-owner) master, the default functionality associated with *ipv6-addr* is ARP response to ARP requests to *ip-addr*, routing of packets destined to the virtual router instance source MAC address and silently discarding packets destined to *ipv6-addr*. An IPv6 virtual router instance can enter the operational state only if one of the configured backup address is a link-local address and the router advertisement of the interface is configured to use the virtual MAC address. Enabling the non-owner-access parameters selectively allows ping, Telnet and traceroute connectivity to *ipv6-addr* when the virtual router instance is operating as master.

The **no** form of the command removes the specified virtual router IP address from the virtual router instance. For non-owner virtual router instances, this causes all routing and local access associated with the *ipv6-addr* to cease. For **owner** virtual router instances, the **no backup** command only removes *ipv6-addr* from the list of advertised IP addresses. If the last *ipv6-addr* or the link-local address is removed from the virtual router instance, the virtual router instance will enter the operationally down state

Special Cases **Assigning the Virtual Router ID Address —** Once the *vrid* is created on the parent IP interface, IP addresses need to be assigned to the virtual router instance. If the *vrid* was created with the keyword **owner**, the virtual router instance IP addresses must have one or more of the parent IP interface defined IP addresses. For non-owner virtual router instances, the virtual router IP addresses each must be within one of the parental IP interface IP address defined local subnets. For both **owner** and non-owner virtual router instances, the virtual router IP addresses must be explicitly defined using the **backup** *ipv6-addr* command.

The following rules apply when adding, changing, or removing parental and virtual router IP addresses:

Owner Virtual Router IP Address Parental Association — When an IP address is assigned to an **owner** virtual router instance, it must be associated with one of the parental IP interface-assigned IP addresses.

Example - Owner Virtual Router Instance

Parent IP addresses:	10.10.10.10/24 11.11.11.11/24	
Virtual router IP addresses:	10.10.10.11	Invalid (not equal to parent IP address)
	10.10.10.10	Associated (same as parent IP address 10.10.10.10)
	10.10.11.11	Invalid (not equal to parent IP address)
	11.11.11.254	Invalid (not equal to parent IP address)
	11.11.11.255	Invalid (not equal to parent IP address)

Non-Owner Virtual Router IP Address Parental Association — When an IP address is assigned to a non-owner virtual router instance, it must be associated with one of the parental IP interface assigned IP addresses. The virtual router IP address must be a valid IP address within one of the parental IP interfaces local subnet. Local subnets are created by the link-local or global IP addresses in conjunction with the IP addresses mask. If the defined virtual router IP address is equal to the associated subnet's broadcast address, it is invalid. Virtual router IP addresses for non-owner virtual router instances that are equal to a parental IP interface IP address are also invalid.

The same virtual router IP address may not be assigned to two separate virtual router instances. If the virtual router IP address already exists on another virtual router instance, the virtual router IP address assignment will fail.

One exception to this rule is for the IPv6 link-local address that is configured as a backup address. The same link-local address can be configured in all virtual routers that use the same vrid.

Example - Non-Owner Virtual Router Instance

Parent IP addresses:	10.10.10.10/24 11.11.11.11/24	
Virtual router IPv6 addresses:	10.10.10.11	Associated with 10.10.10.10 (in subnet)
	10.10.10.10	Invalid (same as parent IP address)
	10.10.11.11	Invalid (outside of all Parent IP subnets)
	11.11.11.254	Associated with 11.11.11.11 (in subnet)
	11.11.11.255	Invalid (broadcast address of 11.11.11.11/ 24)

Virtual Router IP Address Assignment without Parent IP Address — When assigning an IP address to a virtual router instance, an associated IP address (see **Owner Virtual Router IP Address Parental Association** and **Non-Owner Virtual Router IP Address Parental Association**) on the parental IP interface must already exist. If an associated IP address on the parental IP interface is not configured, the virtual router IP address assignment fails.

Virtual Router IPv6 Address Assignment — An IPv6 backup address requires that the parental IP address that is in the same subnet as the backup address must be manually configured, non-EUI-64 and configured to be in the preferred state.

Default no backup — No virtual router IP address is assigned.

Parameters *ipv6-address* — The virtual router IP address expressed in dotted decimal notation. The IP virtual router IP address must be in the same subnet of the parental IP interface IP address or equal to one of the the parent interface addresses for **owner** virtual router instances.

Values	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

bfd-enable

Syntax [**no**] **bfd-enable** [*service-id*] **interface** *interface-name* **dst-ip** *ip-address*
[**no**] **bfd-enable interface** *interface-name* **dst-ip** *ip-address*

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This commands assigns a bi-directional forwarding (BFD) session providing heart-beat mechanism for the given VRRP/SRRP instance. There can be only one BFD session assigned to any given VRRP/SRRP instance, but there can be multiple SRRP/VRRP sessions using the same BFD session.

BFD control the state of the associated interface. By enabling BFD on a given protocol interface, the state of the protocol interface is tied to the state of the BFD session between the local node and the remote node. The parameters used for the BFD are set by the BFD command under the IP interface. The specified interface may not be configured with BFD; when it is, the virtual router will then initiate the BFD session.

The **no** form of this command removes BFD from the configuration.

Default none

Parameters *service-id* — Specifies the service ID of the interface running BFD.

Values		
	service-id:	1 — 2147483647
	svc-name:	64 characters maximum

interface *interface-name* **—** Specifies the name of the interface running BFD. The specified interface may not yet be configured with BFD. However, when it is, this virtual router will then initiate the BFD session.

dst-ip *ip-address* **—** Specifies the destination address to be used for the BFD session.

init-delay

Syntax **init-delay** *seconds*
no init-delay

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command configures a VRRP initialization delay timer.

Parameters *seconds* — Specifies the initialization delay timer for VRRP, in seconds.

Values 1 — 65535

mac

Syntax **mac** *mac-address*
no mac

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command sets an explicit MAC address used by the virtual router instance overriding the VRRP default derived from the VRID.

Changing the default MAC address is useful when an existing HSRP or other non-VRRP default MAC is in use by the IP hosts using the virtual router IP address. Many hosts do not monitor unessential ARPs and continue to use the cached non-VRRP MAC address after the virtual router becomes master of the host's gateway address.

The **mac** command sets the MAC address used in ARP responses when the virtual router instance is master. Routing of IP packets with *mac-address* as the destination MAC is also enabled. The **mac** setting must be the same for all virtual routers participating as a virtual router or indeterminate connectivity by the attached IP hosts will result. All VRRP advertisement messages are transmitted with *mac-address* as the source MAC.

The command can be configured in both non-owner and owner **vrrp** nodal contexts.

The **mac** command can be executed at any time and takes effect ediately. When the virtual router MAC on a master virtual router instance changes, a gratuitous ARP is ediately sent with a VRRP advertisement message. If the virtual router instance is disabled or operating as backup, the gratuitous ARP and VRRP advertisement message is not sent.

The **no** form of the command restores the default VRRP MAC address to the virtual router instance.

Default no mac — The virtual router instance uses the default VRRP MAC address derived from the VRID.

Parameters *mac-address* — The 48-bit MAC address for the virtual router instance in the form *aa*:*bb*:*cc*:*dd*:*ee*:*ff* or *aa-bb-cc-dd-ee-ff* where *aa*, *bb*, *cc*, *dd*, *ee* and *ff* are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC, and non-IEEE reserved MAC addresses.

master-int-inherit

Syntax [**no**] **master-int-inherit**

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command enables the virtual router instance to inherit the master VRRP router's advertisement interval timer which is used by backup routers to calculate the master down timer.

The **master-int-inherit** command is only available in the non-owner nodal context and is used to allow the current virtual router instance master to dictate the master down timer for all backup virtual routers. The **master-int-inherit** command has no effect when the virtual router instance is operating as master.

If **master-int-inherit** is not enabled, the locally configured **message-interval** must match the master's VRRP advertisement message advertisement interval field value or the message is discarded.

The **no** form of the command restores the default operating condition which requires the locally configured **message-interval** to match the received VRRP advertisement message advertisement interval field value.

Default no master-int-inherit — The virtual router instance does not inherit the master VRRP router's advertisement interval timer and uses the locally configured message interval.

message-interval

Syntax **message-interval** {[*seconds*] [**milliseconds** *milliseconds*]}
no message-interval

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command configures the administrative advertisement message timer used by the master virtual router instance to send VRRP advertisement messages and to derive the master down timer as backup.

For an owner virtual router instance, the administrative advertisement timer directly sets the operational advertisement timer and indirectly sets the master down timer for the virtual router instance.

Non-owner virtual router instances usage of the **message-interval** setting is dependent on the state of the virtual router (master or backup) and the state of the **master-int-inherit** parameter.

- When a non-owner is operating as master for the virtual router, the configured **message-interval** is used as the operational advertisement timer similar to an owner virtual router instance. The **master-int-inherit** command has no effect when operating as master.
- When a non-owner is in the backup state with **master-int-inherit** disabled, the configured **message-interval** value is used to match the incoming VRRP advertisement message advertisement interval field. If the locally configured message interval does not match the advertisement interval field, the VRRP advertisement is discarded.
- When a non-owner is in the backup state with **master-int-inherit** enabled, the configured **message-interval** is ignored. The master down timer is indirectly derived from the incoming VRRP advertisement message advertisement interval field value.

VRRP advertisements messages that are fragmented, contain IP options (IPv4), or contain extension headers (IPv6) require a longer message interval to be configured.

The in-use value of the message interval is used to derive the master down timer to be used when the virtual router is operating in backup mode based on the following formula:

(3x (in-use message interval) + skew time)

The skew time portion is used to slow down virtual routers with relatively low priority values when competing in the master election process.

The command is available in both non-owner and owner **vrrp** nodal contexts.

By default, a **message-interval** of 1 second is used.

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

Default 1 — Advertisement timer set to 1 second

Parameters *seconds* — The number of seconds that will transpire before the advertisement timer expires expressed as a decimal integer.

Values IPv4: 1 — 255
IPv6: 1 — 40

milliseconds *milliseconds* **—** Specifies the time interval, in milliseconds, between sending advertisement messages. This parameter is not supported on the 7750 SR-1 or 7450 ESS-1 chassis.

Values 100 — 900
IPv6: 10 — 990

policy

Syntax **policy** *policy-id*
no policy

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command adds a VRRP priority control policy association with the virtual router instance.

To further augment the virtual router instance base priority, VRRP priority control policies can be used to override or adjust the base priority value depending on events or conditions within the chassis.

The policy can be associated with more than one virtual router instance. The priority events within the policy either override or diminish the base priority set with the **priority** command dynamically affecting the in-use priority. As priority events clear in the policy, the in-use priority can eventually be restored to the base **priority** value.

The **policy** command is only available in the non-owner **vrrp** nodal context. The priority of **owner** virtual router instances is permanently set to 255 and cannot be changed by VRRP priority control policies. For non-owner virtual router instances, if the **policy** command is not executed, the base **priority** is used as the in-use priority.

The **no** form of the command removes existing VRRP priority control policy associations from the virtual router instance. All associations must be removed prior to deleting the policy from the system.

Default no policy — No VRRP priority control policy is associated with the virtual router instance.

Parameters *policy-id* — The policy ID of the VRRP priority control expressed as a decimal integer. The *vrrp-policy-id* must already exist for the command to function.

Values 1 — 9999

preempt

Syntax [**no**] **preempt**

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command enables the overriding of an existing VRRP master if the virtual router's in-use priority is higher than the current master.

The priority of the non-owner virtual router instance, the preempt mode allows the best available virtual router to force itself as the master over other available virtual routers.

When **preempt** is enabled, the virtual router instance overrides any non-owner master with an in-use message priority value less than the virtual router instance in-use priority value. If **preempt** is disabled, the virtual router only becomes master if the master down timer expires before a VRRP advertisement message is received from another virtual router.

Enabling **preempt** mode improves the effectiveness of the base **priority** and the VRRP priority control policy mechanisms on the virtual router instance. If the virtual router cannot preempt an existing non-owner master, the affect of the dynamic changing of the in-use priority is diminished.

The **preempt** command is only available in the non-owner **vrrp** nodal context. The owner may not be preempted because the priority of non-owners can never be higher than the owner. The owner always preempts all other virtual routers when it is available.

Non-owner virtual router instances only preempt when **preempt** is set and the current master has an in-use message priority value less than the virtual router instances in-use priority.

A master non-owner virtual router only allows itself to be preempted when the incoming VRRP advertisement message priority field value is one of the following:

- Greater than the virtual router in-use priority value.
- Equal to the in-use priority value and the source IP address (primary IP address) is greater than the virtual router instance primary IP address.

By default, preempt mode is enabled on the virtual router instance.

The **no** form of the command disables preempt mode and prevents the non-owner virtual router instance from preempting another, less desirable virtual router.

Default **preempt** — The preempt mode enabled on the virtual router instance where it will preempt a VRRP master with a lower priority.

priority

Syntax **priority** *base-priority*
no priority

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command configures the base router priority for the virtual router instance used in the master election process.

The priority is the most important parameter set on a non-owner virtual router instance. The priority defines a virtual router's selection order in the master election process. Together, the priority value and the **preempt** mode allow the virtual router with the best priority to become the master virtual router.

The *base-priority* is used to derive the in-use priority of the virtual router instance as modified by any optional VRRP priority control policy. VRRP priority control policies can be used to either override or adjust the base priority value depending on events or conditions within the chassis.

The **priority** command is only available in the non-owner **vrrp** nodal context. The priority of **owner** virtual router instances is permanently set to 255 and cannot be changed.

For non-owner virtual router instances, the default base priority value is 100.

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

Default **100**

Parameters *base-priority* — The base priority used by the virtual router instance expressed as a decimal integer. If no VRRP priority control policy is defined, the *base-priority* is the in-use priority for the virtual router instance.

Values 1 — 254

ping-reply

Syntax [**no**] **ping-reply**

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command enables the non-owner master to reply to ICMP echo requests directed at the vritual router instances IP addresses.

Non-owner virtual router instances are limited by the VRRP specifications to responding to ARP requests destined to the virtual router IP addresses and routing IP packets not addressed to the virtual router IP addresses. Many network administrators find this limitation frustrating when troubleshooting VRRP connectivity issues.

7750 SR OS allows this access limitation to be selectively lifted for certain applications. Ping, Telnet and SSH can be individually enabled or disabled on a per-virtual-router-instance basis.

The **ping-reply** command enables the non-owner master to reply to ICMP echo requests directed at the virtual router instances IP addresses. The Ping request can be received on any routed interface. Ping must not have been disabled at the management security level (either on the parental IP interface or based on the Ping source host address).

When **ping-reply** is not enabled, ICMP echo requests to non-owner master virtual IP addresses are silently discarded.

Non-owner backup virtual routers never respond to ICMP echo requests regardless of the **ping-reply** setting.

The **ping-reply** command is only available in non-owner **vrrp** nodal context.

By default, ICMP echo requests to the virtual router instance IP addresses are silently discarded.

The **no** form of the command configures discarding all ICMP echo request messages destined to the non-owner virtual router instance IP addresses.

Default **no ping-reply** — ICMP echo requests to the virtual router instance IP addresses are discarded.

shutdown

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

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

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

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

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

Special Cases **Non-Owner Virtual Router —** Non-owner virtual router instances can be administratively shutdown. This allows the termination of VRRP participation in the virtual router and stops all routing and other access capabilities with regards to the virtual router IP addresses. Shutting down the virtual router instance provides a mechanism to maintain the virtual routers without causing false backup/master state changes.

If the **shutdown** command is executed, no VRRP advertisement messages are generated and all received VRRP advertisement messages are silently discarded with no processing.

By default, virtual router instances are created in the **no shutdown** state.

Whenever the administrative state of a virtual router instance transitions, a log message is generated.

Whenever the operational state of a virtual router instance transitions, a log message is generated.

Owner Virtual Router — An owner virtual router context does not have a **shutdown** command. To administratively disable an owner virtual router instance, use the **shutdown** command within the parent IP interface node which administratively downs the IP interface.

ssh-reply

Syntax [**no**] **ssh-reply**

Context config>router>if>vrrp

Description This command enables the non-owner master to reply to SSH requests directed at the virtual router instance IP addresses. This command is only applicable to IPv4.

Non-owner virtual router instances are limited by the VRRP specifications to responding to ARP requests destined to the virtual router IP addresses and routing IP packets not addressed to the virtual router IP addresses.

This limitation can be disregarded for certain applications. Ping, Telnet and SSH can be individually enabled or disabled on a per-virtual-router-instance basis.

The **ssh-reply** command enables the non-owner master to reply to SSH requests directed at the virtual router instances IP addresses. The SSH request can be received on any routed interface. SSH must not have been disabled at the management security level (either on the parental IP interface or based on the SSH source host address). Proper login and CLI command authentication is still enforced.

When **ssh-reply** is not enabled, SSH requests to non-owner master virtual IP addresses are silently discarded.

Non-owner backup virtual routers never respond to SSH requests regardless of the **ssh-reply** setting.

The **ssh-reply** command is only available in non-owner **vrrp** nodal context.

By default, SSH requests to the virtual router instance IP addresses are silently discarded.

The **no** form of the command discards all SSH request messages destined to the non-owner virtual router instance IP addresses.

Default **no ssh-reply** — SSH requests to the virtual router instance IP addresses are discarded.

standby-forwarding

Syntax [**no**] **standby-forwarding**

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command specifies whether this VRRP instance allows forwarding packets to a standby router. When disabled, a standby router should not forward traffic sent to virtual router's MAC address. However, the standby router should forward traffic sent to the standby router’s real MAC address. When enabled, a standby router should forward all traffic.

telnet-reply

Syntax [**no**] **telnet-reply**

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command enables the non-owner master to reply to TCP port 23 Telnet requests directed at the virtual router instances’ IP addresses.

Non-owner virtual router instances are limited by the VRRP specifications to responding to ARP requests destined to the virtual router IP addresses and routing IP packets not addressed to the virtual router IP addresses. Many network administrators find this limitation frustrating when troubleshooting VRRP connectivity issues.

This limitation can be disregarded for certain applications. Ping, SSH and Telnet can each be individually enabled or disabled on a per-virtual-router-instance basis.

The **telnet-reply** command enables the non-owner master to reply to Telnet requests directed at the virtual router instances' IP addresses. The Telnet request can be received on any routed interface. Telnet must not have been disabled at the management security level (either on the parental IP interface or based on the Telnet source host address). Proper login and CLI command authentication is still enforced.

When **telnet-reply** is not enabled, Telnet requests to non-owner master virtual IP addresses are silently discarded.

Non-owner backup virtual routers never respond to Telnet requests regardless of the **telnet-reply** setting.

The **telnet-reply** command is only available in non-owner **vrrp** nodal context.

By default, Telnet requests to the virtual router instance IP addresses will be silently discarded.

The **no** form of the command configures discarding all Telnet request messages destined to the non-owner virtual router instance IP addresses.

Default **no telnet-reply** — Telnet requests to the virtual router instance IP addresses are discarded.

traceroute-reply

Syntax [**no**] **traceroute-reply**

Context config>router>if>vrrp
config>router>if>ipv6>vrrp

Description This command is valid only if the VRRP virtual router instance associated with this entry is a non-owner.

When this command is enabled, a non-owner master can reply to traceroute requests directed to the virtual router instance IP addresses.

A non-owner backup virtual router never responds to such traceroute requests regardless of the **traceroute-reply** status.

Default no traceroute-reply

vrrp

Syntax **vrrp** *vrid* [**owner**]
no vrrp *vrid*

Context config>router>interface *ip-int-name*
config>router>if>ipv6

Description This command creates the context to configure a VRRP virtual router instance. A virtual router is defined by its virtual router identifier (VRID) and a set of IP addresses.

The optional **owner** keyword indicates that the **owner** controls the IP address of the virtual router and is responsible for forwarding packets sent to this IP address. The **owner** assumes the role of the master virtual router.

All other virtual router instances participating in this message domain must have the same *vrid* configured and cannot be configured as **owner**. Once created, the **owner** keyword is optional when entering the *vrid* for configuration purposes.

A *vrid* is internally associated with the IP interface. This allows the *vrid* to be used on multiple IP interfaces while representing different virtual router instances.

For IPv4, up to four **vrrp** *vrid* nodes can be configured on a router interface. Each virtual router instance can manage up to 16 backup IP addresses. For IPv6, only one virtual router ID can be configured on a router interface.

The **no** form of the command removes the specified *vrid* from the IP interface. This terminates VRRP participation and deletes all references to the *vrid* in conjunction with the IP interface. The *vrid* does not need to be shutdown to remove the virtual router instance.

Special Cases **Virtual Router Instance Owner IP Address Conditions —** It is possible for the virtual router instance **owner** to be created prior to assigning the parent IP interface primary or secondary IP addresses. When this is the case, the virtual router instance is not associated with an IP address. The operational state of the virtual router instance is down.

VRRP Owner Command Exclusions — By specifying the VRRP *vrid* as **owner**, The following commands are no longer available:

- **vrrp priority —** The virtual router instance **owner** is hard-coded with a **priority** value of 255 and cannot be changed.
- **vrrp master-int-inherit** — Owner virtual router instances do not accept VRRP advertisement messages; the advertisement interval field is not evaluated and cannot be inherited.
- **ping-reply**, **telnet-reply** and **ssh-reply —** The **owner** virtual router instance always allows Ping, Telnet and SSH if the management and security parameters are configured to accept them on the parent IP interface.
- **vrrp shutdown —** The **owner** virtual router instance cannot be shutdown in the **vrrp** node. If this was allowed, VRRP messages would not be sent, but the parent IP interface address would continue to respond to ARPs and forward IP packets. Another virtual router instance may detect the missing master due to the termination of VRRP advertisement messages and become master. This would cause two routers responding to ARP requests for the same IP addresses. To **shutdown** the **owner** virtual router instance, use the **shutdown** command in the parent IP interface context. This will prevent VRRP participation, IP ARP reply and IP forwarding. To continue parent IP interface ARP reply and forwarding without VRRP participation, remove the **vrrp** *vrid* instance.
- traceroute-reply

Default **no vrrp** — No VRRP virtual router instance is associated with the IP interface.

Parameters *vrid* — The virtual router ID for the IP interface expressed as a decimal integer.

Values 1 — 255

owner — Identifies this virtual router instance as owning the virtual router IP addresses. If the **owner** keyword is not specified at the time of *vrid* creation, the **vrrp backup** commands must be specified to define the virtual router IP addresses. The **owner** keyword is not required when entering the *vrid* for editing purposes. Once created as **owner**, a *vrid* on an IP interface cannot have the **owner** parameter removed. The *vrid* must be deleted and than recreated without the **owner** keyword to remove ownership.

Priority Policy Commands

delta-in-use-limit

Syntax **delta-in-use-limit** *in-use-priority-limit*
no delta-in-use-limit

Context config>vrrp>policy *vrrp-policy-id*

Description This command sets a lower limit on the virtual router in-use priority that can be derived from the delta priority control events.

Each *vrrp-priority-id* places limits on the delta priority control events to define the in-use priority of the virtual router instance. Setting this limit prevents the sum of the delta priority events from lowering the in-use priority value of the associated virtual router instances below the configured value.

The limit has no effect on explicit priority control events. Explicit priority control events are controlled by setting the in-use priority to any value between 1 and 254.

Only non-owner virtual router instances can be associated with VRRP priority control policies and their priority control events.

Once the total sum of all delta events is calculated and subtracted from the base **priority** of the virtual router instance, the result is compared to the **delta-in-use-limit** value. If the result is less than the limit, the **delta-in-use-limit** value is used as the virtual router in-use priority value. If an explicit priority control event overrides the delta priority control events, the **delta-in-use-limit** has no effect.

Setting the limit to a higher value than the default of 1 limits the effect of the delta priority control events on the virtual router instance base **priority** value. This allows for multiple priority control events while minimizing the overall effect on the in-use priority.

Changing the *in-use-priority-limit* causes an ediate re-evaluation of the in-use priority values for all virtual router instances associated with this *vrrp-policy-id* based on the current sum of all active delta control policy events.

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

Default **1** — The lower limit of 1 for the in-use priority, as modified, by delta priorty control events.

Parameters *in-use-priority-limit* — The lower limit of the in-use priority base, as modified by priority control policies. The *in-use-priority-limit* has the same range as the non-owner virtual router instance base-priority parameter. If the result of the total delta priority control events minus the virtual router instances base-priority, is less than the *in-use-priority-limit*, the *in-use-priority-limit* value is used as the virtual router instances in-use priority value.

Setting the *in-use-priority-limit* to a value equal to or larger than the virtual router instance *base-priority* prevents the delta priority control events from having any effect on the virtual router instance in-use priority value.

Values 1 — 254

description

Syntax **description** *string*
no description

Context config>vrrp>policy *vrrp-policy-id*

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 the command removes the string from the configuration.

Default none

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.

policy

Syntax **policy** *policy-id* [**context** *service-id*]
no policy *policy-id*

Context config>vrrp

Description This command creates the context to configure a VRRP priority control policy which is used to control the VRRP in-use priority based on priority control events. It is a parental node for the various VRRP priority control policy commands that define the policy parameters and priority event conditions.

The virtual router instance **priority** command defines the initial or base value to be used by non-owner virtual routers. This value can be modified by assigning a VRRP priority control policy to the virtual router instance. The VRRP priority control policy can override or diminish the base priority setting to establish the actual in-use priority of the virtual router instance.

The **policy** *policy-id* command must be created first, before it can be associated with a virtual router instance.

Because VRRP priority control policies define conditions and events that must be maintained, they can be resource intensive. The number of policies is limited to 1000.

The *policy-id* do not have to be consecutive integers. The range of available policy identifiers is from 1 to 9999.

The **no** form of the command deletes the specific *policy-id* from the system.
The *policy-id* must be removed first from all virtual router instances before the **no policy** command can be issued. If the *policy-id* is associated with a virtual router instance, the command will fail.

Default none

Parameters *vrrp-policy-id* — The VRRP priority control ID expressed as a decimal integer that uniquely identifies this policy from any other VRRP priority control policy defined on the system. Up to 1000 policies can be defined.

Values 1 — 9999

context *service-id* **—** Specifies the service ID to which this policy applies. A value of zero (0) means that this policy does not apply to a service but applies to the base router instance.

Values 1 — 2147483647

priority-event

Syntax [**no**] **priority-event**

Context config>vrrp>policy *vrrp-priority-id*

Description This command creates the context to configure VRRP priority control events used to define criteria to modify the VRRP in-use priority.

A priority control event specifies an object to monitor and the effect on the in-use priority level for an associated virtual router instance.

Up to 32 priority control events can be configured within the **priority-event** node.

The **no** form of the command clears any configured priority events.

Priority Policy Event Commands

hold-clear

Syntax **hold-clear** *seconds*
no hold-clear

Context config>vrrp>policy>priority-event>port-down
config>vrrp>policy>priority-event>lag-port-down
config>vrrp>policy>priority-event>route-unknown

Description This command configures the hold clear time for the event. The *seconds* parameter specifies the hold-clear time, the amount of time in seconds by which the effect of a cleared event on the associated virtual router instance is delayed.

The hold-clear time is used to prevent black hole conditions when a virtual router instance advertises itself as a master before other conditions associated with the cleared event have had a chance to enter a forwarding state.

Default no hold-clear

Parameters *seconds* — Specifies the amount of time in seconds by which the effect of a cleared event on the associated virtual router instance is delayed.

Values 0 — 86400

hold-set

Syntax **hold-set** *seconds*
no hold-set

Context config>vrrp>policy>priority-event>host-unreachable
config>vrrp>policy>priority-event>lag-port-down
config>vrrp>policy>priority-event>port-down
config>vrrp>policy>priority-event>route-unknown

Description This command specifies the amount of time that must pass before the set state for a VRRP priority control event event can transition to the cleared state to dampen flapping events. A flapping event continually transitions between clear and set.

The **hold-set** command is used to dampen the effect of a flapping event. The **hold-set** value is loaded into a hold set timer that prevents a set event from transitioning to the cleared state until it expires.

Each time an event transitions between cleared and set, the timer is loaded and begins a countdown to zero. When the timer reaches zero, the event is allowed to enter the cleared state. Entering the cleared state is dependent on the object controlling the event, conforming to the requirements defined in the event itself. It is possible, on some event types, to have another set action reload the hold-set timer. This extends the amount of time that must expire before entering the cleared state.

Once the hold set timer expires and the event meets the cleared state requirements or is set to a lower threshold, the current set effect on the virtual router instances in-use priority can be removed. As with **lag-port-down** events, this may be a decrease in the set effect if the *clearing* amounts to a lower set threshold.

The **hold-set** command can be executed at anytime. If the hold-set timer value is configured larger than the new *seconds* setting, the timer is loaded with the new **hold-set** value.

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

Default 0 — The hold-set timer is disabled so event transitions are processed ediately.

Parameters *seconds* — The number of seconds that the hold set timer waits after an event enters a set state or enters a higher threshold set state, depending on the event type.

The value of 0 disables the hold set timer, preventing any delay in processing lower set thresholds or cleared events.

Values 0 — 86400

priority

Syntax **priority** *priority-level* [{**delta** | **explicit**}]
no priority

Context config>vrrp>policy>priority-event>host-unreachable *ip-addr*
config>vrrp>policy>priority-event>lag-port-down *lag-id*>number-down *number-of-lag-ports-down*
config>vrrp>policy>priority-event>port-down *port-id*[.*channel-id*]
config>vrrp>policy>priority-event>route-unknown *prefix*/*mask-length*

Description This command controls the effect the set event has on the virtual router instance in-use priority.

When the event is set, the *priority-level* is either subtracted from the base priority of each virtual router instance or it defines the explicit in-use priority value of the virtual router instance depending on whether the **delta** or **explicit** keywords are specified.

Multiple set events in the same policy have interaction constraints:

- If any set events have an explicit **priority** value, all the delta **priority** values are ignored.
- The set event with the lowest explicit **priority** value defines the in-use priority that are used by all virtual router instances associated with the policy.
- If no set events have an explicit **priority** value, all the set events delta **priority** values are added and subtracted from the base priority value defined on each virtual router instance associated with the policy.
- If the delta priorities sum exceeds the **delta-in-use-limit** parameter, then the **delta-in-use-limit** parameter is used as the value subtracted from the base priority value defined on each virtual router instance associated with the policy.

If the **priority** command is not configured on the priority event, the *priority-value* defaults to 0 and the qualifier keyword defaults to **delta**, thus, there is no impact on the in-use priority.

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

Default 0 delta — The set event will subtract 0 from the base priority (no effect).

Parameters *priority-level* — The priority level adjustment value expressed as a decimal integer.

Values 0 — 254

delta | **explicit —** Configures what effect the *priority-level* will have on the base priority value.

When **delta** is specified, the *priority-level* value is subtracted from the associated virtual router instance's base priority when the event is set and no explicit events are set. The sum of the priority event *priority-level* values on all set delta priority events are subtracted from the virtual router base priority to derive the virtual router instance in-use priority value. If the **delta** priority event is cleared, the *priority-level* is no longer used in the in-use priority calculation.

When **explicit** is specified, the *priority-level* value is used to override the base priority of the virtual router instance if the priority event is set and no other **explicit** priority event is set with a lower *priority-level*. The set **explicit** priority value with the lowest *priority-level* determines the actual in-use protocol value for all virtual router instances associated with the policy.

Default **delta**

Values delta, explicit

mc-ipsec-non-forwarding

Syntax [**no**] **mc-ipsec-non-forwarding** *tunnel-grp-id*

Context config>vrrp>policy>priority-event

Description Thic command configures an instance of a multi-chassis IPsec tunnel-group Priority Event used to override the base priority value of a VRRP virtual router instance depending on the operational state of the event.

Parameters *tunnel-grp-id* — Identifies the multi-chassis IPSec tunnel group whose non-forwarding state is monitored by this priority control event.

Priority Policy Port Down Event Commands

port-down

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

Context config>vrrp>policy>priority-event

Description This command configures a port down priority control event that monitors the operational state of a port or SONET/SDH channel. When the port or channel enters the operational down state, the event is considered set. When the port or channel enters the operational up state, the event is considered cleared.

Multiple unique **port-down** event nodes can be configured within the **priority-event** context up to the overall limit of 32 events. Up to 32 events can be defined in any combination of types.

The **port-down** command can reference an arbitrary port or channel . The port or channel does not need to be pre-provisioned or populated within the system. The operational state of the **port-down** event is set as follows:

- Set – non-provisioned
- Set – not populated
- Set – down
- Cleared – up

When the port or channel is provisioned, populated, or enters the operationally up or down state, the event operational state is updated appropriately.

When the event enters the operationally down, non-provisioned, or non-populated state, the event is considered to be set. When an event transitions from clear to set, the set is processed ediately and must be reflected in the associated virtual router instances in-use priority value. As the event transitions from cleared to set, a hold set timer is loaded with the value configured by the events **hold-set** command. This timer prevents the event from clearing until it expires, damping the effect of event flapping. If the event clears and becomes set again before the hold set timer expires, the timer is reset to the **hold-set** value, extending the time before another clear can take effect.

When the event enters the operationally up state, the event is considered to be cleared. Once the events **hold-set** expires, the effects of the events **priority** value are ediately removed from the in-use priority of all associated virtual router instances.

The actual effect on the virtual router instance in-use priority value depends on the defined event priority and its delta or explicit nature.

The **no** form of the command deletes the specific port or channel monitoring event. The event may be removed at anytime. When the event is removed, the in-use priority of all associated virtual router instances will be re-evaluated. The events **hold-set** timer has no effect on the removal procedure.

Default **no port-down** — No port down priority control events are defined.

Parameters *port-id* — The port ID of the port monitored by the VRRP priority control event.

The *port-id* can only be monitored by a single event in this policy. The port can be monitored by multiple VRRP priority control policies. A port and a specific channel on the port are considered to be separate entities. A port and a channel on the port can be monitored by separate events in the same policy.

Values	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, ppp
			bundle-num	1 —256
		ccag-id	ccag-*id*. *path-id*[*cc-type*]	
			ccag	keyword
			id	1 — 8
			path-id	a, b
			cc-type	.sap-net, .net-sap

The POS channel on the port monitored by the VRRP priority control event. The *port-id*.*channel-id* can only be monitored by a single event in this policy. The channel can be monitored by multiple VRRP priority control policies. A port and a specific channel on the port are considered to be separate entities. A port and a channel on the port can be monitored by separate events in the same policy.

If the port is provisioned, but the *channel* does not exist or the port has not been populated, the appropriate event operational state is Set – non-populated.

If the port is not provisioned, the event operational state is Set – non-provisioned.

If the POS interface is configured as a clear-channel, the *channel-id* is 1 and the channel bandwidth is the full bandwidth of the port.

Priority Policy LAG Events Commands

lag-port-down

Syntax [**no**] **lag-port-down** *lag-id*

Context config>vrrp>policy>priority-event

Description This command creates the context to configure Link Aggregation Group (LAG) priority control events that monitor the operational state of the links in the LAG.

The **lag-port-down** command configures a priority control event. The event monitors the operational state of each port in the specified LAG. When one or more of the ports enter the operational down state, the event is considered to be set. When all the ports enter the operational up state, the event is considered to be clear. As ports enter the operational up state, any previous set threshold that represents more down ports is considered cleared, while the event is considered to be set.

Multiple unique **lag-port-down** event nodes can be configured within the **priority-event** node up to the maximum of 32 events.

The **lag-port-down** command can reference an arbitrary LAG. The *lag-id* does have to already exist within the system. The operational state of the **lag-port-down** event will indicate:

- Set – non-existent
- Set – one port down
- Set – two ports down
- Set – three ports down
- Set – four ports down
- Set – five ports down
- Set – six ports down
- Set – seven ports down
- Set – eight ports down
- Cleared – all ports up

When the *lag-id* is created, or a port in *lag-id* becomes operationally up or down, the event operational state must be updated appropriately.

When one or more of the LAG composite ports enters the operationally down state or the *lag-id* is deleted or does not exist, the event is considered to be set. When an event transitions from clear to set, the set is processed ediately and must be reflected in the associated virtual router instances in-use priority value. As the event transitions from clear to set, a hold set timer is loaded with the value configured by the events **hold-set** command. This timer prevents the event from clearing until it expires, damping the effect of event flapping. If the event clears and becomes set again before the hold set timer expires, the timer is reset to the **hold-set** value, extending the time before another clear can take effect.

The **lag-port-down** event is considered to have a tiered event set state. While the priority impact per number of ports down is totally configurable, as more ports go down, the effect on the associated virtual router instances in-use priority is expected to increase (lowering the priority). When each configured threshold is crossed, any higher thresholds are considered further event sets and are processed ediately with the hold set timer reset to the configured value of the **hold-set** command. As the thresholds are crossed in the opposite direction (fewer ports down then previously), the priority effect of the event is not processed until the hold set timer expires. If the number of ports down threshold again increases before the hold set timer expires, the timer is only reset to the **hold-set** value if the number of ports down is equal to or greater than the threshold that set the timer.

The event contains **number-down** nodes that define the priority delta or explicit value to be used based on the number of LAG composite ports that are in the operationally down state. These nodes represent the event set thresholds. Not all port down thresholds must be configured. As the number of down ports increase, the **number-down** *ports-down* node that expresses a value equal to or less than the number of down ports describes the delta or explicit priority value to be applied.

The **no** form of the command deletes the specific LAG monitoring event. The event can be removed at anytime. When the event is removed, the in-use priority of all associated virtual router instances must be reevaluated. The events **hold-set** timer has no effect on the removal procedure.

Default no lag-port-down — No LAG priority control events are created.

Parameters *lag-id* — The LAG ID that the specific event is to monitor expressed as a decimal integer. The *lag-id* can only be monitored by a single event in this policy. The LAG may be monitored by multiple VRRP priority control policies. A port within the LAG and the LAG ID itself are considered to be separate entities. A composite port may be monitored with the **port-down** event while the *lag-id* the port is in is monitored by a **lag-port-down** event in the same policy.

Values 1 — 200

number-down

Syntax [**no**] **number-down** *number-of-lag-ports-down*

Context config>vrrp>policy>priority-event>lag-port-down *lag-id*

Description This command creates a context to configure an event set threshold within a lag-port-down priority control event.

The **number-down** command defines a sub-node within the **lag-port-down** event and is uniquely identified with the *number-of-lag-ports-down* parameter. Each **number-down** node within the same **lag-port-down** event node must have a unique *number-of-lag-ports-down* value. Each **number-down** node has its own **priority** command that takes effect whenever that node represents the current threshold.

The total number of sub-nodes (uniquely identified by the *number-of-lag-ports-down* parameter) allowed in a single **lag-port-down** event is equal to the total number of possible physical ports allowed in a LAG.

A **number-down** node is not required for each possible number of ports that could be down. The active threshold is always the closest lower threshold. When the number of ports down equals a given threshold, that is the active threshold.

The **no** form of the command deletes the event set threshold. The threshold may be removed at any time. If the removed threshold is the current active threshold, the event set thresholds must be re-evaluated after removal.

Default no number-down — No threshold for the LAG priority event is created.

Parameters *number-of-lag-ports-down* — The number of LAG ports down to create a set event threshold. This is the active threshold when the number of down ports in the LAG equals or exceeds *number-of-lag-ports-down*, but does not equal or exceed the next highest configured *number-of-lag-ports-down*.

Values 1 — 64 (for 64-link LAG)
1 — 32 (for other LAGs)

Priority Policy Host Unreachable Event Commands

drop-count

Syntax **drop-count** *consecutive-failures*
no drop-count

Context config>vrrp *vrrp-policy-id*>priority-event>host-unreachable *ip-addr*

Description This command configures the number of consecutively sent ICMP echo request messages that must fail before the host unreachable priority control event is set.

The **drop-count** command is used to define the number of consecutive message send attempts that must fail for the **host-unreachable** priority event to enter the set state. Each unsuccessful attempt increments the event's consecutive message drop counter. With each successful attempt, the event's consecutive message drop counter resets to zero.

If the event's consecutive message drop counter reaches the **drop-count** value, the **host-unreachable** priority event enters the set state.

The event's **hold-set** value defines how long the event must stay in the set state even when a successful message attempt clears the consecutive drop counter. The event is not cleared until the consecutive drop counter is less than the **drop-count** value and the **hold-set** timer has a value of zero (expired).

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

Default 3 — 3 consecutive ICMP echo request failures are required before the host unreachable priority control event is set.

Parameters *consecutive-failures* — The number of ICMP echo request message attempts that must fail for the event to enter the set state. It also defines the threshold so a lower consecutive number of failures can clear the event state.

Values 1 — 60

host-unreachable

Syntax [**no**] **host-unreachable** *ip-address*
[**no**] **host-unreachable** *ipv6-address*

Context config>vrrp>policy>priority-event

Description This command creates the context to configure a host unreachable priority control event to monitor the ability to receive ICMP echo reply packets from an IP host address.

A host unreachable priority event creates a continuous ICMP echo request (ping) probe to the specified *ip-address*. If a ping fails, the event is considered to be set. If a ping is successful, the event is considered to be cleared.

Multiple unique (different *ip-address*) **host-unreachable** event nodes can be configured within the **priority-event** node to a maximum of 32 events.

The **host-unreachable** command can reference any valid local or remote IP address. The ability to ARP a local IP address or find a remote IP address within a route prefix in the route table is considered part of the monitoring procedure. The **host-unreachable** priority event operational state tracks ARP or route table entries dynamically appearing and disappearing from the system. The operational state of the **host-unreachable** event can be one of the following:

Host Unreachable Operational State	Description
Set – no ARP	No ARP address found for *ip-addr* for **drop-count** consecutive attempts. Only applies when IP address is considered local.
Set – no route	No route exists for *ip-addr* for **drop-count** consecutive attempts. Only when IP address is considered remote.
Set – host unreachable	ICMP host unreachable message received for **drop-count** consecutive attempts.
Set – no reply	ICMP echo request timed out for **drop-count** consecutive attempts.
Set – reply received	Last ICMP echo request attempt received an echo reply but historically not able to clear the event.
Cleared – no ARP	No ARP address found for *ip-addr* - not enough failed attempts to set the event.
Cleared – no route	No route exists for *ip-addr* - not enough failed attempts to set the event.
Cleared – host unreachable	ICMP host unreachable message received - not enough failed attempts to set the event.
Cleared – no reply	ICMP echo request timed out - not enough failed attempts to set the event.
Cleared – reply received	Event is cleared - last ICMP echo request received an echo reply.

Unlike other priority event types, the **host-unreachable** priority event monitors a repetitive task. A historical evaluation is performed on the success rate of receiving ICMP echo reply messages. The operational state takes its cleared and set orientation from the historical success rate. The informational portion of the operational state is derived from the last attempt's result. It is possible for the previous attempt to fail while the operational state is still cleared due to an insufficient number of failures to cause it to become set. It is also possible for the state to be set while the previous attempt was successful.

When an event transitions from clear to set, the set is processed ediately and must be reflected in the associated virtual router instances in-use priority value. As the event transitions from clear to set, a hold set timer is loaded with the value configured by the events **hold-set** command. This timer prevents the event from clearing until it expires, damping the effect of event flapping. If the event clears and becomes set again before the hold set timer expires, the timer is reset to the **hold-set** value, extending the time before another clear can take effect.

The hold-set timer be expired and the historical success rate must be met prior to the event operational state becoming cleared.

The **no** form of the command deletes the specific IP host monitoring event. The event may be deleted at anytime. When the event is deleted, the in-use priority of all associated virtual router instances must be reevaluated. The event's **hold-set** timer has no effect on the removal procedure.

Default **no host-unreachable** — No host unreachable priority events are created.

Parameters *ip-addr* — The IP address of the host for which the specific event will monitor connectivity. The *ip-addr* can only be monitored by a single event in this policy. The IP address can be monitored by multiple VRRP priority control policies. The IP address can be used in one or multiple **ping** requests. Each VRRP priority control **host-unreachable** and **ping** destined to the same *ip-addr* is uniquely identified on a per message basis. Each session originates a unique identifier value for the ICMP echo request messages it generates. This allows received ICMP echo reply messages to be directed to the appropriate sending application.

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

Note that the link-local IPv6 address must have an interface name specified. The global IPv6 address must not have an interface name specified.

interval

Syntax **interval** *seconds*
no interval

Context config>vrrp>priority-event>host-unreachable

Description This command configures the number of seconds between host unreachable priority event ICMP echo request messages directed to the host IP address.

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

Default 1

Parameters *seconds* — The number of seconds between the ICMP echo request messages sent to the host IP address for the host unreachable priority event.

Values 1 — 60

padding-size

Syntax **padding-size** *size*
no padding-size

Context config>vrrp>priority-event>host-unreachable

Description This command allows the operator to increase the size of IP packet by padding the PDU.

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

Default 0

Parameters *size* — Specifies amount of increase to to ICMP PDU.

Values 0 — 16384

timeout

Syntax **timeout** *seconds*
no timeout

Context config>vrrp *vrrp-policy-id*>priority-event>host-unreachable *ip-addr*

Description This command defines the time, in seconds, that must pass before considering the far-end IP host unresponsive to an outstanding ICMP echo request message.

The **timeout** value is not directly related to the configured **interval** parameter. The **timeout** value may be larger, equal, or smaller, relative to the **interval** value.

If the **timeout** value is larger than the **interval** value, multiple ICMP echo request messages may be outstanding. Every ICMP echo request message transmitted to the far end host is tracked individually according to the message identifier and sequence number.

With each consecutive attempt to send an ICMP echo request message, the timeout timer is loaded with the **timeout** value. The timer decrements until:

- An internal error occurs preventing message sending (request unsuccessful).
- An internal error occurs preventing message reply receiving (request unsuccessful).
- A required route table entry does not exist to reach the IP address (request unsuccessful).
- A required ARP entry does not exist and ARP request timed out (request unsuccessful).
- A valid reply is received (request successful).

Note that it is possible for a required ARP request to succeed or timeout after the message timeout timer expires. In this case, the message request is unsuccessful.

If an ICMP echo reply message is not received prior to the **timeout** period for a given ICMP echo request, that request is considered to be dropped and increments the consecutive message drop counter for the priority event.

If an ICMP echo reply message with the same sequence number as an outstanding ICMP echo request message is received prior to that message timing out, the request is considered successful. The consecutive message drop counter is cleared and the request message no longer is outstanding.

If an ICMP Echo Reply message with a sequence number equal to an ICMP echo request sequence number that had previously timed out is received, that reply is silently discarded while incrementing the priority event reply discard counter.

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

Default 1

Parameters *seconds* — The number of seconds before an ICMP echo request message is timed out. Once a message is timed out, a reply with the same identifier and sequence number is discarded.

Values 1 — 60

Priority Policy Route Unknown Event Commands

less-specific

Syntax [**no**] **less-specific** [**allow-default**]

Context config>vrrp>policy>priority-event>route-unknown *prefix/mask-length*

Description This command allows a CIDR shortest match hit on a route prefix that contains the IP route prefix associated with the route unknown priority event.

The **less-specific** command modifies the search parameters for the IP route prefix specified in the **route-unknown** priority event. Specifying **less-specific** allows a CIDR shortest match hit on a route prefix that contains the IP route prefix.

The **less-specific** command eases the RTM lookup criteria when searching for the *prefix/mask-length*. When the **route-unknown** priority event sends the prefix to the RTM (as if it was a destination lookup), the result route table prefix (if a result is found) is checked to see if it is an exact match or a less specific match. The **less-specific** command enables a less specific route table prefix to match the configured prefix. When **less-specific** is not specified, a less specific route table prefix fails to match the configured prefix. The **allow-default** optional parameter extends the **less-specific** match to include the default route (0.0.0.0).

The **no** form of the command prevents RTM lookup results that are less specific than the route prefix from matching.

Default no less-specific — The route unknown priority events requires an exact prefix/mask match.

Parameters **allow-default —** When the **allow-default** parameter is specified with the **less-specific** command, an RTM return of 0.0.0.0 matches the IP prefix. If **less-specific** is entered without the **allow-default** parameter, a return of 0.0.0.0 will not match the IP prefix. To disable **allow-default**, but continue to allow **less-specific** match operation, only enter the **less-specific** command (without the **allow-default** parameter).

next-hop

Syntax [**no**] **next-hop** *ip-address*

Context config>vrrp>policy>priority-event>route-unknown *prefix/mask-length*

Description This command adds an allowed next hop IP address to match the IP route prefix for a route-unknown priority control event.

If the next-hop IP address does not match one of the defined *ip-address*, the match is considered unsuccessful and the **route-unknown** event transitions to the set state.

The **next-hop** command is optional. If no **next-hop** *ip-address* commands are configured, the comparison between the RTM prefix return and the **route-unknown** IP route prefix are not included in the next hop information.

When more than one next hop IP addresses are eligible for matching, a **next-hop** command must be executed for each IP address. Defining the same IP address multiple times has no effect after the first instance.

The **no** form of the command removes the *ip-address* from the list of acceptable next hops when looking up the **route-unknown** prefix. If this *ip-address* is the last next hop defined on the **route-unknown** event, the returned next hop information is ignored when testing the match criteria. If the *ip-address* does not exist, the **no next-hop** command returns a warning error, but continues to execute if part of an **exec** script.

Default no next-hop — No next hop IP address for the route unknown priority control event is defined.

Parameters *ip-address* — The IP address for an acceptable next hop IP address for a returned route prefix from the RTM when looking up the **route-unknown** route prefix.

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

Note that the link-local IPv6 address must have an interface name specified. The global IPv6 address must not have an interface name specified.

protocol

Syntax **protocol** {**bgp** | **bgp-vpn** | **ospf** | **is-is** | **rip** | **static**}
no protocol

Context config>vrrp>policy>priority-event>route-unknown *prefix/mask-length*

Description This command adds one or more route sources to match the route unknown IP route prefix for a route unknown priority control event.

If the route source does not match one of the defined protocols, the match is considered unsuccessful and the **route-unknown** event transitions to the set state.

The **protocol** command is optional. If the **protocol** command is not executed, the comparison between the RTM prefix return and the **route-unknown** IP route prefix will not include the source of the prefix. The **protocol** command cannot be executed without at least one associated route source parameter. All parameters are reset each time the **protocol** command is executed and only the explicitly defined protocols are allowed to match.

The **no** form of the command removes protocol route source as a match criteria for returned RTM route prefixes.

To remove specific existing route source match criteria, execute the **protocol** command and include only the specific route source criteria. Any unspecified route source criteria is removed.

Default no protocol — No route source for the route unknown priority event is defined.

Parameters **bgp —** This parameter defines BGP as an eligible route source for a returned route prefix from the RTM when looking up the **route-unknown** route prefix. The **bgp** parameter is not exclusive from the other available **protocol** parameters. If **protocol** is executed without the **bgp** parameter, a returned route prefix with a source of BGP will not be considered a match and will cause the event to enter the set state.

bgp-vpn — This parameter defines **bgp-vpn** as an eligible route source for a returned route prefix from the RTM when looking up the **route-unknown** route prefix. The **bgp-vpn** parameter is not exclusive from the other available **protocol** parameters. If **protocol** is executed without the **bgp-vpn** parameter, a returned route prefix with a source of **bgp-vpn** will not be considered a match and will cause the event to enter the set state.

ospf — This parameter defines OSPF as an eligible route source for a returned route prefix from the RTM when looking up the **route-unknown** route prefix. The **ospf** parameter is not exclusive from the other available **protocol** parameters. If **protocol** is executed without the **ospf** parameter, a returned route prefix with a source of OSPF will not be considered a match and will cause the event to enter the set state.

is-is — This parameter defines IS-IS as an eligible route source for a returned route prefix from the RTM when looking up the **route-unknown** route prefix. The **is-is** parameter is not exclusive from the other available **protocol** parameters. If **protocol** is executed without the **is-is** parameter, a returned route prefix with a source of IS-IS will not be considered a match and will cause the event to enter the set state.

rip — This parameter defines RIP as an eligible route source for a returned route prefix from the RTM when looking up the **route-unknown** route prefix. The **rip** parameter is not exclusive from the other available **protocol** parameters. If **protocol** is executed without the **rip** parameter, a returned route prefix with a source of RIP will not be considered a match and will cause the event to enter the set state.

static — This parameter defines a static route as an eligible route source for a returned route prefix from the RTM when looking up the **route-unknown** route prefix. The **static** parameter is not exclusive from the other available **protocol** parameters. If **protocol** is executed without the **static** parameter, a returned route prefix with a source of static route will not be considered a match and will cause the event to enter the set state.

route-unknown

Syntax [**no**] **route-unknown** *prefix***/***mask-length*

Context config>vrrp>policy>priority-event

Description This command creates a context to configure a route unknown priority control event that monitors the existence of a specific active IP route prefix within the routing table.

The **route-unknown** command configures a priority control event that defines a link between the VRRP priority control policy and the Route Table Manager (RTM). The RTM registers the specified route prefix as monitored by the policy. If any change (add, delete, new next hop) occurs relative to the prefix, the policy is notified and takes proper action according to the priority event definition. If the route prefix exists and is active in the routing table according to the conditions defined, the event is in the cleared state. If the route prefix is removed, becomes inactive or fails to meet the event criteria, the event is in the set state.

The command creates a **route-unknown** node identified by *prefix/mask-length* and containing event control commands.

Multiple unique (different *prefix/mask-length*) **route-unknown** event nodes can be configured within the **priority-event** node up to the maximum limit of 32 events.

The **route-unknown** command can reference any valid IP addres mask-length pair. The IP address and associated mask length define a unique IP router prefix. The dynamic monitoring of the route prefix results in one of the following event operational states:

route-unknown Operational State	Description
Set – non-existent	The route does not exist in the route table.
Set – inactive	The route exists in the route table but is not being used.
Set – wrong next hop	The route exists in the route table but does not meet the **next-hop** requirements.
Set – wrong protocol	The route exists in the route table but does not meet the **protocol** requirements.
Set – less specific found	The route exists in the route table but does is not an exact match and does not meet any **less-specific** requirements.
Set – default best match	The route exists in the route table as the default route but the default route is not allowed for route matching.
Cleared – less specific found	A less specific route exists in the route table and meets all criteria including the **less-specific** requirements.
Cleared – found	The route exists in the route table manager and meets all criteria.

An existing route prefix in the RTM must be active (used by the IP forwarding engine) to clear the event operational state. It may be less specific (the defined prefix may be contained in a larger prefix according to Classless Inter-Domain Routing (CIDR) techniques) if the event has the **less-specific** statement defined. The less specific route that incorporates the router prefix may be the default route (0.0.0.0) if the **less-specific allow-default** statement is defined. The matching prefix may be required to have a specific next hop IP address if defined by the event **next-hop** command. Finally, the source of the RTM prefix may be required to be one of the dynamic routing protocols or be statically defined if defined by the event **protocol** command. If an RTM prefix is not found that matches all the above criteria (if defined in the event control commands), the event is considered to be set. If a matching prefix is found in the RTM, the event is considered to be cleared.

When an event transitions from clear to set, the set is processed ediately and must be reflected in the associated virtual router instances in-use priority value. As the event transitions from clear to set, a hold set timer is loaded with the value configured by the events **hold-set** command. This timer prevents the event from clearing until it expires, damping the effect of event flapping. If the event clears and becomes set again before the hold set timer expires, the timer is reset to the **hold-set** value, extending the time before another clear can take effect.

The **no** form of the command is used to remove the specific *prefix/mask-length* monitoring event. The event can be removed at anytime. When the event is removed, the in-use priority of all associated virtual router instances must be reevaluated. The events **hold-set** timer has no effect on the removal procedure.

Default **no route-unknown** — No route unknown priority control events are defined for the priority control event policy.

Parameters *prefix* — The IP prefix address to be monitored by the route unknown priority control event in dotted decimal notation.

Values 0.0.0.0 — 255.255.255.255

mask-length — The subnet mask length expressed as a decimal integer associated with the IP *prefix* defining the route prefix to be monitored by the route unknown priority control event.

Values 0 — 32

ip-address — The IP address of the host for which the specific event will monitor connectivity. The *ip-addr* can only be monitored by a single event in this policy. The IP address can be monitored by multiple VRRP priority control policies. The IP address can be used in one or multiple **ping** requests. Each VRRP priority control **host-unreachable** and **ping** destined to the same *ip-addr* is uniquely identified on a per message basis. Each session originates a unique identifier value for the ICMP echo request messages it generates. This allows received ICMP echo reply messages to be directed to the appropriate sending application.

Values *ip-prefix/mask*: ip-prefix a.b.c.d (host bits must be 0)
mask 0 — 32
ipv6-address/*prefix*:
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
prefix-length 1 — 128

Show Commands

instance

Syntax **instance**
instance [**interface** *interface-name* [**vrid** *virtual-router-id*]
instance interface *interface-name* **vrid** *virtual-router-id* **ipv6**

Context show>vrrp

Description This command displays information for VRRP instances.

If no command line options are specified, summary information for all VRRP instances displays.

Parameters **interface** *ip-int-name* **—** Displays detailed information for the VRRP instances on the specified IP interface including status and statistics.

Default Summary information for all VRRP instances.

vrid *virtual-router-id* **—** Displays detailed information for the specified VRRP instance on the IP interface.

Default All VRIDs for the IP interface.

Values 1 — 255

ipv6 — Specifies the IPv6 instance.

Output **VRRP Instance Output —** The following table describes the instance command output fields for VRRP.

Label	Description
`Interface name`	The name of the IP interface.
`VR ID`	The virtual router ID for the IP interface
`Own` `Owner`	`Yes` — Specifies that the virtual router instance as owning the virtual router IP addresses.
	`No` — Indicates that the virtual router instance is operating as a non-owner.
`Adm`	`Up` — Indicates that the administrative state of the VRRP instance is up.
	`Down` — Indicates that the administrative state of the VRRP instance is down.
`Opr`	`Up` — Indicates that the operational state of the VRRP instance is up.
	`Down` — Indicates that the operational state of the VRRP instance is down.

Label	Description (Continued)
`State`	When owner, **backup** defines the IP addresses that are advertised within VRRP advertisement messages. When non-owner, **backup** actually creates an IP interface IP address used for routing IP packets and communicating with the system when the access commands are defined (ping-reply, telnet-reply, and ssh-reply).
`Pol Id`	The value that uniquely identifies a Priority Control Policy.
`Base Priority`	The *base-priority* value used to derive the in-use priority of the virtual router instance as modified by any optional VRRP priority control policy.
`InUse Priority`	The current in-use priority associated with the VRRP virtual router instance.
`Msg Int`	The administrative advertisement message timer used by the master virtual router instance to send VRRP advertisement messages and to derive the master down timer as backup.
`Inh Int`	`Yes` — When the VRRP instance is a non-owner and is operating as a backup and the **master-int-inherit** command is enabled, the master down timer is indirectly derived from the value in the advertisement interval field of the VRRP message received from the current master. `No` — When the VRRP instance is operating as a backup and the **master-int-inherit** command is *not* enabled, the configured advertisement interval is matched against the value in the advertisement interval field of the VRRP message received from the current master. If the two values do not match then the VRRP advertisement is discarded. If the VRRP instance is operating as a master, this value has no effect.
`Backup Addr`	The backup virtual router IP address.
`BFD`	Indicates BFD is enabled.
`VRRP State`	Specifies whether the VRRP instance is operating in a master or backup state.
`Policy ID`	The VRRP priority control policy associated with the VRRP virtual router instance. A value of 0 indicates that no control policy policy is associated with the virtual router instance.
`Preempt Mode`	`Yes` — The preempt mode is enabled on the virtual router instance where it will preempt a VRRP master with a lower priority. `No` — The preempt mode is disabled and prevents the non-owner virtual router instance from preempting another, less desirable virtual router.

Label	Description (Continued)
Ping Reply	Yes — A non-owner master is enabled to reply to ICMP Echo requests directed to the virtual router instance IP addresses. Ping Reply is valid only if the VRRP virtual router instance associated with this entry is a non-owner. A non-owner backup virtual router never responds to such ICMP echo requests irrespective if Ping Reply is enabled. No — ICMP echo requests to the virtual router instance IP addresses are discarded.
Telnet Reply	Yes — Non-owner masters can to reply to TCP port 23 Telnet requests directed at the virtual router instances IP addresses. No — Telnet requests to the virtual router instance IP addresses are discarded.
SSH Reply	Yes — Non-owner masters can to reply to SSH requests directed at the virtual router instances IP addresses. No — All SSH request messages destined to the non-owner virtual router instance IP addresses are discarded.
Primary IP of Master	The IP address of the VRRP master.
Primary IP	The IP address of the VRRP owner.
Up Time	The date and time when the operational state of the event last changed.
Virt MAC Addr	The virtual MAC address used in ARP responses when the VRRP virtual router instance is operating as a master.
Auth Type	Specifies the VRRP authentication Type 0 (no authentication), Type 1 (simple password), or Type 2 (MD5) for the virtual router.
Addr List Mismatch	Specifies whether a trap was generated when the IP address list received in the advertisement messages received from the current master did not match the configured IP address list. This is an edge triggered notification. A second trap will not be generated for a packet from the same master until this event has been cleared.
Master Priority	The priority of the virtual router instance which is the current master.
Master Since	The date and time when operational state of the virtual router changed to master. For a backup virtual router, this value specifies the date and time when it received the first VRRP advertisement message from the virtual router which is the current master.

Sample Output

```
*A:ALA-A# show router vrrp instance
===============================================================================
VRRP Instances
===============================================================================
Interface Name                   VR Id Own Adm  State       Base Pri   Msg Int
                                 IP        Opr  Pol Id      InUse Pri  Inh Int
-------------------------------------------------------------------------------
n2                               1     No  Up   Master       100       1
                                 IPv4      Up   n/a         100        No
  Backup Addr: 5.1.1.10
n2                               10    No  Up   Master       100       1.0
                                 IPv6      Up   n/a         100        Yes
  Backup Addr: 5::10
               FE80::10
-------------------------------------------------------------------------------
Instances : 2
===============================================================================
*A:ALA-A#


*A:ALA-A# show router vrrp instance interface n2 vrid 1
===============================================================================
VRRP Instance 1 for interface "n2"
===============================================================================
Owner               : No                  VRRP State        : Master
Primary IP of Master: 5.1.1.2 (Self)
Primary IP          : 5.1.1.2             Standby-Forwarding: Disabled
VRRP Backup Addr    : 5.1.1.10
Admin State         : Up                  Oper State        : Up
Up Time             : 09/23/2004 06:53:45 Virt MAC Addr     : 00:00:5e:00:01:01
Auth Type           : None
Config Mesg Intvl   : 1                   In-Use Mesg Intvl : 1
Master Inherit Intvl: No
Base Priority       : 100                 In-Use Priority   : 100
Policy ID           : n/a                 Preempt Mode      : Yes
Ping Reply          : No                  Telnet Reply      : No
SSH Reply           : No                  Traceroute Reply  : No
Init Delay          : 0                   Init Timer Expires: 0.000 sec
Creation State      : Active
-------------------------------------------------------------------------------
Master Information
-------------------------------------------------------------------------------
Primary IP of Master: 5.1.1.2 (Self)
Addr List Mismatch  : No                  Master Priority   : 100
Master Since        : 09/23/2004 06:53:49
-------------------------------------------------------------------------------
Masters Seen (Last 32)
-------------------------------------------------------------------------------
Primary IP of Master   Last Seen             Addr List Mismatch     Msg Count
-------------------------------------------------------------------------------
5.1.1.2                09/23/2004 06:53:49   No                             0
-------------------------------------------------------------------------------
Statistics
-------------------------------------------------------------------------------
Become Master       : 1                   Master Changes    : 1
Adv Sent            : 103                 Adv Received      : 0
Pri Zero Pkts Sent  : 0                   Pri Zero Pkts Rcvd: 0
Preempt Events      : 0                   Preempted Events  : 0
Mesg Intvl Discards : 0                   Mesg Intvl Errors : 0
```

```
Addr List Discards  : 0                   Addr List Errors  : 0
Auth Type Mismatch  : 0                   Auth Failures     : 0
Invalid Auth Type   : 0                   Invalid Pkt Type  : 0
IP TTL Errors       : 0                   Pkt Length Errors : 0
Total Discards      : 0
===============================================================================
*A:ALA-A#


*A:ALA-A# show router vrrp instance interface n2 vrid 1 ipv6
===============================================================================
VRRP Instance 1 for interface "n2"
===============================================================================
No Matching Entries
===============================================================================
*A:ALA-A#


*A:ALA-A# show router vrrp instance interface n2 vrid 10 ipv6
===============================================================================
VRRP Instance 10 for interface "n2"
===============================================================================
Owner               : No                  VRRP State        : Master
Primary IP of Master: FE80::1 (Self)
Primary IP          : FE80::1
                                          Standby-Forwarding: Disabled
VRRP Backup Addr    : 5::10
                    : FE80::10
Admin State         : Up                  Oper State        : Up
Up Time             : 09/23/2004 06:55:12 Virt MAC Addr     : 00:00:5e:00:02:0a
Config Mesg Intvl   : 1.0                 In-Use Mesg Intvl : 1.0
Master Inherit Intvl: Yes
Base Priority       : 100                 In-Use Priority   : 100
Policy ID           : n/a                 Preempt Mode      : Yes
Ping Reply          : No                  Telnet Reply      : No
                                          Traceroute Reply  : No
Init Delay          : 0                   Init Timer Expires: 0.000 sec
Creation State      : Active
-------------------------------------------------------------------------------
Master Information
-------------------------------------------------------------------------------
Primary IP of Master: FE80::1 (Self)
Addr List Mismatch  : No                  Master Priority   : 100
Master Since        : 09/23/2004 06:55:16
=============================================================================
Masters Seen (Last 32)
===============================================================================
Primary IP of Master
                       Last Seen             Addr List Mismatch     Msg Count
-------------------------------------------------------------------------------
FE80::1
                       09/23/2004 06:55:16   No                             0
-------------------------------------------------------------------------------
Statistics
-------------------------------------------------------------------------------
Master Transitions  : 1                   Discontinuity Time: 09/09/2004 01:57*
Adv Sent            : 23                  Adv Received      : 0
Pri Zero Pkts Sent  : 0                   Pri Zero Pkts Rcvd: 0
Preempt Events      : 0                   Preempted Events  : 0
Mesg Intvl Discards : 0                   Mesg Intvl Errors : 0
Total Discards      : 0                   Addr List Errors  : 0
```

```
Auth Failures       : 0                   Invalid Pkt Type  : 0
IP TTL Errors       : 0                   Pkt Length Errors : 0
===============================================================================
* indicates that the corresponding row element may have been truncated.
```

policy

Syntax **policy** [*vrrp-policy-id* [**event** *event-type specific-qualifier*]]

Context show>vrrp

Description This command displays VRRP priority control policy information.

If no command line options are specified, a summary of the VRRP priority control event policies displays.

Parameters *vrrp-policy-id* — Displays information on the specified priority control policy ID.

Default All VRRP policies IDs

Values 1 — 9999

event *event-type* — Displays information on the specified VRRP priority control event within the policy ID.

Default All event types and qualifiers

Values **port-down** *port-id*
lag-port-down *lag-id*
host-unreachable *host-ip-addr*
route-unknown *route-prefix*/*mask*
mc-ipsec-non-forwarding

specific-qualifier — Display information about the specified qualifier.

Values port-id, lag-id, host-ip-addr, route-prefix/mask, tunnel-group-id

Output **VRRP Policy Output —** The following table describes the VRRP policy command output fields.

Label	Description
`Policy Id`	The VRRP priority control policy associated with the VRRP virtual router instance. A value of 0 indicates that no control policy is associated with the virtual router instance.
`Current Priority & Effects`	
`Current Explicit`	When multiple explicitly defined events associated with the priority control policy happen simultaneously, the lowest value of all the current explicit priorities will be used as the in-use priority for the virtual router.

Label	Description (Continued)
`Current Delta Sum`	The sum of the priorities of all the delta events when multiple delta events associated with the priority control policy happen simultaneously. This sum is subtracted from the base priority of the virtual router to give the in-use priority.
`Delta Limit`	The delta-in-use-limit for a VRRP policy. Once the total sum of all delta events has been calculated and subtracted from the base-priority of the virtual router, the result is compared to the delta-in-use-limit value. If the result is less than this value, the delta-in-use-limit value is used as the virtual router in-use priority value. If an explicit priority control event overrides the delta priority control events, the delta-in-use-limit has no effect. If the delta-in-use-limit is 0, the sum of the delta priority control events to reduce the virtual router's in-use-priority to 0 can prevent it from becoming or staying master.
`Current Priority`	The configured delta-in-use-limit priority for a VRRP priority control policy or the configured delta or explicit priority for a priority control event.
`Applied`	The number of virtual router instances to which the policy has been applied. The policy cannot be deleted unless this value is 0.
`Description`	A text string which describes the VRRP policy.
`Event Type & ID`	A delta priority event is a conditional event defined in a priority control policy that subtracts a given amount from the base priority to give the current in-use priority for the VRRP virtual router instances to which the policy is applied. An explicit priority event is a conditional event defined in a priority control policy that explicitly defines the in-use priority for the VRRP virtual router instances to which the policy is applied. Explicit events override all delta Events. When multiple explicit events occur simultaneously, the event with the lowest priority value defines the in-use priority.
`Event Oper State`	The operational state of the event.
`Hold Set Remaining`	The amount of time that must pass before the set state for a VRRP priority control event can transition to the cleared state to dampen flapping events.
`Priority & Effect`	`Delta` — The *priority-level* value is subtracted from the associated virtual router instance's base priority when the event is set and no explicit events are set. The sum of the priority event *priority-level* values on all set delta priority events are subtracted from the virtual router base priority to derive the virtual router instance in-use priority value. If the **delta** priority event is cleared, the *priority-level* is no longer used in the in-use priority calculation.

Label	Description (Continued)
	Explicit — The *priority-level* value is used to override the base priority of the virtual router instance if the priority event is set and no other **explicit** priority event is set with a lower *priority-level*. The set **explicit** priority value with the lowest *priority-level* determines the actual in-use protocol value for all virtual router instances associated with the policy.
In Use	Specifies whether or not the event is currently affecting the in-use priority of some virtual router.

Sample Output

```
A:ALA-A# show vrrp policy
===============================================================================
VRRP Policies
===============================================================================
Policy    Current             Current      Current      Delta       Applied
Id        Priority & Effect   Explicit     Delta Sum    Limit
-------------------------------------------------------------------------------
1         None                None         None         1           Yes
2         None                None         None         1           No
===============================================================================
A:ALA-A#
```

```
A:ALA-A# show vrrp policy 1
===============================================================================
VRRP Policy 1
===============================================================================
Description     : 10.10.200.253 reachability
Current Priority: None                 Applied           : No
Current Explicit: None                 Current Delta Sum : None
Delta Limit     : 1

-------------------------------------------------------------------------------
Applied To                       VR     Opr     Base    In-use  Master  Is
Interface Name                   Id             Pri     Pri     Pri     Master
-------------------------------------------------------------------------------
None

-------------------------------------------------------------------------------
Priority Control Events
-------------------------------------------------------------------------------
Event Type & ID                  Event Oper State        Hold Set  Priority In
                                                         Remaining &Effect  Use
-------------------------------------------------------------------------------
Host Unreach 10.10.200.252       n/a                     Expired    20 Del  No
Host Unreach 10.10.200.253       n/a                     Expired    10 Del  No
Route Unknown 10.10.100.0/24     n/a                     Expired     1 Exp  No
===============================================================================
A:ALA-A#
```

VRRP Policy Event Output — The following table describes a specific event VRRP policy command output fields.

Label	Description
`Description`	A text string which describes the VRRP policy.
`Policy Id`	The VRRP priority control policy associated with the VRRP virtual router instance. A value of 0 indicates that no control policy is associated with the virtual router instance.
`Current Priority`	The base router priority for the virtual router instance used in the master election process.
`Current Explicit`	When multiple explicitly defined events associated with the priority control policy happen simultaneously, the lowest value of all the current explicit priorities will be used as the in-use priority for the virtual router.
`Applied`	The number of virtual router instances to which the policy has been applied. The policy cannot be deleted unless this value is 0.
`Current Delta Sum`	The sum of the priorities of all the delta events when multiple delta events associated with the priority control policy happen simultaneously. This sum is subtracted from the base priority of the virtual router to give the in-use priority.
`Delta Limit`	The delta-in-use-limit for a VRRP policy. Once the total sum of all delta events has been calculated and subtracted from the base-priority of the virtual router, the result is compared to the delta-in-use-limit value. If the result is less than this value, the delta-in-use-limit value is used as the virtual router in-use priority value. If an explicit priority control event overrides the delta priority control events, the delta-in-use-limit has no effect. If the delta-in-use-limit is 0, the sum of the delta priority control events to reduce the virtual router's in-use-priority to 0 can prevent it from becoming or staying master.
`Applied to Interface Name`	The interface name where the VRRP policy is applied.
`VR ID`	The virtual router ID for the IP interface.
`Opr`	`Up` — Indicates that the operational state of the VRRP instance is up. `Down` — Indicates that the operational state of the VRRP instance is down.
`Base Pri`	The base priority used by the virtual router instance.
`InUse Priority`	The current in-use priority associated with the VRRP virtual router instance.

Label	Description (Continued)
`Master Priority`	The priority of the virtual router instance which is the current master.
`Priority`	The base priority used by the virtual router instance.
`Priority Effect`	`Delta` — A delta priority event is a conditional event defined in a priority control policy that subtracts a given amount from the base priority to give the current in-use priority for the VRRP virtual router instances to which the policy is applied. `Explicit` — A conditional event defined in a priority control policy that explicitly defines the in-use priority for the VRRP virtual router instances to which the policy is applied. Explicit events override all delta events. When multiple explicit events occur simultaneously, the event with the lowest priority value defines the in-use priority.
`Current Priority`	The configured delta-in-use-limit priority for a VRRP priority control policy or the configured delta or explicit priority for a priority control event.
`Event Oper State`	The operational state of the event.
`Hold Set Remaining`	The amount of time that must pass before the set state for a VRRP priority control event can transition to the cleared state to dampen flapping events.
`Priority`	The base priority used by the virtual router instance.
`Priority Effect`	`Delta` — The *priority-level* value is subtracted from the associated virtual router instance's base priority when the event is set and no explicit events are set. The sum of the priority event *priority-level* values on all set delta priority events are subtracted from the virtual router base priority to derive the virtual router instance in-use priority value. If the **delta** priority event is cleared, the *priority-level* is no longer used in the in-use priority calculation. `Explicit` — The *priority-level* value is used to override the base priority of the virtual router instance if the priority event is set and no other **explicit** priority event is set with a lower *priority-level*. The set **explicit** priority value with the lowest *priority-level* determines the actual in-use protocol value for all virtual router instances associated with the policy.
`Hold Set Config`	The configured number of seconds that the hold set timer waits after an event enters a set state or enters a higher threshold set state, depending on the event type.
`Value In Use`	`Yes` — The event is currently affecting the in-use priority of some virtual router.

Label	Description (Continued)
	No — The event is not affecting the in-use priority of some virtual router.
# trans to Set	The number of times the event has transitioned to one of the 'set' states.
Last Transition	The time and date when the operational state of the event last changed.

Sample Output

```
A:ALA-A#show vrrp policy 1 event port-down
===============================================================================
VRRP Policy 1, Event Port Down 1/1/1
===============================================================================
Description     :
Current Priority: None                 Applied           : Yes
Current Explicit: None                 Current Delta Sum : None
Delta Limit     : 1

-------------------------------------------------------------------------------
Applied To                       VR     Opr     Base    In-use  Master  Is
Interface Name                   Id             Pri     Pri     Pri     Master
-------------------------------------------------------------------------------
ies301backup                     1      Down    100     100     0       No

-------------------------------------------------------------------------------
Priority Control Event Port Down 1/1/1
-------------------------------------------------------------------------------
Priority        : 30                   Priority Effect   : Delta
Hold Set Config : 0 sec                Hold Set Remaining: Expired
Value In Use    : No                   Current State     : Cleared
# trans to Set  : 6                    Previous State    : Set-down
Last Transition : 04/13/2007 04:54:35
===============================================================================
A:ALA-A#

A:ALA-A# show vrrp policy 1 event host-unreachable
===============================================================================
VRRP Policy 1, Event Host Unreachable 10.10.200.252
===============================================================================
Description     : 10.10.200.253 reachability
Current Priority: None                 Applied           : No
Current Explicit: None                 Current Delta Sum : None
Delta Limit     : 1

-------------------------------------------------------------------------------
Applied To                       VR     Opr     Base    In-use  Master  Is
Interface Name                   Id             Pri     Pri     Pri     Master
-------------------------------------------------------------------------------
None

-------------------------------------------------------------------------------
Priority Control Event Host Unreachable 10.10.200.252
-------------------------------------------------------------------------------
Priority        : 20                   Priority Effect   : Delta
Interval        : 1 sec                Timeout           : 1 sec
Drop Count      : 3
Hold Set Config : 0 sec                Hold Set Remaining: Expired
```

```
Value In Use    : No                   Current State     : n/a
# trans to Set  : 0                    Previous State    : n/a
Last Transition : 04/13/2007 23:10:24
===============================================================================
A:ALA-A#


A:ALA-A# show vrrp policy 1 event route-unknown
===============================================================================
VRRP Policy 1, Event Route Unknown 10.10.100.0/24
===============================================================================
Description     : 10.10.200.253 reachability
Current Priority: None                 Applied           : No
Current Explicit: None                 Current Delta Sum : None
Delta Limit     : 1

-------------------------------------------------------------------------------
Applied To                       VR     Opr     Base    In-use  Master  Is
Interface Name                   Id             Pri     Pri     Pri     Master
-------------------------------------------------------------------------------
None

-------------------------------------------------------------------------------
Priority Control Event Route Unknown 10.10.100.0/24
-------------------------------------------------------------------------------
Priority        : 1                    Priority Effect   : Explicit
Less Specific   : No                   Default Allowed   : No
Next Hop(s)     : None
Protocol(s)     : None
Hold Set Config : 0 sec                Hold Set Remaining: Expired
Value In Use    : No                   Current State     : n/a
# trans to Set  : 0                    Previous State    : n/a
Last Transition : 04/13/2007 23:10:24
===============================================================================
A:ALA-A#
```

statistics

Syntax **statistics**

Context show>router>vrrp

Description This command displays statistics for VRRP instance.

Output **VRRP Statistics Output —** The following table describes the VRRP statistics output fields.

Table 7: Show VRRP Statistics Output

Label	Description
`VR Id Errors`	Displays the number of virtual router ID errors.
`Version Errors`	Displays the number of version errors.
`Checksum Errors`	Displays the number of checksum errors.

Sample Output

```
A:ALA-48# show router vrrp statistics
===============================================================================
VRRP Global Statistics
===============================================================================
VR Id Errors       : 0                  Version Errors     : 0
Checksum Errors    : 0
===============================================================================
A:ALA-48#
```

Monitor Commands

instance

Syntax **instance interface** *interface-name* **vr-id** *virtual-router-id* [**ipv6**] [**interval** *seconds*] [**repeat** *repeat*] [**absolute | rate**]

Context monitor>router>vrrp

Description Monitor statistics for a VRRP instance.

Parameters *interface-name* — The name of the existing IP interface on which VRRP is configured.

vr-id *virtual-router-id* **—** The virtual router ID for the existing IP interface, expressed as a decimal integer.

interval *seconds* **—** Configures the interval for each display in seconds.

Default 5 seconds

Values 3 — 60

repeat *repeat* — Configures how many times the command is repeated.

Default 10

Values 1 — 999

absolute — When the **absolute** keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.

rate — When the **rate** keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.

ipv6 — Specifies to monitor IPv6 instances.

Sample Output

```
*A:ALA-A# monitor router vrrp instance interface n2 vr-id 1
===============================================================================
Monitor statistics for VRRP Instance 1 on interface "n2"
===============================================================================
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Become Master       : 1                 Master Changes    : 1
Adv Sent            : 1439              Adv Received      : 0
Pri Zero Pkts Sent  : 0                 Pri Zero Pkts Rcvd: 0
Preempt Events      : 0                 Preempted Events  : 0
Mesg Intvl Discards : 0                 Mesg Intvl Errors : 0
Addr List Discards  : 0                 Addr List Errors  : 0
Auth Type Mismatch  : 0                 Auth Failures     : 0
Invalid Auth Type   : 0                 Invalid Pkt Type  : 0
IP TTL Errors       : 0                 Pkt Length Errors : 0
Total Discards      : 0
===============================================================================
*A:ALA-A#


*A:ALA-A# monitor router vrrp instance interface n2 vr-id 10 ipv6
===============================================================================
Monitor statistics for VRRP Instance 10 on interface "n2"
===============================================================================
-------------------------------------------------------------------------------
At time t = 0 sec (Base Statistics)
-------------------------------------------------------------------------------
Master Transitions  : 1                   Discontinuity Time: 09/09/2004 01:57*
Adv Sent            : 1365                Adv Received      : 0
Pri Zero Pkts Sent  : 0                   Pri Zero Pkts Rcvd: 0
Preempt Events      : 0                   Preempted Events  : 0
Mesg Intvl Discards : 0                   Mesg Intvl Errors : 0
Total Discards      : 0                   Addr List Errors  : 0
Auth Failures       : 0                   Invalid Pkt Type  : 0
IP TTL Errors       : 0                   Pkt Length Errors : 0
===============================================================================
*A:ALA-A#
```

Clear Commands

interface

Syntax **interface** *ip-int-name* [**vrid** *virtual-router-id*]
interface *ip-int-name* **vrid** *virtual-router-id* **ipv6**

Context clear>router>vrrp

Description This command resets VRRP protocol instances on an IP interface.

Parameters *ip-int-name* — The IP interface to reset the VRRP protocol instances.

vrid *vrid* **—** Resets the VRRP protocol instance for the specified VRID on the IP interface.

Default All VRIDs on the IP interface.

Values 1 — 255

ipv6 — Clears IPv6 information for the specified interface.

statistics

Syntax **statistics** [**policy** *policy-id*]

Context clear>router>vrrp

Description This command enables the context to clear and reset VRRP entities.

Parameters **policy** *policy-id* **—** Clears statistics for the specified policy.

Values 1 — 9999

statistics

Syntax **statistics interface** *interface-name* [**vrid** *virtual-router-id*]
statistics
statistics interface *interface-name* **vrid** *virtual-router-id* **ipv6**

Context clear>router>vrrp

Description This command clears statistics for VRRP instances on an IP interface or VRRP priority control policies.

Parameters **interface** *ip-int-name* **—** Clears the VRRP statistics for all VRRP instances on the specified IP interface.

vrid *virtual-router-id* **—** Clears the VRRP statistics for the specified VRRP instance on the IP interface.

Default All VRRP instances on the IP interface.

Values 1 — 255

policy [*vrrp-policy-id*] **—** Clears VRRP statistics for all or the specified VRRP priority control policy.

Default All VRRP policies.

Values 1 — 9999

ipv6 — Clears IPv6 statistics for the specified interface.

VRRP Debug Commands

events

Syntax **events**
events interface *ip-int-name* [**vrid** *virtual-router-id*]
events interface *ip-int-name* **vrid** *virtual-router-id* **ipv6**
no events
no events interface *ip-int-name* **vrid** *virtual-router-id* **ipv6**
no events interface *ip-int-name* [**vrid** *virtual-router-id*]

Context debug>router>vrrp

Description This command enables debugging for VRRP events.

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

Parameters *ip-int-name* — Displays the specified interface name.

vrid *virtual-router-id* **—** Displays the specified VRID.

ipv6 — Debugs the specified IPv6 VRRP interface.

packets

Syntax **packets interface** *ip-int-name* [**vrid** *virtual-router-id*]
packets
no packets interface *ip-int-name* [**vrid** *virtual-router-id*] [**ipv6**]
no packets

Context debug>router>vrrp

Description This command enables debugging for VRRP packets.

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

Parameters *ip-int-name* — Displays the specified interface name.

vrid *virtual-router-id* **—** Displays the specified VRID.

Filter Policies

In This Chapter

The SROS supports filter policies for services and network interfaces (described in this chapter), subscriber management (integrated with service filter policies with the subscriber management specifics defined in the SROS Triple Play Guide), and CPM security and Management Interface (described in SROS Router Configuration Guide).

Topics in this chapter include:

ACL Filter Policy Overview

ACL Filter policies, also referred to as Access Control Lists (ACLs) or filters for short, are sets of ordered rule entries specifying packet match criteria and actions to be performed to a packet upon a match. Filter policies are created with a unique filter ID, but each filter can also have a unique filter name configured once the filter policy has been created. Either filter ID or filter name can be used throughout the system to manage filter policies and assign them to interfaces.

There are three main types of filter policies: IPv4, IPv6, and MAC filter policies. Additionally MAC filter policies support three sub-types: (**configure filter mac-filter type** {**normal** | **isid** | **vid**}). These sub-types allow operators to configure different L2 match criteria for a L2 MAC filter.

There are different kinds of filter policies as defined by the filter policy **scope**:

- An **exclusive** filter allows defining policy rules explicitly for a single interface. An exclusive filter allows highest-level of customization but uses most resources, since each exclusive filter consumes H/W resources on line cards the interface exists.
- A **template** filter allows usage of identical set of policy rules across multiple interfaces. Template filters use a single set of resources per line card, regardless of how many interfaces use a given template filter policy on that line card. Template filter policies used on access interfaces, consume resources on line cards only if at least one access interface for a given template filter policy is configured on a given line card.
- An **embedded** filter allows defining common set of policy rules that can then be used (embedded) by other exclusive or template filters in the system. This allows optimized management of filter policies.

Once created, filter policies must then be associated with interfaces/services/subscribers or with other filter policies (if the created policy cannot be directly deployed on interface/services/subscriber), so the incoming/outgoing traffic can be subjected to filter rules. Filter policies are associated with interfaces/services/subscribers separately in ingress and in egress direction. A policy deployed on ingress and egress direction can be same or different. In general, it is recommended to use different filter policies per-ingress and per-egress directions and to use different filter policies per service type, since filter policies support different match criteria and different actions for different direction/service contexts. A filter policy is applied to a packet in the ascending rule entry order. When a packet matches all the parameters specified in a filter entry’s match criteria, the system takes the action defined for that entry. If a packet does not match the entry parameters, the packet is compared to the next higher numerical filter entry rule and so on. If the packet does not match any of the entries, the system executes the **default-action** specified in the filter policy: **drop** or **forward**.

For Layer 2, either an IPv4/IPv6, and MAC filter policy can be applied. For Layer 3 and network interfaces, an IPv4/IPv6 policy can be applied. For r-VPLS service, a L2 filter policy can be applied to L2 forwarded traffic and L3 filter policy can be applied to L3 routed traffic. For dual stack interfaces, if both IPv4 and IPv6 filter policies are configured, the policy applied will be based on the outer IP header of the packet. Note that non-IP packets are not hitting an IP filter policy, so the default action in the IP filter policy will not apply to these packets.

Filter Policy Basics

The following subsections define main functionality supported by filter policies.

Filter Policy Packet Match Criteria

This section defines packet match criteria supported on SROS-based routers/switches for IPv4, IPv6 and MAC filters. Types of criteria supported depends on the hardware platform and filter direction, please see your Alcatel-Lucent representative for further details.

General notes:

- If multiple unique match criteria are specified in a single filter policy entry, all criteria must be met in order for the packet to be considered a match against that filter policy entry (logical AND).
- Any match criteria not explicitly defined is ignored during match.
- An ACL filter policy entry with match criteria defined but no action configured, is considered incomplete and inactive (an entry is not downloaded to the line card). A filter policy must have at least single entry active for the policy to be considered active.
- An ACL filter entry with no match conditions defined matches all packets.
- Because an ACL filter policy is an order list, entries should be configured (numbered) from the most explicit to the least explicit.

IPv4/IPv6 Filter Policy Entry Match Criteria

The below lists IPv4 and IPv6 match criteria supported by SROS routers/switches. The criteria are evaluated against outer IPv4/IPv6 header and a L4 header that follows (if applicable). Support for a given match criteria may depend on H/W and/or filter direction as per below description. It is recommended not to configure a filter in a direction or on a H/W where a given match condition is not supported as this may lead to undesired behavior. Some match criteria may be grouped in match lists and may be auto-generated based on router configuration – see Advanced Filter Policy topics for more details.

Basic L3 match criteria:

- **dscp** — Match for the specified DSCP value against the Differentiated Services Code Point/Traffic Class field in the IPv4/v6 packet header.

- **src-ip/dst-ip** — Match for the specified source/destination IPv4/IPv6 address-prefix against the source/destination IPv4/IPv6 address field in the IPv4/IPv6 packet header. Operator can optionally configure a mask to be used in a match.
- **flow-label** — Match for the specified flow label against the Flow label field in IPv6 packet . Operator can optionally configure a mask to be used in a match. Supported for ingress filters only. Requires minimum chassis mode C.
- **packet-length** — Match for the specified packet-length value/range against the Total Length field in IPv4 packet. This match condition is supported for drop action only and is part of action evaluation – i.e. after packet is determined to match the entry based on other match criteria configured. Packets that match all match criteria for a given filter policy entry are dropped if the packet-length match criterion is met and forwarded if the packet match criterion is not met. Supported for ingress filters only. Requires minimum FP-2 based line cards. The match is always true if filter is configured on egress or on older H/W.

Fragmentation match criteria:

- **fragment** — Enable fragmentation support in filter policy match. For IPv4, match against MF bit or Fragment Offset field to determine whether the packet is a fragment or not. For IPv6, match against Next Header Field for Fragment Extension Header value to determine whether the packet is a fragment or not. Up to 6 extension headers are matched against to find Fragmentation Extension Header.

  Additional, match against whether the fragment is an initial fragment or non-initial fragment is also supported for IPv6 filters. These match criteria are supported on ingress only and require minimum FP-2 based line cards.

IPv4 options match criteria:

- **ip-option** — Match for the specified option value in the first option of the IPv4 packet. Operator can optionally configure a mask to be used in a match.
- **option-present** — Match for the presence or absence of the IP options in the IPv4 packet. Padding and EOOL are also considered as IP options. Up to 6 IP options are matched against.
- **multiple-options** — Match for the presence of multiple IP options in the IPv4 packet.
- **src-route-option** — Match for the presence of IP Option 3 or 9 (Loose or Strict Source Route) in the first 3 IP Options of the IPv4 packet. A packet will also match this rule if the packet has more than 3 IP Options.

IPv6 next-header match criteria (see also Upper-layer protocol match next-header description below):

- **ah-ext-header** — Match for presence/absence of the Authentication Header extension header in the IPv6 packet. This match criterion is supported on ingress only and requires minimum FP-2 based line cards. Up to 6 extension headers are matched against.

- **esp-ext-header** — Match for presence/absence of the Encapsulating Security Payload extension header in the IPv6 packet. This match criterion is supported on ingress only and requires minimum FP-2 based line cards. Up to 6 extension headers are matched against.
- **hop-by-hop-opt** — Match for the presence/absence of Hop-by-hop options extension header in the IPv6 packet. This match criterion is supported on ingress only and requires minimum FP-2 based line cards. Up to 6 extension headers are matched against.
- **routing-type0** — Match for the presence/absence of Routing extension header type 0 in the IPv6 packet. This match criterion is supported on ingress only and requires minimum FP-2 based line cards. Up to 6 extension headers are matched against.

Upper-layer protocol match:

- **next-header** — Match for the specified upper layer protocol (for example, TCP, UDP, IGMPv6) against the Next Header field of the IPv6 packet header. "*" can be used to specify TCP or UDP upper-layer protocol match (Logical OR). Note: next-header matching allows also matching on presence of a subset of IPv6 extension headers. See CLI section for details on which extension header match is supported.
- **protocol** — Match for the specified protocol against the Protocol field in the IPv4 packet header (for example, TCP, UDP, IGMP) of the outer IPv4. "*" can be used to specify TCP or UDP upper-layer protocol match (Logical OR).
- **icmp-code** — Match for the specified value against the Code field of the ICMP/ICMPv6 header of the packet. This match is supported only for entries that also define protocol/ next-header match for "ICMP"/"ICMPv6" protocol.
- **icmp-type** — Match for the specified value against the Type field of the ICMP/ICMPv6 header of the packet. This match is supported only for entries that also define protocol/ next-header match for "ICMP"/"ICMPv6" protocol.
- **src-port/dst-port** – Match for the specified port value or port range against the Source Port Number/Destination Port Number of the UDP/TCP packet header. An option to match either source or destination (Logical OR) using a single filter policy entry is supported by using a directionless "port" command. Source/destination match is supported only for entries that also define protocol/next-header match for "TCP" or "UDP" or "TCP or UDP" protocols. Note that a non-initial fragment will never match an entry with port criteria specified.
- **tcp-ack/tcp-syn** — Match for the TCP ACK/TCP SYNC flag presence/absence in the TCP header of the packet. This match is supported only for entries that also define protocol/next-header match for "TCP" protocol.

MAC Filter Policy Entry Match Criteria

The below lists MAC match criteria supported by SROS routers/switches for all types of MAC filters (normal, isid, and vid). The criteria are evaluated against the Ethernet header of the Ethernet frame. Support for a given match criteria may depend on H/W and/or filter direction as per below description. Match criterion is blocked if it is not supported by a specified frame-type or MAC filter sub-type. It is recommended not to configure a filter in a direction or on a H/W where a given match condition is not supported as this may lead to undesired behavior.

- **frame-type** — Entering the frame type allows the filter to match for a specific type of frame format. For example, configuring frame-type ethernet_II will match only Ethernet-II frames.
- **src-mac**— Entering the source MAC address allows the filter to search for matching a source MAC address frames. Operator can optionally configure a mask to be used in a match.
- **dst-mac**— Entering the destination MAC address allows the filter to search for matching destination MAC address frames. Operator can optionally configure a mask to be used in a match.
- **dot1p** — Entering an IEEE 802.1p value allows the filter to search for matching 802.1p frames. Operator can optionally configure a mask to be used in a match.
- **etype**— Entering an Ethertype value allows the filter to search for matching Ethernet II frames. The Ethernet type field is a two-byte field used to identify the protocol carried by the Ethernet frame.
- **ssap**— Entering an Ethernet 802.2 LLC SSAP value allows the filter to search for matching frames with a source access point on the network node designated in the source field of the packet. Operator can optionally configure a mask to be used in a match.
- **dsap**— Entering an Ethernet 802.2 LLC DSAP value allows the filter to search for matching frames with a destination access point on the network node designated in the destination field of the packet.. Operator can optionally configure a mask to be used in a match.
- **snap-oui**— Entering an Ethernet IEEE 802.3 LLC SNAP OUI allows the filter to search for matching frames with the specified the three-byte OUI field.
- **snap-pid**— Entering an Ethernet IEEE 802.3 LLC SNAP PID allows the filter to search for the matching frames with the specified two-byte protocol ID that follows the three-byte OUI field.
- **isid** — Entering an Ethernet IEEE 802.1ag ISID from the I-TAG value allows the filter to search for the matching Ethernet frames with the 24 bits ISID value from the PBB I-TAG. This match criterion is mutually exclusive with all the other match criteria under a particular mac-filter policy and is applicable to MAC filters of type isid only. The resulting mac-filter can only be applied on a BVPLS SAP or PW in the egress direction.

- **inner-tag/outer-tag** — Entering inner-tag/outer-tag VLAN ID values allows the filter to search for the matching Ethernet frames with the non-service delimiting tags as described In “VID MAC filters” subsection later-on this. This match criterion is mutually exclusive with all other match criteria under a particular mac-filter policy and is applicable to MAC filters of type vid only.

Filter Policy Actions

The following lists actions supported by ACL filter policies

- **drop** — This action allows operator to deny traffic to ingress/egress the system
- **forward** — This action allows operator to permit traffic to ingress/egress the system and be subject to regular processing
- **forward** “Policy-based Routing/Forwarding (PBR/PBF) action”— PBR/PBF actions allows operator to permit ingress traffic but change the regular routing/forwarding packet would be a subject to. The PBR/PBF is applicable to unicast traffic only. The following PBR/PBF actions are supported (See CLI section for command details):
  - → **router** — changes the routing instance a packet is routed in from the upcoming interface’s instance to the routing instance specified in the PBR action (supports both GRT and VPRN redirect). Requires network interfaces to be on FP2 line cards or newer. Supported for ingress IPv4/IPv6filter policies only, deployed on L3 interfaces. Packets are dropped if they cannot be routed in the configured routing instance. Requires minimum Chassis mode D.
  - → **next-hop** — changes the IP destination address used in routing from the address in the packet to the address configure in this PBR action. The operator can configure whether the next-hop IP address must be direct (local subnet only) or indirect (any IP). Supported for ingress IPv4/IPv6 filter policies only, deployed on L3 interfaces. If configured next-hop is not reachable, traffic is dropped and “ICMP destination unreachable” message is sent. For IPv6, requires minimum Chassis mode C.
  - → **lsp** — forwards the incoming traffic onto the specified LSP. Supports RSVP-TE LSPs(type static or dynamic only) or MPLS-TP LSPs. Supported for ingress IPv4/IPv6 filter policies only deployed on IES SAPs or network interfaces. If the configured LSP is down, traffic matches the entry and action forward is executed.
  - → **interface** — forwards the incoming traffic onto the specified IPv4 interface. Supported for ingress IPv4 filter policies in global routing table instance. If the configured interface is down or not of the supported type, traffic is dropped.
  - → **sap** — forwards the incoming traffic onto the specified VPLS SAP. Supported for ingress IPv4/IPv6 and MAC filter policies deployed in VPLS service. The SAP traffic is to egress on must be in the same VPLS service as the incoming interface. If the configured SAP is down, traffic is dropped.
  - → **sdp** — forwards the incoming traffic onto the specified VPLS SDP. Supported for ingress IPv4/IPv6 and MAC filter policies deployed in VPLS service. The SDP traffic is to egress on must be in the same VPLS service as the incoming interface. If the configured SDP is down, traffic is dropped.

  - → **redirect-policy** — implements PBR next-hop action with ability to select and prioritize multiple redirect targets and monitor the specified redirect targets so PBR action can be changed if the selected destination goes down. Supported for ingress IPv4 filter policies only, deployed on L3 interfaces. See Redirect Policies section later on for more details

- **forward** “isa action” — ISA processing actions allow operator to permit ingress traffic and send it for ISA processing as per specified isa action. The following isa actions are supported (see CLI section for command details):
  - → **nat** — forwards matching traffic for NAT. Supported for IPv4/IPv6 filter policies for L3 services in GRT or VPRN. If ISAs performing NAT are down, traffic is dropped. (see CLI for options)
  - → **reassemble** — forwards matching packets to the reassembly function. Supported for IPv4 ingress filter policies only. If ISAs performing reassemble are down, traffic is dropped.
  - → **gtp-local-breakout** — forwards matching traffic to NAT instead of being GTP tunneled to the mobile operator’s PGW or GGSN. The action applies to GTP-subscriber-hosts. If filter is deployed on other entities, action forward is applied. Supported for IPv4 ingress filter policies only. If ISAs performing NAT are down, traffic is dropped.
- **http-redirect** — implements HTTP redirect captive portal. HTTP GET is forwarded to CPM card for captive portal processing by router. See HTTP-redirect (Captive Portal) section for further details.

In addition to the above actions, operator can select a **default-action** for a filter policy. Default action is executed on packets subjected to an active filter when none of the filter’s active entries matches the packet. By default, filter policies have default action set to **drop** but operator can select a default action to be **forward** instead.

Filter Policy Statistics

Filter policies support per-entry, packet match debug statistics. The cumulative matched packet counters are available per ingress and per egress direction. Every packet arriving on an interface/ service/subscriber using a filter policy increments ingress or egress (as applicable) matched packet count for a filter entry the packet matches (if any) on the line card the packet ingresses/egresses. For each policy, the counters for all entries are collected from all line cards, summed up and made available to an operator.

Starting with SROS Release 11.0 R4, filter policies applied on access interfaces are downloaded only when active and only to line cards that have interfaces associated with those filter policies. If a filter policy is not downloaded to any line card, the statistics show 0 (zero). If a filter policy is being removed from any of the line cards the policy is currently downloaded to (as result of association change or when a filter becomes inactive), the debug statistics for the filter are reset to 0 (zero). Downloading a filter policy to a new line card keeps incrementing existing statistics.

Filter Policy Logging

SROS supports logging of the information from the packets that match given filter policy. Logging is configurable per filter policy entry by specifying pre-configured filter log (**config filter log**). A filter log can be applied to ACL filters and CPM hardware filters. Operator can configure multiple filter logs and specify: memory allocated to a filter log destination, syslog id for filter log destination, filter logging summarization, and wrap-around behavior.

Notes related to filter log summarization:

- The implementation of the feature applies to filter logs with destination syslog.
- Summarization logging is the collection and summarization of log messages for 1 specific log-id within a period of time.
- The summarization interval is 100 seconds.
- Upon activation of a summary, a mini-table with src/dst-address and count is created for each type (IP/IPv6/MAC).
- Every received log packet (due to filter hit) is examined for source or destination address.
- If the log packet (source/destination address) matches a source/destination address entry in the mini-table a packet received previously), the summary counter of the matching address is incremented.
- If source or destination address of the log messages does not match an entry already present in the table, the source/destination address is stored in a free entry in the mini-table.
- In case the mini-table has no more free entries, only total counter is incremented.
- At expiry of the summarization interval, the mini-table for each type is flushed to the syslog destination.

Filter Policy cflowd Sampling

Filter policies can be used to control how cflowd sampling is performed on an IP interface. If an IP interface has cflowd sampling enabled, an operator can exclude some flows for interface sampling by configuring filter policy rules that match the flows and by disabling interface sampling as part of the filter policy entry configurations (**interface-disable-sample**). If an IP interface has cflowd sampling disabled, an operator can enable cflowd sampling on a subset of flows by configuring filter policy rules that match the flows and by enabling cflowd sampling as part of the filter policy entry configurations (**filter-sample**).

Note that the above cflowd filter sampling behavior is exclusively driven by match criteria: The sampling logic applies regardless of whether an action was executed or not (including evaluation of **packet-length** match condition).

Filter policy management

Modifying Existing Filter Policy

There are several ways to modify an existing filter policy. A filter policy can be modified through configuration change or can have entries populated through dynamic, policy-controlled dynamic interfaces like Radius or OpenFlow or Flowspec or Gx for example. Although in general, the SROS ensures filter resources exist before a filter can be modified, because of a dynamic nature of the policy-controlled interfaces, a configuration that was accepted may not be applied in H/W due to lack of resources. When that happens, an error is raised.

A filter policy can be modified directly – by changing/adding/deleting the existing entry in that filter policy or indirectly. Examples of indirect change to filter policy include, among others, changing embedded filter entry this policy embeds (see Embedded filters section), changing redirect policy this filter policy uses.

Finally, a filter policy deployed on a given interface can be changed by changing the policy the interface is associated with.

All of the above changes can be done in service. Note that a filter policy that is associated with service/interface cannot be deleted unless all associations are removed first.

For a large (complex) filter policy change, it may take a few seconds to load and initiate the filter policy configuration. It should also be noted, that filter policy changes are downloaded to line cards immediately, therefore operators should use filter policy copy or transactional CLI to ensure partial policy change is not activated.

Filter Policy Copy and Renumbering

To assist operators in filter policy management, SROS supports entry copy and entry renumbering operations.

Filter **copy** allows operators to perform bulk operations on filter policies by copying one filter's entries to another filter. Either all entries or a specified entry of the source filter can be selected for copy. When entries are copied, entry order is preserved unless destination filter's entry ID is selected (applicable to single entry copy). The filter copy allows overwrite of the existing entries in the destination filter by specifying "overwrite" option during the copy command. Filter copy can be used, for example, when creating new policies from existing policies or when modifying an existing filter policy (an existing source policy is copied to a new destination policy, the new destination policy is modified, then the new destinations policy is copied back the source policy with overwrite specified).

Entry renumbering allows operator to change relative order of a filter policy entry by changing the entry Id. Entry renumbering can also be used to move 2 entries closer together or further apart, thus creating additional entry space for new entries.

Filter Policy Advanced Topics

Match-list for Filter Policies

Figure 14 depicts an approach to implement logical OR on a list of matching criterion (IPv4 address prefixes in this example) in one or more filter policies prior to introduction of match list.

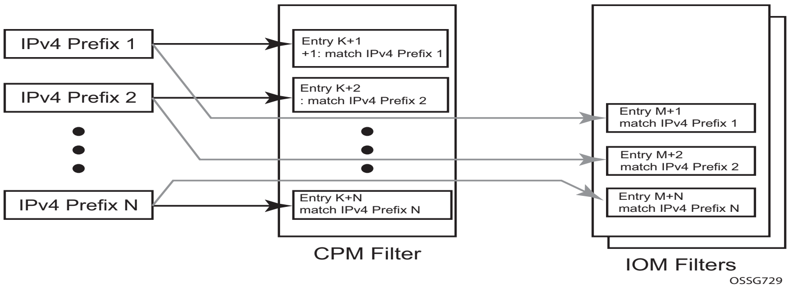

IPv4 Prefix 1
IPv4 Prefix 2
IPv4 Prefix N
Entry K+1 +1: match IPv4 Prefix 1
Entry K+2 : match IPv4 Prefix 2
Entry K+N match IPv4 Prefix N
CPM Filter
Entry M+1 match IPv4 Prefix 1
Entry M+2 match IPv4 Prefix 2
Entry M+N match IPv4 Prefix N
IOM Filters
OSSG729

Figure 14: IOM/CPM Filter Policy using Individual Address Prefixes

An operator has to create one entry for each address prefix to execute a common action. Each entry defines a match on a unique address prefix from the list plus any other additional match criteria and the common action. If the same set of address prefixes needs to be used in another IOM or CPM filter policy, an operator again needs to create one entry for each address prefix of the list in those filter policies. Same procedure applies (not shown above) if another action needs to be performed on the list of the addresses within the same filter policy (when for example specifying different additional match criteria). This process can introduce large operational overhead, especially when a list contains many elements or/and needs to be reused multiple times across one or more filter policies.

Match list for CPM and IOM filter policies are introduced to eliminate above operational complexity by simplifying the IOM and CPM filter policy management on a list of a match criterion. Instead of defining multiple filter entries in any given filter, an operator can now group same type of the matching criteria into a single filter match list, and then use that list as a match criterion value, thus requiring only single filter policy entry per each unique action. The same match list can be used in one or more IOM filter policies as well as CPM filter policies.

The match lists further simplify management and deployment of the policy changes. A change in a match-list content is automatically propagated across all policies employing that list in their match criteria, thus only a single configuration change is required to trigger policy changes when a list is used by multiple entries in one or more filter policies.

Figure 15 depicts how the IOM/CPM filter policy illustrated at the top of this section changes with a filter match list usage (using IPv4 address prefix list in this example).

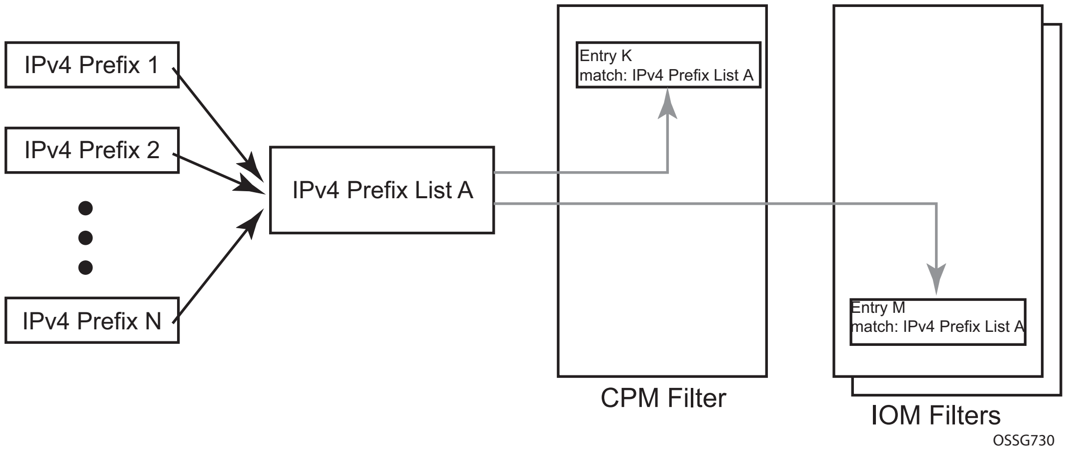


Figure 15: IOM/CPM Filter Policy Using an Address Prefix Match List

Note: The hardware resource usage does not change whether filter match lists are used or whether operator creates multiple entries (each per one element of the list): however, a careful consideration must be given to how the lists are used to ensure only desired match permutations are created in a filter policy entry (especially when other matching criteria that are also lists or ranges are specified in the same entry). The system verifies that a new list element, for example, an IP address prefix, cannot be added to a given list or a list cannot be used by a new filter policy unless resources exist in hardware to implement the required filter policy (ies) that reference that list. If that is not the case, addition of a new element to the list or use of the list by another policy will fail.

Some use cases like those driven by dynamic policy changes, may result in acceptance of filter policy configuration changes that cannot be programmed in hardware because of the resource exhaustion. If that is the case, when attempting to program a filter entry that uses a match list(s), the operation will fail, the entry will be not programmed, and a notification of that failure will be provided to an operator.

Please refer to SROS Release Notes for what objects can be grouped into a filter match list for IOM and CPM filter policies.

Auto-generation of Filter-policy Address Prefix Match Lists

It is often desired to automatically update a filter policy when the configuration on a router changes. To allow such a touch-less filter policy management, SROS allows auto-generation of address prefixes for IPv4 or IPv6 address prefix match lists based on operator-configured criteria. When the configuration on a router changes, the match lists address prefixes are automatically updated and, in-turn, all filter policies (CPM or IOM) that use these match lists are automatically updated.

When using auto-generation of address prefixes inside an address prefix match list operators can:

- Specify one or more *regex* expression matches against SROS router configuration per list.
- Specify wildcard matches by specifying *regex* wildcard match expression (".*").
- Mix auto-generated entries with statically configured entries within a match list.

The following additional rules apply to auto-generated entries:

- Operational and administrative states of a given router configuration are ignored when auto-generating address prefixes.
- Duplicates are not removed when populated by different auto-generation matches and static configuration.
- A configuration will fail if auto-generation of address prefix would result in filer policy resource exhaustion on a filter entry, system, or line-card level.

NOTE: See Release notes and CLI section for details on what configuration supports address prefix list auto-generation.

The following may apply to this feature:

If filter policy resources are not available for newly auto-generated address prefixes when a BGP configuration changes, new address-prefixes will not be added to impacted match lists or filter policies as applicable. An operator must free resources and change filter policy configuration or must change BGP configuration to recover from this failure.

Embedded Filters

When a large number of standard filter policies are configured in a system, a set of policies will often contain one or more common blocks of entries that define, for example, system-wide and/or service-wide security rules. Prior to introduction of the embedded filters, such common rules would have to be configured separately in each exclusive/template policy.

To simplify management of such common rules across multiple filter policies, operator can now use embedded filter policies. An embedded filter policy is a special type of a filter policy that cannot be deployed directly but instead is used to define a common filter policy rules that are then included in (embedded by) other filter policies in the system. Thanks to embedding, a common set of rules can now be defined and changed in a single place but deployed across multiple filter policies. The following main rules apply when embedding an embedded filter policy:

1. An operator can explicitly define an offset at which to embed a given embedded filter into a given embedding filter—the embedded filter entry number X becomes an entry (X + offset) in the embedding filter.
2. An exclusive/template filter policy may embed multiple embedded filter policies as long as the embedded entries do not overlap.
3. A single embedded filter policy may be embedded in many exclusive/template filter policies.
4. When embedding an embedded filter, an operator may wish to change or deactivate an embedded filter policy entry in one of the embedding filter, thus allowing for customizing of the common embedded filter policy rules by the embedding filter. This can be achieved by either defining an entry in the embedding filter that will match ahead of the embedded filter entry or by overwriting the embedded filter entry in the embedding filter.

   For example: If embedded filter 99 has entry 20 that drops packets that match IP source address **src_address**, and filter 200 embeds filter 99 at offset 100, then to *deactivate* the embedded entry 20, an operator could define an entry 120 (embedded entry number 20 + offset 100) in filter policy 200, that has the same match criteria and has either no action defined (this will deactivate the embedded entry and allow continued evaluation of filter policy 200), or has action forward defined (packets will match the new entry and will be forwarded instead of dropped, evaluation of filter policy 200 will stop).
5. Any embedded policy rule edits are automatically applied to all filter policies that embed that embedded filter policy.
6. The system verifies whether system and h/w resources exist when a new embedded filter policy is created, changed or embedded. If resources are not available, the configuration is rejected. In rare cases, filter policy resource check may pass but filter policy can still fail to load due to a resource exhaustion on a line card (for example when other filter policy entries are dynamically configured by applications like RADIUS in parallel). If that is the case, the embedded filter policy configured will be de-activated (configuration will be changed from **activate** to **inactivate**).

7. An embedded filter is never embedded partially into an exclusive/template filter; that is, resources must exist to embed all embedded filter entries in a given exclusive/template filter. Although a partial embedding into a single filter will not take place, an embedded filter may be embedded only in a subset of embedding filters (only those where there are sufficient resources available).

Figure 16 shows implementation of embedded filter policy using IPv4 ACL filter policy example with an embedded filter 10 being used to define common filter rules that are then embedded into filter 1 and 20 (with filter 20 overwriting rule at offset 50):

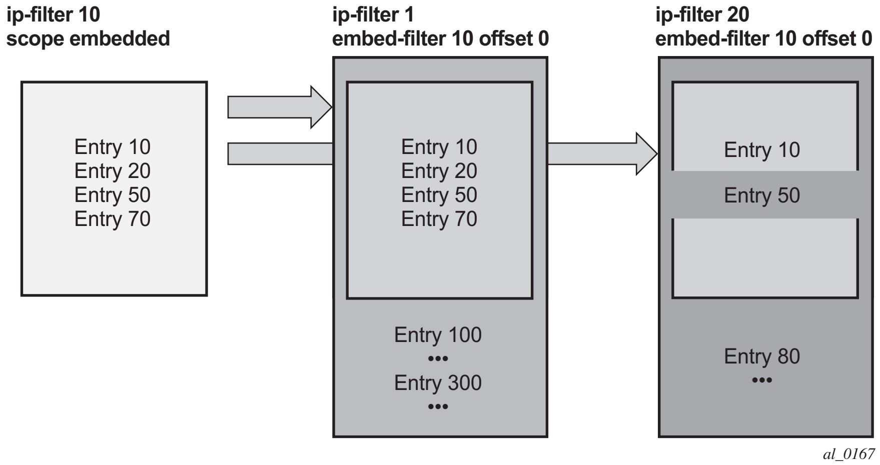


Figure 16: Embedded Filter Policy

NOTE: Embedded filter policies are supported for line card IP(v4) and IPv6 filter policies only.

ISID MAC Filters

ISID filters are a type of MAC filters that allows filtering based on the ISID values rather than L2 criteria used by MAC filters of type "**normal**" or "**vid**". ISID filters can be deployed on iVPLS PBB SAPs and ePipe PBB SAPs in the following scenarios:

The MMRP usage of the mrp-policy ensures automatically that traffic using Group BMAC is not flooded between domains. However; there could be a small transitory periods when traffic originated from PBB BEB with unicast BMAC destination may be flooded in the BVPLS context as unknown unicast in the BVPLS context for both IVPLS and PBB Epipe. To restrict distribution of this traffic for local PBB services ISID filters can be deployed. The mac-filter configured with

ISID match criterion can be applied to the same interconnect endpoint(s), BVPLS SAP or PW, as the mrp-policy to restrict the egress transmission any type of frames that contain a local ISID. The ISID filters will be applied as required on a per B-SAP or B-PW basis just in the egress direction.

The ISID match criteria are exclusive with any other criteria under mac-filter. A new mac-filter type attribute is defined to control the use of ISID match criteria and must be set to ISID to allow the use of ISID match criteria.

VID MAC filters

VID Filters are a type of MAC filters that extend the capability of current Ethernet Ports with null or default SAP tag configuration to match and take action on VID tags. Service delimiting tags (for example QinQ 1/1/1:10.20 or dot1q 1/1/1:10, where outer tag 10 and inner tags 20 are service delimiting) allow fine grain control of frame operations based on the VID tag. Service delimiting tags are exact match and are stripped from the frame as illustrated in Figure 17. Exact match or service delimiting Tags do not require VID filters. VID filters can only be used to match on frame tags that are after the service delimiting tags.

With VID Filters operators can choose to match VID tags for up to two tags on ingress or egress or both.

- The outer-tag is the first tag in the packet that is carried transparently through the service.
- The inner-tag is the second tag in the packet that is carried transparently through the service.

VID Filters add the capability to perform VID value filter policies on default tags (1/1/1:* or 1/1/1:x.*, or 1/1/1/:*.0), or null tags (1/1/1, 1/1/1:0 or 1/1/1:x.0). The matching is based on the port configuration and the SAP configuration.

In the industry the QinQ tags are often referred to as the C-VID (Customer VID) and S-VID (service VID). The terms outer tag and inner tag allow flexibility without having to refer to C-TAG and an S-TAG explicitly. The position of inner and outer tags is relative to the port configuration and SAP configuration. Matching of tags is allowed for up to the first two tags on a frame. Since service delimiting tags may be 0, 1 or 2 tags.

The meaning of inner and outer has been designed to be consistent for egress and ingress when the number of non service delimiting tags is consistent. Service 1 in Figure 17 shows a conversion from qinq to a single dot1q example where there is one non-service delimiting tag on ingress and egress. Service 2 shows a symmetric example with two non-service delimiting tags (plus and additional tag for illustration) to two non-service delimiting tags on egress. Service 3 illustrates single non-service delimiting tags on ingress and to two tags with one non-service delimiting tag on ingress and egress.

SAP-ingress QoS setting allows for MAC-criteria type VID which uses the VID filter matching capabilities QoS and VID Filters (moved to QoS guide) on page 313.

A VID filter entry can also be used as a debug or lawful intercept mirror source entry.

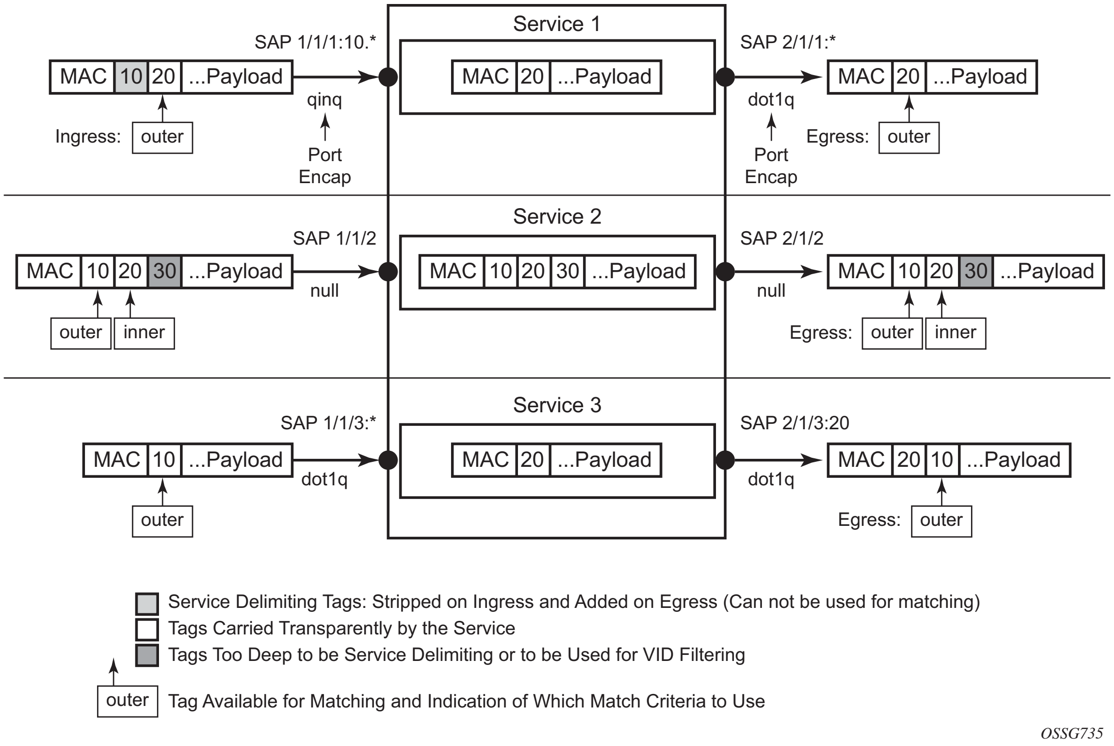


Figure 17: VID Filtering Examples

VID filters are available on Ethernet SAPs for Epipe, VPLS or I-VPLS including eth-tunnel and eth-ring services.

Arbitrary Bit Matching of VID Filters

In addition to matching an exact value, a VID filter mask allows masking any set of bits. The masking operation is ((value & vid-mask) = = (tag and vid-mask)). For example: A value of 6 and a mask of 7 would match all VIDs with the lower 3 bits set to 6. VID filters allow explicit matching of VIDs and matching of any bit pattern within the VID tag.

When using VID filters on SAPs only VID filters are allowed on this SAP. Filters of type normal and ISID are not allowed.

An additional check for the “0” VID tag may be required when using certain wild card operations. For example frames with no tags on null encapsulated ports will match a value of 0 in outer tag and inner tag because there are no tags in the frame for matching. If a zero tag is possible but not desired it can be explicitly filtered using exact match on “0” prior to testing other bits for “0”.

Note that **configure>system>ethernet>new-qinq-untagged-sap** is a special QinQ function for single tagged QinQ frames with a null second tag. Using this in combination with VID filters is not recommended. Note that the outer-tag is the only tag available for filtering on egress for frames arriving from MPLS SDPs or from PBB services even though additional tags may be carried transparently.

Port Group Configuration Example

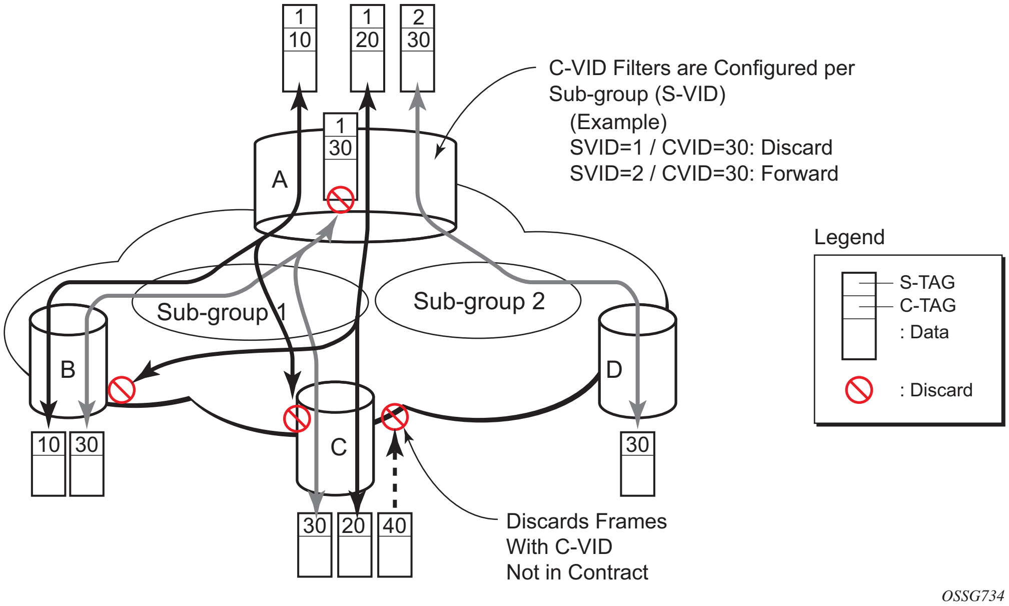


Figure 18: Port Groups

Figure 18 shows a customer use example where some VLANs are prevented from ingressing or egressing certain ports. In the example, port A sap 1/1/1:1.* would have a filter as shown below while port A sap 1/1/1:2.* would not.:

```
mac-filter 4 create
     default-action forward
             type vid
             entry 1 create
                 match frame-type ethernet_II
                     outer-tag 30 4095
                 exit
                 action drop
             exit
         exit
```

Redirect Policies

SROS-based routers support configuring of redirect policies. Redirect policies allow specifying multiple redirect target destinations and defining health check test methods used to validate the ability for a given destination to receive redirected traffic. This destination monitoring allows router to react to target destination failures.

Redirect policy supports the following destination tests:

- **ping test** – with with configurable interval, drop-count, and time-out for the test
- **url-test** – with configurable URL to test; interval, drop-count and timeout for the test; and configurable action (disable destination, lower or raise priority) based upon return error code
- **snp-test -** with configurable OID stand Community strings; interval, drop-count and timeout for the test; and configurable action (disable destination, lower or raise priority) based upon SNMP return value.

Each destination is assigned an initial or base priority describing this destination's relative importance within the policy. The destination with the highest priority value is selected as most-preferred destination and programmed on line cards in filter policies using this redirect policy as an action. Note that only destinations that are not disabled by the programmed test (if configured) are considered when selecting the most-preferred destination. If the most-preferred destination is selected, forward redirect-policy action is equivalent to forward next-hop indirect "most-preferred destination" action. If none of the configured destinations is selected as most-preferred (all destinations are down or no destination are programmed in the policy), forward redirect-policy action is equivalent to forward action

Feature caveats:

- Redirect policy is supported for ingress IPv4 filter policies only
- Redirect policy test are performed in GRT instance, even if the policy is deployed in VPRN
- Different platforms support different scale for redirect policies, please contact your local Alcatel-Lucent representative to ensure the planned deployment does not exceed recommended scale

HTTP-redirect (Captive Portal)

Web redirection policies can be configured on SR OS routers/switches. The http redirection action can block a customer's request from an intended recipient and force the customer to connect to the service's portal server. 255 unique entries with **http-redirect** are allowed.

Traffic Flow

The following example provides a brief scenario of a customer connection with web redirection.

1. The customer gets an IP address using DHCP (if the customer is trying to set a static IP he will be blocked by the anti-spoofing filter).
2. The customer tries to connect to a website.
3. The router intercepts the HTTP GET request and blocks it from the network
4. The router then sends the customer an HTTP 302 (service temporarily unavailable/moved). The target URL should then include the customer's IP and MAC addresses as part of the portal's URL.
5. The customer's web browser will then close the original connection and open a new connection to the web portal.
6. The web portal updates the ACL (directly or through SSC) to remove the redirection policy.
7. The customer connects to the original site.

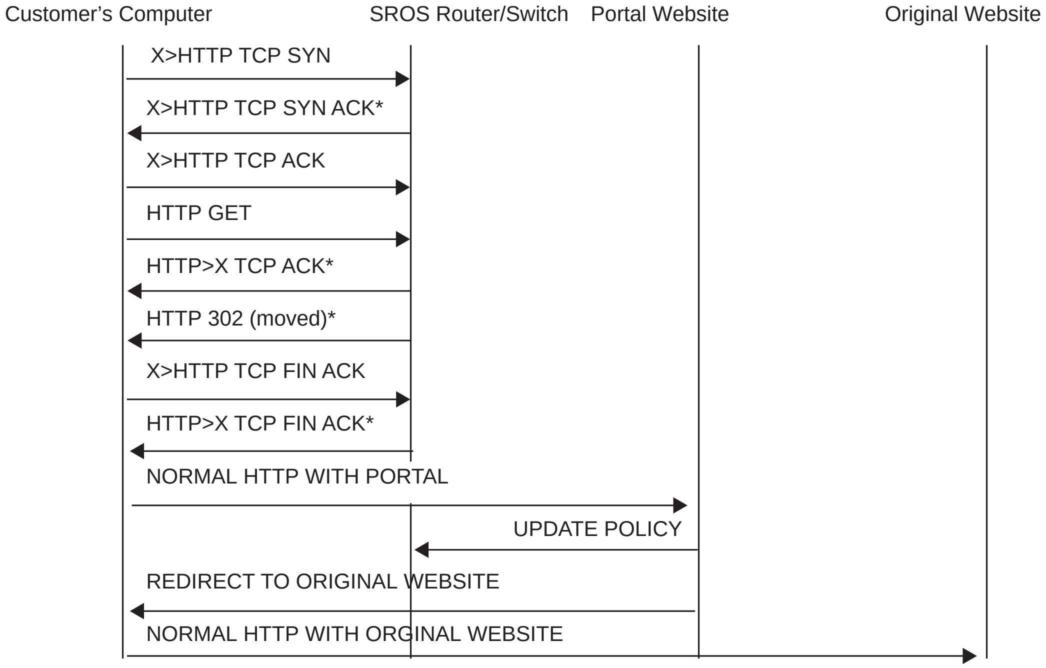


Figure 19: Web Redirect Traffic Flow

Starred entries (*) are items the router performs masquerading as the destination, regardless of the destination IP address or type of service.

The following displays information that can optionally be added as variables in the portal URL (http-redirect url):

- $IP – The customer’s IP address.
- $MAC – The customer’s MAC address.
- $URL – The original requested URL.
- $SAP – The customer’s SAP.
- $SUB – The customer’s subscriber identification string”.
- $CID — A string that represents the circuit-id or interface-id of the subscriber host (hexadecimal format).
- $RID — A string that represents the remote-id of the subscriber host (hexadecimal format).
- $SAPDESC – A configurable string that represents the configured SAP description.

Note that the subscriber identification string is available only when used with subscriber management. Refer to the subscriber management section of the SROS Triple Play Guide and the SR OS Router Configuration Guide.

Since most web sites are accessed using the domain name the router allows either DNS queries or responds to DNS with the portal's IP address.

Filter Policies and Dynamic, Policy-Driven Interfaces

In addition to configuration interfaces like CLI/SNMP for example; filter policies can be modified and/or assigned to by dynamic, policy-driven interfaces. Example of such interfaces include: BGP flowspec, OpenFlow, Radius.

For BGP flowspec, system may auto-create internal filter policies (if an interface on which BGP flowspec is enabled does not have a filter policy assigned). Then upon receiving of a flowspec rule, system will attach flowspec filter rules at the end of the filter policy used on the interface up to the supported flowspec limit. Please see BGP flowspec for more information.

For Radius, operator can assign filter policies to a subscriber, and populate filter policies used by subscriber within a pre-configured block reserved for Radius filter entries. See TPSDA guide and filter RADIUS-related commands for more details.

For OpenFlow, embedded filter infrastructure is used to inject OpenFlow rules into an existing filter policy. Please see "Hybrid OpenFlow Switch" section for more details.

Policy-controlled auto-created filters are recreated on system reboot. Policy-controlled filter-entries are lost on system reboot and need to be reprogrammed.

Configuring Filter Policies with CLI

This section provides information to configure filter policies using the command line interface.

Topics in this section include:

- Basic Configuration on page 448
- Common Configuration Tasks on page 449
  - → Creating an IP Filter Policy on page 449
  - → Creating an IPv6 Filter Policy on page 454
  - → Applying (IPv4/v6) Filter Policies to a Network Port on page 461
  - → Creating a Redirect Policy on page 462
  - → Configuring Policy-Based Forwarding for Deep Packet Inspection in VPLS on page 463
- Filter Management Tasks on page 466
  - → Renumbering Filter Policy Entries on page 466
  - → Modifying a Filter Policy on page 468
  - → Deleting a Filter Policy on page 470
  - → Deleting a Filter Policy on page 470
  - → Copying Filter Policies on page 473

Basic Configuration

The most basic IP, IPv6 and MAC filter policies must have the following:

- A filter ID
- Template scope, either *exclusive* or *template*
- Default action, either drop or forward
- At least one filter entry
  - → Specified action, either drop or forward
  - → Specified matching criteria

The following example displays a sample configuration of an IP filter policy. The configuration blocks all incoming TCP session except Telnet and allows all outgoing TCP sessions from IP net 10.67.132.0/24. Figure 20 depicts the interface to apply the filter.

```
A:ALA-1>config>filter# info
----------------------------------------------
        ip-filter 3 create
            entry 10 create
                match protocol 6
                    dst-port eq 23
                    src-ip 10.67.132.0/24
                exit
                action forward
            exit
            entry 20 create
                match protocol 6
                    tcp-syn true
                    tcp-ack false
                exit
                action drop
            exit
        exit
----------------------------------------------
A:ALA-1>config>filter#
```

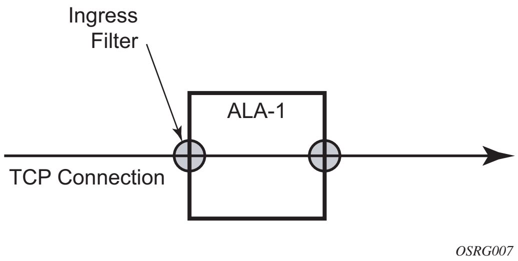


Figure 20: Applying an IP Filter to an Ingress Interface

Common Configuration Tasks

This section provides a brief overview of the tasks that must be performed for both IP and MAC filter configurations and provides the CLI commands.

To configure a filter policy, perform the following tasks:

- Creating an IP Filter Policy on page 449
- Creating an IPv6 Filter Policy on page 454
- Creating a MAC Filter Policy on page 455
- Creating a Match List for Filter Policies on page 459
- Applying (IPv4/v6) Filter Policies to a Network Port on page 461

Creating an IP Filter Policy

Configuring and applying filter policies is optional. Each filter policy must have the following:

- The filter type specified (IP)
- A filter policy ID
- A default action, either drop or forward
- Filter policy scope specified, either *exclusive* or *template*
- At least one filter entry with matching criteria specified
- Optionally, an existing filter policy can have a Filter Name assigned, that can then be used in CLI to reference that filter policy including assigning it to SAPs and/or network interfaces.

IP Filter Policy

The following displays an exclusive filter policy configuration example:

```
A:ALA-7>config>filter# info
----------------------------------------------
...
        ip-filter 12 create
            description "IP-filter"
            scope exclusive
        exit
...
----------------------------------------------
A:ALA-7>config>filter#
```

IP Filter Entry

Within a filter policy, configure filter entries which contain criteria against which ingress, egress, or network traffic is matched. The action specified in the entry determine how the packets are handled, either dropped or forwarded.

- Enter a filter entry ID. The system does not dynamically assign a value.
- Assign an action, either drop or forward.
- Specify matching criteria.

The following displays an IP filter entry configuration example.

```
A:ALA-7>config>filter>ip-filter# info
----------------------------------------------
            description "filter-main"
            scope exclusive
            entry 10 create
                description "no-91"
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.0.100/24
                exit
                no action
            exit
----------------------------------------------
A:ALA-7>config>filter>ip-filter#
```

Configuring the HTTP-Redirect Option

If http-redirect is specified as an action, a corresponding forward entry must be specified before the redirect. Note that http-redirect is not supported on 7750 SR-1 or 7450 ESS-1 models.

The following displays an http-redirect configuration example:

```
A:ALA-48>config>filter>ip-filter# info
----------------------------------------------
            description "filter-main"
            scope exclusive
            entry 10 create
                description "no-91"
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.0.100/24
                exit
                no action
            exit
            entry 20 create
                match protocol tcp
                    dst-ip 100.0.0.2/32
                    dst-port eq 80
                exit
                action forward
            exit
            entry 30 create
                match protocol tcp
                    dst-ip 10.10.10.91/24
                    dst-port eq 80
                exit
                action http-redirect "http://100.0.0.2/login.cgi?mac=$MAC$sap=$S
AP&ip=$IP&orig_url=$URL"
            exit
----------------------------------------------
A:ALA-48>config>filter>ip-filter#
```

Cflowd Filter Sampling

Within a filter entry, you can specify that traffic matching the associated IP filter entry is sampled. if the IP interface is set to cflowd acl mode. Enabling filter-sample enables the cflowd tool.

The following displays an IP filter entry configuration example.

```
A:ALA-7>config>filter>ip-filter# info
----------------------------------------------
            description "filter-main"
            scope exclusive
            entry 10 create
                description "no-91"
                filter-sample
                interface-disable-sample
                match
                exit
                action forward redirect-policy redirect1
            exit
----------------------------------------------
A:ALA-7>config>filter>ip-filter#
```

Within a filter entry, you can also specify that traffic matching the associated IP filter entry is not sampled by cflowd if the IP interface is set to cflowd interface mode. The following displays an IP filter entry configuration example:

```
A:ALA-7>config>filter>ip-filter# info
----------------------------------------------
            description "filter-main"
            scope exclusive
            entry 10 create
                description "no-91"
                no filter-sample
                no interface-disable-sample
                match
                exit
                action forward redirect-policy redirect1
            exit
----------------------------------------------
A:ALA-7>config>filter>ip-filter#
```

Creating an IPv6 Filter Policy

Configuring and applying IPv6 filter policies is optional. IPv6 Filter Policy must be configured separately from IP (IPv4) filter policy. The configuration mimics IP Filter policy configuration. Please see Creating an IP Filter Policy on page 449.

Creating a MAC Filter Policy

Configuring and applying filter policies is optional. Each filter policy must have the following:

- The filter policy type specified (MAC normal, MAC isid, MAC vid).
- A filter policy ID.
- A default action, either drop or forward.
- Filter policy scope, either *exclusive* or *template*.
- At least one filter entry.
- Matching criteria specified.

MAC Filter Policy

The following displays an MAC filter policy configuration example:

```
A:ALA-7>config>filter# info
----------------------------------------------
...
        mac-filter 90 create
            description "filter-west"
            scope exclusive
            type normal
        exit
----------------------------------------------
A:ALA-7>config>filter#
```

MAC ISID Filter Policy

The following displays an ISID filter configuration example:

```
A;ALA-7>config>filter# info
----------------------------------------------
mac-filter 90 create
     description "filter-wan-man"
     scope template
     type isid
     entry 1 create
          description "drop-local-isids"
          match
               isid 100 to 1000
          exit
          action drop
     exit
     entry 2 create
          description "allow-wan-isids"
          match
               isid 150
          exit
          action forward
     exit
```

MAC VID Filter Policy

The following displays VID filter configuration example:

```
A:TOP_NODE>config>filter>mac-filter# info
----------------------------------------------
      default-action forward
      type vic
      entry 1 create
         match frame-type ethernet_II
           ouiter-tag 85 4095
         exit
         action drop
      exit
      entry 2 create
         match frame-type ethernet_II
           ouiter-tag 43 4095
         exit
         action drop
      exit
----------------------------------------------
A:TOP_NODE>config>filter>mac-filter#
```

MAC Filter Entry

Within a filter policy, configure filter entries which contain criteria against which ingress, egress, or network traffic is matched. The action specified in the entry determine how the packets are handled, either dropped or forwarded.

- Enter a filter entry ID. The system does not dynamically assign a value.
- Assign an action, either drop or forward.
- Specify matching criteria.

The following displays a MAC filter entry configuration example:

```
A:sim1>config>filter# info
----------------------------------------------
        mac-filter 90 create
            entry 1 create
                description "allow-104"
                match
                exit
                action drop
            exit
        exit
----------------------------------------------
A:sim1>config>filter#
```

Creating a Match List for Filter Policies

IP filter policies support usage of match lists as a single match criteria. To create a match list you must:

- Specify a type of a match list (IPv4 address prefix for example).
- Define a unique match list name (IPv4PrefixBlacklist for example).
- Specify at least one list argument (a valid IPv4 address prefix for example).

Optionally a description can also be defined.

The following displays an IPv4 address prefix list configuration example and usage in an IP filter policy:

```
*A:ala-48>config>filter# info
----------------------------------------------
      match-list
        ip-prefix-list "IPv4PrefixBlacklist"
           description "default IPv4 prefix blacklist"
           prefix 10.0.0.0/21
           prefix 10.254.0.0/24
        exit
     exit
     ip-filter 10
        scope template
        filter-name "IPv4PrefixBlacklistFilter"
        entry 10
           match
              src-ip ip-prefix-list IPv4PrefixBlacklist
           exit
           action drop
        exit
      exit
---------------------------------------------
```

Apply IP (v4/v6) and MAC Filter Policies to a Service

IP and MAC filter policies are applied by associating them with a SAP and/or spoke-sdp in ingress and/or egress direction as desired. Filter ID is used to associate an existing filter policy, or if defined, a Filter Name for that Filter ID policy can be used in the CLI.

The following output displays IP and MAC filters assigned to an ingress and egress SAP and spoke SDP:

```
A:ALA-48>config>service>epipe# info
----------------------------------------------
            sap 1/1/1.1.1 create
                ingress
                    filter ip 10
                exit
                egress
                    filter mac 92
                exit
            exit
            spoke-sdp 8:8 create
                ingress
                    filter ip “epipe sap default filter”
                exit
                egress
                    filter mac 91
                exit
            exit
            no shutdown
----------------------------------------------
A:ALA-48>config>service>epipe#
```

The following output displays an IPv6 filters assigned to an IES service interface:

```
A:ALA-48>config>service>ies# info
----------------------------------------------
            interface "testA" create
                address 192.22.1.1/24
                sap 2/1/3:0 create
                exit
                ipv6
                 ingress
                    filter ipv6 100
                 egress
                    filter ipv6 100
                exit
            exit
...
----------------------------------------------
A:ALA-48>config>service>ies#
```

Applying (IPv4/v6) Filter Policies to a Network Port

IP filter policies can be applied to network IP (v4/v6)interfaces. MAC filters cannot be applied to network IP interfaces or to routable IES services. Similarly to applying filter policies to service, IP (v4/v6) filter policies are applied to network interfaces by associating a policy with ingress and/or egress direction as desired. Filter ID is used to associate an existing filter policy, or if defined, a Filter Name for that Filter ID policy can be used in the CLI.

The following displays an IP filter applied to an interface at ingress.

```
A:ALA-48>config>router# info
#------------------------------------------
# IP Configuration
#------------------------------------------
...
        interface "to-104"
            address 10.0.0.103/24
            port 1/1/1
            ingress
                filter ip 10
            exit
            egress
                filter ip “default network egress policy”
            exit
        exit
...
#------------------------------------------
A:ALA-48>config>router#
```

The following displays IPv4 and IPv6 filters applied to an interface at ingress and egress.

```
A:config>router>if# info
----------------------------------------------
            port 1/1/1
            ipv6
                address 3FFE::101:101/120
            exit
            ingress
                filter ip 2
                filter ipv6 1
            exit
            egress
                filter ip 2
                filter ipv6 1
            exit
----------------------------------------------
A:config>router>if#
```

Creating a Redirect Policy

Configuring and applying redirect policies is optional. Each redirect policy must have the following:

- A destination IP address
- A priority (default is 100)
- At least one of the following tests must be enabled:
  - → Ping test
  - → SNMP test
  - → URL test

The following displays a redirection policy configuration:

```
A:ALA-7>config>filter# info
----------------------------------------------
        redirect-policy "redirect1" create
            destination 10.10.10.104 create
                description "SNMP_to_104"
                priority 105
                snmp-test "SNMP-1"
                    interval 30
                    drop-count 30 hold-down 120
                exit
                no shutdown
            exit
            destination 10.10.10.105 create
                priority 95
                ping-test
                    timeout 30
                    drop-count 5
                exit
                no shutdown
            exit
            destination 10.10.10.106 create
                priority 90
                url-test "URL_to_106"
                    url "http://aww.alcatel.com/ipd/"
                    interval 60
                    return-code 2323 4567 raise-priority 96
                exit
                no shutdown
            exit
...
----------------------------------------------
A:ALA-7>config>filter#
```

Configuring Policy-Based Forwarding for Deep Packet Inspection in VPLS

The purpose policy-based forwarding is to capture traffic from a customer and perform a deep packet inspection (DPI) and forward traffic, if allowed, by the DPI.

In the following example, the split horizon groups are used to prevent flooding of traffic. Traffic from customers enter at SAP 1/1/5:5. Due to the mac-filter 100 that is applied on ingress, all traffic with dot1p 07 marking will be forwarded to SAP 1/1/22:1, which is the DPI.

DPI performs packet inspection/modification and either drops the traffic or forwards the traffic back into the box through SAP 1/1/21:1. Traffic will then be sent to spoke-sdp 3:5.

SAP 1/1/23:5 is configured to see if the VPLS service is flooding all the traffic. If flooding is performed by the router then traffic would also be sent to SAP 1/1/23:5 (which it should not).

Figure shows an example to configure policy-based forwarding for deep packet inspection on a VPLS service. For information about configuring services, refer to the 7750 SR OS Services Guide.

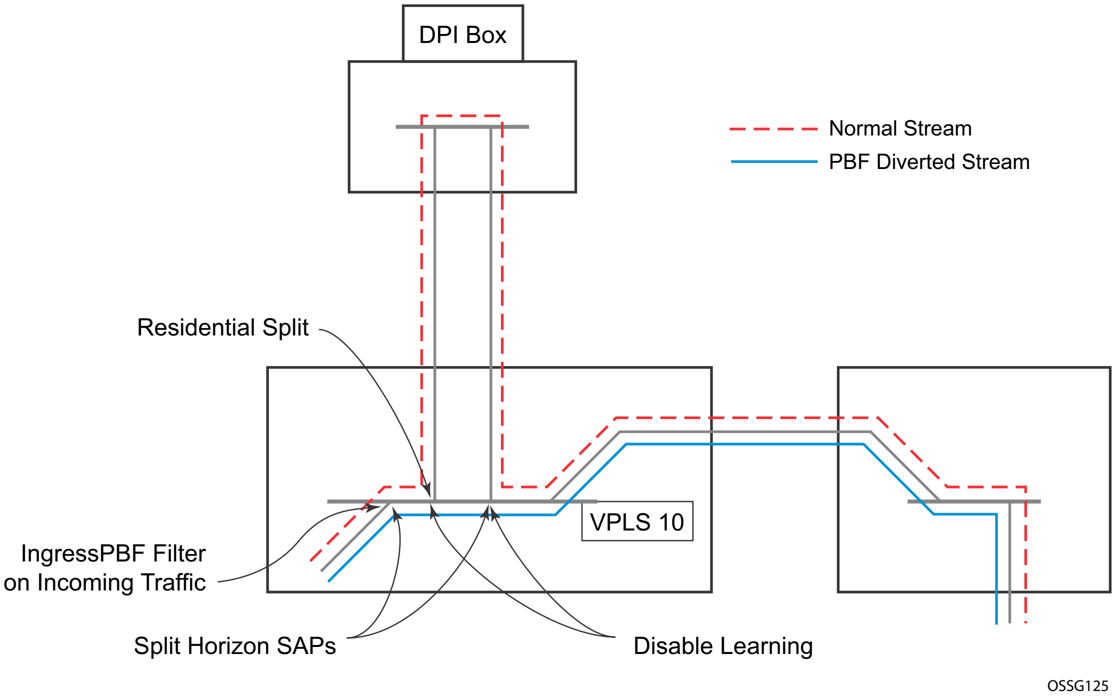


Figure 21: Policy-Based Forwarding for Deep Packet Inspection

The following displays a VPLS service configuration with DPI example:

```
*A:ALA-48>config>service# info
----------------------------------------------
...
        vpls 10 customer 1 create
            service-mtu 1400
            split-horizon-group "dpi" residential-group create
            exit
            split-horizon-group "split" create
            exit
            stp
                shutdown
            exit
            sap 1/1/21:1 split-horizon-group "split" create
                disable-learning
                static-mac 00:00:00:31:11:01 create
            exit
            sap 1/1/22:1 split-horizon-group "dpi" create
                disable-learning
                static-mac 00:00:00:31:12:01 create
            exit
            sap 1/1/23:5 create
                static-mac 00:00:00:31:13:05 create
            exit
            no shutdown
        exit
...
----------------------------------------------
*A:ALA-48>config>service#
```

The following displays a MAC filter configuration example:

```
*A:ALA-48>config>filter# info
----------------------------------------------
...
        mac-filter 100 create
            default-action forward
            entry 10 create
                match
                    dot1p 7 7
                exit
                log 101
                action forward sap 1/1/22:1
            exit
        exit
...
----------------------------------------------
*A:ALA-48>config>filter#
```

The following displays the MAC filter added to the VPLS service configuration:

```
*A:ALA-48>config>service# info
----------------------------------------------
...
        vpls 10 customer 1 create
            service-mtu 1400
            split-horizon-group "dpi" residential-group create
            exit
            split-horizon-group "split" create
            exit
            stp
                shutdown
            exit
            sap 1/1/5:5 split-horizon-group "split" create
                ingress
                    filter mac 100
                exit
                static-mac 00:00:00:31:15:05 create
            exit
            sap 1/1/21:1 split-horizon-group "split" create
                disable-learning
                static-mac 00:00:00:31:11:01 create
            exit
            sap 1/1/22:1 split-horizon-group "dpi" create
                disable-learning
                static-mac 00:00:00:31:12:01 create
            exit
            sap 1/1/23:5 create
                static-mac 00:00:00:31:13:05 create
            exit
            spoke-sdp 3:5 create
            exit
            no shutdown
        exit
....
----------------------------------------------
*A:ALA-48>config>service#
```

Filter Management Tasks

This section discusses the following filter policy management tasks:

- Renumbering Filter Policy Entries on page 466
- Modifying a Filter Policy on page 468
- Deleting a Filter Policy on page 470
- Modifying a Redirect Policy on page 471
- Deleting a Redirect Policy on page 472
- Copying Filter Policies on page 473

Renumbering Filter Policy Entries

The system exits the matching process when the first match is found and then executes the actions in accordance with the specified action. Because the ordering of entries is important, the numbering sequence may need to be rearranged. Entries should be numbered from the most explicit to the least explicit.

The following example illustrates renumbering of filter entries.

Example:

```
config>filter>ip-filter# renum 10 15
config>filter>ip-filter# renum 20 10
config>filter>ip-filter# renum 40 1
```

The following displays the original filter entry order on the left side and the reordered filter entries on the right side:

```
A:ALA-7>config>filter# info
----------------------------------------------
...
        ip-filter 11 create
            description "filter-main"
            scope exclusive
            entry 10 create
                description "no-91"
                filter-sample
                interface-disable-sample
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.10.103/24
                exit
               action forward redirect-policy redirect1
            exit
            entry 20 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.0.100/24
                exit
                action drop
            exit
            entry 30 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.0.200/24
                exit
                action forward
            exit
            entry 40 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.10.106/24
                exit
                action drop
            exit
        exit
...
----------------------------------------------
A:ALA-7>config>filter#
```

```
A:ALA-7>config>filter# info
----------------------------------------------
...
        ip-filter 11 create
            description "filter-main"
            scope exclusive
            entry 1 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.10.106/24
                exit
                action drop
            exit
            entry 10 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.0.100/24
                exit
                action drop
            exit
            entry 15 create
                description "no-91"
                filter-sample
                interface-disable-sample
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.10.103/24
                exit
               action forward redirect-policy
                   redirect1
            exit
            entry 30 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.0.200/24
                exit
                action forward
            exit
        exit
...
----------------------------------------------
A:ALA-7>config>filter#
```

Modifying a Filter Policy

There are several ways to modify an existing filter policy. A filter policy can be modified dynamically as part of subscriber management dynamic insertion/removal of filter policy entries (see SROS Triple Play Guide for details). A filter policy can be modified indirectly by configuration change to a match list the filter policy uses (as described earlier in this guide). In addition, a filter policy can be directly edited as described below.

To access a specific IP (v4/v6), or MAC filter, you must specify the filter ID, or if defined, filter name. Use the **no** form of the command to remove the command parameters or return the parameter to the default setting.

Example:

```
config>filter>ip-filter# description "New IP filter info"
config>filter>ip-filter# entry 2 create
config>filter>ip-filter>entry$ description "new entry"
config>filter>ip-filter>entry# action drop
config>filter>ip-filter>entry# match dst-ip 10.10.10.104/32
config>filter>ip-filter>entry# exit
config>filter>ip-filter#
```

The following output displays the modified IP filter output:

```
A:ALA-7>config>filter# info
----------------------------------------------
...
        ip-filter 11 create
            description "New IP filter info"
            scope exclusive
            entry 1 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.10.106/24
                exit
                action drop
            exit
            entry 2 create
                description "new entry"
                match
                    dst-ip 10.10.10.104/32
                exit
                action drop
            exit
            entry 10 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.0.100/24
                exit
                action drop
            exit
            entry 15 create
                description "no-91"
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.10.103/24
                exit
                action forward
            exit
            entry 30 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.0.200/24
                exit
                action forward
            exit
        exit
..
----------------------------------------------
A:ALA-7>config>filter#
```

Deleting a Filter Policy

Before you can delete a filter, you must remove the filter association from all the applied ingress and egress SAPs and network interfaces by executing **no filter** command in all context where the filter is used.

The following illustrates an example of removing a filter (filter ID 11) from an ingress ePipe SAP:

Example:

```
config>service# epipe 5
config>service>epipe# sap 1/1/2:3
config>service>epipe>sap# ingress
config>service>epipe>sap>ingress# no filter
```

After you have removed the filter from the SAPs network interfaces, you can delete the filter as shown in the following example.

Example:

```
config>filter# no ip-filter 11
```

Modifying a Redirect Policy

To access a specific redirect policy, you must specify the policy name. Use the `no` form of the command to remove the command parameters or return the parameter to the default setting.

Example:
```
config>filter# redirect-policy redirect1
config>filter>redirect-policy# description "New redirect info"
config>filter>redirect-policy# destination 10.10.10.106
config>filter>redirect-policy>dest# no url-test "URL_to_106"
config>filter>redirect-policy>dest# url-test "URL_to_Proxy"
config>filter>redirect-policy>dest>url-test$ url http://
            www.alcatel.com
config>filter>redirect-policy>dest>url-test# interval 10
config>filter>redirect-policy>dest>url-test# timeout 10
config>filter>redirect-policy>dest>url-test# return-code 1
            4294967295 raise-priority 255
```

```
A:ALA-7>config>filter# info
----------------------------------------------
...
        redirect-policy "redirect1" create
            description "New redirect info"
            destination 10.10.10.104 create
                description "SNMP_to_104"
                priority 105
                snmp-test "SNMP-1"
                    interval 30
                    drop-count 30 hold-down 120
                exit
                no shutdown
            exit
            destination 10.10.10.105 create
                priority 95
                ping-test
                    timeout 30
                    drop-count 5
                exit
                no shutdown
            exit
            destination 10.10.10.106 create
                priority 90
                url-test "URL_to_Proxy"
                    url "http://www.alcatel.com"
                    interval 10
                    timeout 10
                    return-code 1 4294967295 raise-priority 255
                exit
                no shutdown
            exit
            no shutdown
        exit
...
----------------------------------------------
A:ALA-7>config>filter#
```

Deleting a Redirect Policy

Before you can delete a redirect policy from the filter configuration, you must remove the policy association from the IP filter.

The following example shows the command usage to replace the configured redirect policy (**redirect1**) with a different redirect policy (**redirect2**) and then removing the **redirect1** policy from the filter configuration.

Example:

```
config>filter>ip-filter 11
       config>filter>ip-filter# entry 1
       config>filter>ip-filter>entry# action forward redirect-policy
redirect2
       config>filter>ip-filter>entry# exit
       config>filter>ip-filter# exit
       config>filter# no redirect-policy redirect1
```

```
A:ALA-7>config>filter>ip-filter# info
----------------------------------------------
            description "This is new"
            scope exclusive
            entry 1 create
              filter-sample
              interface-disable-sample
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.10.106/24
                exit
                action forward redirect-policy redirect2
            exit
            entry 2 create
                description "new entry"
...
----------------------------------------------
A:ALA-7>config>filter>ip-filter#
```

Copying Filter Policies

When changes are to be made to an existing filter policy applied to a one or more SAPs/network interfaces, it is recommended to first copy the applied filter policy, then modify the copy and then overwrite the applied policy with the modified copy. This ensures that a policy being modified is not applied when partial changes are done as any filter policy edits are applied immediately to all services where the policy is applied.

New filter policies can also be created by copying an existing policy and renaming the new filter.

The following displays the command usage to copy an existing IP filter (**11**) to create a new filter policy (**12**) that can then be edited. And once edits are completed, it can be used to overwrite existing policy (**11**).

Example: `config>filter# copy ip-filter 11 to 12`

```
A:ALA-7>config>filter# info
----------------------------------------------
...
        ip-filter 11 create
            description "This is new"
            scope exclusive
            entry 1 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.10.106/24
                exit
                action drop
            exit
            entry 2 create
...
        ip-filter 12 create
            description "This is new"
            scope exclusive
            entry 1 create
                match
                    dst-ip 10.10.10.91/24
                    src-ip 10.10.10.106/24
                exit
                action drop
            exit
            entry 2 create
...
----------------------------------------------
A:ALA-7>config>filter#
```

Filter Command Reference

Command Hierarchies

Configuration Commands

DHCP Filter Policy Commands

```
config
    — filter
            — dhcp-filter filter-id [create]
            — no dhcp-filter  filter-id
                    — description description-string
                    — no description
                    — entry entry-id  [create]
                    — no entry entry-id
                            — action {bypass-host-creation}
                            — action drop
                            — no action
                            — option dhcp-option-number {present | absent}
                            — option dhcp-option-number match hex hex-string [exact] [invert-match]
                            — option dhcp-option-number match string ascii-string [exact] [invert-match]
                            — no option
```

IP Filter Policy Commands

```
config
    — filter
            — ip-filter filter-id [create]
            — ip-filter {filter-id | filter-name}
            — no ip-filter filter-id
                    — default-action {drop | forward}
                    — description description-string
                    — no description
                    — embed-filter {filter-id | open-flow ofs-name} [offset offset ] [{active | inactive}]
                    — no embed-filter {filter-id}
                    — entry entry-id  [time-range  time-range-name] [create]
                    — no entry entry-id
                            — action [drop]
                            — action drop packet-length {{lt | gt | eq} packet-length-value} | {range
                              packet-length-value packet-length-value}
                            — action forward
                            — action forward next-hop {ip-address|indirect ip-address|interface ip-
                              int-name}
                            — action forward [redirect-policy policy-name]
                            — action forward {sap sap-id|sdp sdp-id:vc-id}
                            — action http-redirect rdr-url-string [allow-radius-override]
                            — action forward lsp lsp-name
                            — action forward router {router-instance | service-name service-name}
                            — action gtp-local-breakout
                            — action nat [nat-policy nat-policy-name]
                            — action reassemble
                            — action forward [sap sap-id|sdp sdp-id:vc-id]
                            — no action
                            — description description-string
                            — no description
                            — [no] filter-sample
                            — [no] interface-disable-sample
                            — log log-id
                            — no log
                            — match [protocol protocol-id]
                            — no match
                                    — dscp dscp-name
                                    — no dscp
                                    — dst-ip {ip-address/mask | ip-address ipv4-address-mask | ip-
                                      prefix-list prefix-list-name}
                                    — no dst-ip
                                    — dst-port {lt | gt | eq} dst-port-number
                                    — dst-port port-list-name
                                    — dst-port range dst-port-number dst-port-number
                                    — no dst-port
                                    — fragment {true|false|first-only|non-first-only}
                                    — no fragment
                                    — icmp-code icmp-code
                                    — no icmp-code
                                    — icmp-type icmp-type
                                    — no icmp-type
                                    — ip-option ip-option-value [ip-option-mask]
                                    — no ip-option
                                    — multiple-option {true | false}
                                    — no multiple-option
                                    — option-present {true | false}
                                    — no option-present
                                    — port {lt|gt|eq} port-number
                                    — port port-list port-list-name
                                    — port range port-number port-number
                                    — no port
                                    — src-ip{ip-address/mask | ip-address ipv4-address-mask  | ip-
                                      prefix-list prefix-list-name}
                                    — no src-ip
                                    — src-port {{lt | gt | eq} src-port-number}
                                    — src-port port-list port-list-name
                                    — src-port range src-port-number src-port-number
                                    — no src-port
                                    — src-route-option {true|false}
                                    — no src-route-option
                                    — tcp-ack {true | false}
                                    — no tcp-ack
                                    — tcp-syn {true | false}
                                    — no tcp-syn
                    — filter-name filter-name
                    — no filter-name
                    — renum old-entry-id new-entry-id
                    — scope {exclusive | template | embedded}
                    — no scope
                    — shared-radius-filter-wmark low low-watermark high high-watermark
                    — no shared-radius-filter-wmark
                    — sub-insert-credit-control start-entry entry-id count count
                    — no sub-insert-credit-control
                    — sub-insert-radius start-entry entry-id count count
                    — no sub-insert-radius
                    — sub-insert-shared-radius start-entry entry-id count count
                    — no sub-insert-shared-radius
                    — sub-insert-wmark low low-watermark high high-watermark
                    — no sub-insert-wmark
```

IPv6 Filter Policy Commands

```
config
    — filter
            — ipv6-filter filter-id [create]
            — ipv6-filter {filter-id | filter-name}
            — no ipv6-filter filter-id
                    — default-action {drop | forward}
                    — description description-string
                    — no description
                    — embed-filter {filter-id | open-flow ofs-name} [offset offset ] [{active | inactive}]
                    — no embed-filter {filter-id | open-flow ofs-name}
                    — entry entry-id  [time-range  time-range-name] [create]
                    — no entry entry-id
                            — action [drop]
                            — action drop packet-length {{lt | eq | gt} packet-length-value | range
                              packet-length-value packet-length-value}
                            — action forward
                            — action forward next-hop {ipv6-address|indirect ipv6-address}
                            — action forward [lsp lsp-name]
                            — action forward {sap sap-id|sdp sdp-id:vc-id}
                            — action forward router{router-instance service-name service-name}
                            — action http-redirect rdr-url-string [allow-radius-override]
                            — action nat nat-type nat-type [nat-policy nat-policy-name]
                            — no action
                            — description description-string
                            — no description
                            — [no] filter-sample
                            — [no] interface-disable-sample
                            — log log-id
                            — no log
                            — match [next-header next-header]
                            — no match
                                    — ah-ext-hdr {true | false }
                                    — no ah-ext-hdr
                                    — dscp dscp-name
                                    — no dscp
                                    — dst-ip {ipv6-address/prefix-length | ipv6-address ipv6-
                                      address-mask | ipv6-prefix-list prefix-list-name}
                                    — no dst-ip
                                    — dst-port {lt | gt | eq} dst-port-number
                                    — dst-port port-list port-list-name
                                    — dst-port range dst-port-number dst-port-number
                                    — no dst-port
                                    — esp-ext-hdr {true | false }
                                    — no esp-ext-hdr
                                    — flow-label flow-label [mask]
                                    — no flow-label
                                    — fragment {true|false|first-only|non-first-only}
                                    — no fragment
                                    — hop-by-hop-opt {true|false}
                                    — no hop-by-hop-opt
                                    — icmp-code icmp-code
                                    — no icmp-code
                                    — icmp-type icmp-type
                                    — no icmp-type
                                    — port {lt|gt|eq} port-number
                                    — port port-list port-list-name
                                    — port range port-number port-number
                                    — no port
                                    — routing-type0 {true|false}
                                    — no routing-type0
                                    — src-ip{ipv6-address/prefix-length | ipv6-address ipv6-address-
                                      mask | ipv6-prefix-list prefix-list-name}
                                    — no src-ip
                                    — src-port {lt | gt | eq} src-port-number}
                                    — src-port port-list port-list-name
                                    — src-port range src-port-number src-port-number
                                    — no src-port
                                    — tcp-ack {true | false}
                                    — no tcp-ack
                                    — tcp-syn {true | false}
                                    — no tcp-syn
                    — filter-name filter-name
                    — no filter-name
                    — group-inserted-entries application application location location
                    — renum old-entry-id new-entry-id
                    — scope {exclusive | template | embedded}
                    — no scope
                    — shared-radius-filter-wmark low low-watermark high high-watermark
                    — no shared-radius-filter-wmark
                    — sub-insert-credit-control start-entry entry-id count count
                    — no sub-insert-credit-control
                    — sub-insert-radius start-entry entry-id count count
                    — no sub-insert-radius
                    — sub-insert-shared-radius start-entry entry-id count count
                    — no sub-insert-shared-radius
                    — sub-insert-wmark low low-watermark high high-watermark
                    — no sub-insert-wmark
```

Log Filter Commands

```
config
    — filter
            — log log-id [create]
            — no log log-id
                    — description description-string
                    — no description
                    — destination memory num-entries | syslog syslog-id
                    — no destination
                    — [no] shutdown
                    — summary
                            — [no] shutdown
                            — summary-crit dst-addr
                            — summary-crit src-addr
                            — no summary-crit
                    — [no] wrap-around
```

MAC Filter Commands

```
config
    — filter
            — mac-filter filter-id [create]
            — mac-filter {filter-id | filter-name}
            — no mac-filter filter-id
                    — default-action {drop | forward}
                    — description description-string
                    — no description
                    — entry entry-id [time-range time-range-name]
                    — no entry entry-id [create]
                            — action [drop]
                            — action forward {sap sap-id | sdp sdp-id | vc-id}
                            — no action
                            — description description-string
                            — no description
                            — log log-id
                            — no log
                            — match [frame-type {802dot3 | 802dot2-llc | 802dot2-snap |
                              ethernet_II}]
                            — no match
                                    — dot1p dot1p-value [dot1p-mask]
                                    — no dot1p
                                    — dsap dsap-value [dsap-mask]
                                    — no dsap
                                    — dst-mac ieee-address [ieee-address-mask]
                                    — no dst-mac
                                    — etype 0x0600..0xffff
                                    — no etype
                                    — inner-tag value [vid-mask]
                                    — no inner-tag
                                    — isid  value [to higher-value]
                                    — no isid
                                    — outer-tag value [vid-mask]
                                    — no outer-tag
                                    — snap-oui {zero | non-zero}
                                    — no snap-oui
                                    — snap-pid snap-pid
                                    — no snap-pid
                                    — ssap ssap-value [ssap-mask]
                                    — no ssap
                                    — src-mac ieee-address [ieee-address-mask]
                                    — no src-mac
                    — renum old-entry-id new-entry-id
                    — scope {exclusive | template}
                    — no scope
                    — type filter-type
```

Match Filter List Commands

```
config
    — filter
            — match-list
                    — ip-prefix-list ip-prefix-list-name [create]
                    — no ip-prefix-list ip-prefix-list-name
                            — [no] apply-path
                                    — bgp-peers index group reg-exp neighbor reg-exp
                                    — no bgp-peers index
                            — description description-string
                            — no description
                            — [no] prefix ip-prefix/prefix-length
                    — ipv6-prefix-list ipv6-prefix-list-name [create]
                    — no ipv6-prefix-list ipv6-prefix-list-name
                            — [no] apply-path
                                    — bgp-peers index group reg-exp neighbor reg-exp
                                    — no bgp-peers index
                            — description description-string
                            — no description
                            — [no] prefix ipv6-prefix/prefix-length
                    — port-list port-list-name create
                    — no port-list port-list-name
                            — description description-string
                            — no description
                            — [no] port port number
                            — [no] port range start end
                            — no port
```

Redirect Policy Configuration Commands

```
config
    — filter
            — redirect-policy redirect-policy-name [create]
            — no redirect-policy redirect-policy-name
                    — description description-string
                    — no description
                    — destination ip-address [create]
                    — no destination ip-address
                            — description description-string
                            — no description
                            — [no] ping-test
                                    — drop-count consecutive-failures [hold-down seconds]
                                    — no drop-count
                                    — interval seconds
                                    — no interval
                                    — timeout seconds
                                    — no timeout
                            — priority [priority]
                            — no priority
                            — [no] shutdown
                            — snmp-test test-name [create]
                            — no snmp-test test-name
                                    — drop-count consecutive-failures [hold-down seconds]
                                    — no drop-count
                                    — interval seconds
                                    — no interval
                                    — oid oid-string community community-string
                                    — no oid
                                    — return-value return-value type return-type [disable | lower-
                                      priority priority | raise-priority priority]
                                    — no return-value return-value type return-type
                                    — timeout seconds
                                    — no timeout
                            —  url-test test-name [create]
                            — no url-test test-name
                                    — drop-count consecutive-failures [hold-down seconds]
                                    — no drop-count
                                    — interval seconds
                                    — no interval
                                    — return-code return-code-1 [return-code-2] [disable | lower-
                                      priority priority | raise-priority priority]
                                    — no return-code return-code-1  [return-code-2]
                                    — timeout seconds
                                    — no timeout
                                    — url url-string [http-version version-string]
                                    — no url
                    — [no] shutdown
```

Copy Filter Commands

- **config**
  - — **filter**
    - — **copy ip-filter** *src-filter-id* [**src-entry** *src-entry-id*] **to** *dst-filter-id* [**dst-entry** *dst-entry-id*] [**overwrite**]
    - — **copy ipv6-filter** *src-filter-id* [**src-entry** *src-entry-id*] **to** *dst-filter-id* [**dst-entry** *dst-entry-id*] [**overwrite**]
    - — **copy mac-filter** *src-filter-id* [**src-entry** *src-entry-id*] **to** *dst-filter-id* [**dst-entry** *dst-entry-id*] [**overwrite**]

Show Commands

- **show**
  - — **filter**
    - — **dhcp** [*filter-id*]
    - — **download-failed**
    - — **ip** [**filter-type** *filter-type*]
    - — **ip embedded** [**inactive**]
    - — **ip** *ip-filter-id* **embedded** [**inactive**]
    - — **ip** *ip-filter-id* [**detail**]
    - — **ip** *ip-filter-id* **associations**
    - — **ip** *ip-filter-id* **type entry-type**
    - — **ip** *ip-filter-id* **counters** [**type** *entry-type*]
    - — **ip** *ip-filter-id* **entry** *entry-id* **counters**
    - — **ip** *ip-filter-id* **entry** *entry-id* [**detail**]
    - — **ipv6** [**filter-type** *filter-type*]
    - — **ipv6 embedded** [**inactive**]
    - — **ipv6** *ipv6-filter-id* **embedded** [**inactive**]
    - — **ipv6** *ipv6-filter-id* [detail]
    - — **ipv6** *ipv6-filter-id* **associations**
    - — **ipv6** *ipv6-filter-id* **type** *entry-type*
    - — **ipv6** *ipv6-filter-id* **counters** [**type** *entry-type*]
    - — **ipv6** *ipv6-filter-id* **entry** *entry-id* **counters**
    - — **ipv6** *ipv6-filter-id* **entry** *entry-id* [**detail**]
    - — **log** [**bindings**]
    - — **log** *log-id* [**match** *string*]
    - — **mac** {*mac-filter-id* [**entry** *entry-id*] [**association** | **counters**]}
    - — **match-list**
      - — **ip-prefix-list** [*prefix-list-name*]
      - — **ip-prefix-list** *prefix-list-name* **references**
      - — **ipv6-prefix-list** [*prefix-list-name*]
      - — **ipv6-prefix-list** *prefix-list-name* **references**
      - — **port-list** [*port-list-name*]
      - — **port-list** port-list-name **references**
    - — **redirect-policy** {*redirect-policy-name* [**dest** *ip-address*] [**association**]}

Clear Commands

- **clear**
  - — **filter**
    - — **ip** *filter-id* [**entry** *entry-id*] [**ingress** | **egress**]
    - — **ipv6** *filter-id* [**entry** *entry-id*] [**ingress** | **egress**]
    - — **log** *log-id*
    - — **mac** *filter-id* [**entry** *entry-id*] [**ingress** | **egress**]

Monitor Commands

monitor

— **filter ip** *ip-filter-id* **entry** *entry-id* [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]
— **filter ipv6** *ipv6-filter-id* **entry** *entry-id* [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]
— **filter mac** *mac-filter-id* **entry** *entry-id* [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

Configuration Commands

Generic Commands

description

Syntax **description** *string*
no description

Context config>filter>dhcp-filter
config>filter>ip-filter
config>filter>ipv6-filter
config>filter>ip-filter>entry
config>filter>ip-filter>entry
config>filter>ipv6-filter>entry
config>filter>log
config>filter>mac-filter
config>filter>mac-filter>entry
config>filter>redirect-policy
config>filter>redirect-policy>destination
config>filter>match-list>ip-prefix-list
config>filter>match-list>ip-filter
config>filter>match-list>port-list

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 context in the configuration file.

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

Default none

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.

Global Filter Commands

dhcp-filter

Syntax **dhcp-filter** *filter-id* [**create**]
no dhcp-filter *filter-id*

Context config>filter

Description This command configures the identification number of a DHCP filter.

Parameters *filter-id* — Specifies the DHCP filter policy ID number.

Values 1 — 65535

create — Keyword required when first creating the configuration context. Once the context is created, one can navigate into the context without the **create** keyword.

filter-name — A string of up to 64 characters uniquely identifying this filter policy.

ip-filter

Syntax **ip-filter** *filter-id* [**create**]
ip-filter {*filter-id* **|** *filter-name*}
no ip-filter *filter-id*

Context config>filter

Description This command creates a configuration context for an IP (v4) filter policy.

The **no** form of the command deletes the IP filter policy. A filter policy cannot be deleted until it is removed from all objects where it is applied.

Parameters *filter-id* — Specifies the IP filter policy ID number.

Values 1 — 65535

create — Keyword required when first creating the configuration context. Once the context is created, one can navigate into the context without the **create** keyword.

filter-name — A string of up to 64 characters uniquely identifying this filter policy.

ipv6-filter

Syntax **ipv6-filter** *filter-id* [**create**]
ip-filter {*filter-id* **|** *filter-name*}
no ipv6-filter *ipv6-filter-id*

Context config>filter

Description This command creates a configuration context for an IP (v6) filter policy.

The **no** form of the command deletes the IP filter policy. A filter policy cannot be deleted until it is removed from all objects where it is applied.

Parameters *filter-id* — specifies the IPv6 filter policy ID number.

Values 1 — 65535

create — Keyword required when first creating the configuration context. Once the context is created, one can navigate into the context without the **create** keyword.

filter-name — A string of up to 64 characters uniquely identifying this IPv6 filter policy.

mac-filter

Syntax **mac-filter** *filter-id* [**create**]
mac-filter {*filter-id* **|** *filter-name*}
no mac-filter *filter-id*

Context config>filter

Description This command enables the context for a MAC filter policy.

The **no** form of the command deletes the mac-filter policy. A filter policy cannot be deleted until it is removed from all objects where it is applied.

Parameters *filter-id* — The MAC filter policy ID number.

Values 1 — 65535

create — Keyword required when first creating the configuration context. Once the context is created, one can navigate into the context without the **create** keyword.

filter-name — A string of up to 64 characters uniquely identifying this filter policy.

redirect-policy

Syntax [**no**] **redirect-policy** *redirect-policy-name*

Context config>filter

Description This command configures redirect policies.

The **no** form of the command removes the redirect policy from the filter configuration only if the policy is not referenced in a filter and the filter is not in use (applied to a service or network interface).

Default none

Parameters *redirect-policy-name* — Specifies the redirect policy name. 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. There is no limit to the number of redirect policies that can be configured.

log

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

Context config>filter

Description This command enables the context to create a filter log policy.

The **no** form of the command deletes the filter log ID. The log cannot be deleted if there are filter entries configured to write to the log. All filter entry logging associations need to be removed before the log can be deleted.

Special Cases **Filter log 101 —** Filter log 101 is the default log and is automatically created by the system. Filter log 101 is always a memory filter log and cannot be changed to a Syslog filter log. The log size defaults to 1000 entries. The number of entries and wrap-around behavior can be modified.

Default **log 101**

Parameters *log-id* — The filter log ID destination expressed as a decimal integer.

Values 101 — 199

DHCP Filter Commands

action

Syntax **action** {**bypass-host-creation**}
action drop
no action

Context config>filter>dhcp-filter>entry

Description This command specifies the action to take on DHCP host creation when the filter entry matches.

The **no** form of the command reverts to the default wherein the host creation proceeds as normal

Default no action

Parameters **bypass-host-creation —** Specifies that the host creation is bypassed.

drop — Specifies the DHCP message is dropped.

option

Syntax **option** *dhcp-option-number* {**present | absent**}
option *dhcp-option-number* **match hex** *hex-string* [**exact**] [**invert-match**]
option *dhcp-option-number* **match string** *ascii-string* [**exact**] [**invert-match**]
no option

Context config>filter>dhcp-filter>entry

Description This command configures the action to take on DHCP host creation when the filter entry matches.

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

Parameters *dhcp-option-number —*

Values 0 — 255

present — Specifies that the related DHCP option must be present.

absent — Specifies that the related DHCP option must be absent.

match hex *hex-string* — The option must (partially) match a specified hex string.

Values 0x0..0xFFFFFFFF...(max 254 hex nibbles)

match string *ascii-string* — The option must (partially) match a specified ASCII string.

Values Up to 127 characters

exact — This option requires an exact match of a hex or ascii string.

invert-match — Requires the option not to (partially) match.

Filter Log Commands

destination

Syntax **destination memory** *num-entries*
destination syslog *syslog-id*
no destination

Context config>filter>log

Description This command configures the destination for filter log entries for the filter log ID.

Filter logs can be sent to either memory (**memory**) or to an existing Syslog server definition (**syslog**).

If the filter log destination is **memory**, the maximum number of entries in the log must be specified.

The **no** form of the command deletes the filter log association.

Default **no destination**

Parameters **memory** *num-entries* **—** Specifies the destination of the filter log ID is a memory log. The *num-entries* value is the maximum number of entries in the filter log expressed as a decimal integer.

Values 10 — 50000

syslog *syslog-id* **—** Specifies the destination of the filter log ID is a Syslog server. The *syslog-id* parameter is the number of the Syslog server definition.

Values 1 — 10

shutdown

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

Context config>filter>log
config>filter>log>summary

Administratively enables/disabled (AdminUp/AdminDown) an entity. Downing an entity does not change, reset or remove any configuration settings or statistics. Many objects must be shutdown before they may be deleted.

The **shutdown** command administratively downs an entity. Administratively downing an entity changes the operational state of the entity to down.

Unlike other commands and parameters where the default state will not be 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 no shutdown

summary

Syntax **summary**

Context config>filter>log

Description This command enables the context to configure log summarization. These settings will only be taken into account when syslog is the log destination. Note that summary settings will only be taken into account in case the log destination is syslog.

Parameters none

summary-crit

Syntax **summary-crit dst-addr**
summary-crit src-addr
no summary-crit

Context config>filter>log>summary

Description This command defines the the key of the index of the minitable. If key information is changed while summary is in no shutdown, the filter summary minitable is flushed and recreated with different key information. Log packets received during the reconfiguration time will be handled as if summary was not active.

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

Default dst-addr

Parameters **dst-addr —** Specifies that received log packets are summarized based on the destination IP, IPv6, or MAC address.

src-addr — Specifies that received log packets are summarized based on the source IP, IPv6 or MAC address.

wrap-around

Syntax [**no**] **wrap-around**

Context config>filter>log

Description This command configures a memory filter log to log until full or to store the most recent log entries (circular buffer).

Specifying **wrap-around** configures the memory filter log to store the most recent filter log entries (circular buffer). When the log is full, the oldest filter log entries are overwritten with new entries.

The **no** form of the command configures the memory filter log to accept filter log entries until full. When the memory filter log is full, filter logging for the log filter ID ceases.

Default wrap-around

ACL Filter Policy Commands

default-action

Syntax **default-action** {**drop | forward**}

Context config>filter>ip-filter
config>filter>ipv6-filter
config>filter>mac-filter

Description This command defines default action to be applied to packets for this filter policy.

Default drop

Parameters **drop —** Specifies all packets will be dropped unless there is a filter entry which causes the packet to be forwarded.

forward — Specifies all packets will be forwarded unless there is a filter entry which causes the packet to be dropped.

embed-filter

Syntax **embed-filter** *filter-id* [**offset** *offset*] [{**active | inactive**} **embed-filter open-flow** *ofs-name* [**offset** *offset*] [{ active | inactive}]]
no embed-filter {*filter-id* **| open-flow** *ofs-name*}

Context config>filter>ip-filter
config>filter>ipv6-filter

Description This command embeds a previously defined IPv4, or IPv6 embedded filter policy or a Hybrid OpenFlow switch instanceinto this exclusive or template filter policy at the specified offset value.

active | **inactive** keywords:

active – an embedded filter entries are to be included in this embedding filter policy and activated on applicable line cards – default if no keyword is specified and omitted in info command (but not info detail), or when saving configuration

inactive – an embedded filter policy entries are to be included in this embedded filter policy but are not downloaded to line cards – i.e. remain inactive. Always shown as part of info command or when saved to a configuration file.

The **no** form of this command removes the embeding from this filter policy.

Please see the description of embedded filter policies in this guide for further operational details.

Default No embedded filter policies are included in a filter policy by default

Parameters *filter-id* — Specifies a previously defined embedded filter policy.

ofs-name — name of the currently configured Hybrid OpenFlow switch instance *offset* — a value from 0 to 65535, an embedded filter entry X will have an entry X + offset in the embedding filter.

filter-name

Syntax **filter-name** *filter-name*

Context config>filter>ip-filter
config>filter>ipv6>filter
config>filter>mac-filter

Description This command configures filter-name attribute of a given filter. filter-name, when configured, can be used instead of filter ID to reference the given policy in the CLI.

Default no filter-name

Parameters *filter-name* — A string of up to 64 characters uniquely identifying this filter policy.

scope

Syntax **scope** {**exclusive** | **template** | **embedded**}
no scope

Context config>filter>ip-filter
config>filter>ipv6-filter
config>filter>mac-filter

Description This command configures the filter policy scope as exclusive, template, or embedded. If the scope of the policy is template and is applied to one or more services or network interfaces, the scope cannot be changed.

The **no** form of the command sets the scope of the policy to the default of **template**.

Default **template**

Parameters **exclusive —** When the scope of a policy is defined as exclusive, the policy can only be applied to a single entity (SAP or network port). Attempting to assign the policy to a second entity will result in an error message. If the policy is removed from the entity, it will become available for assignment to another entity.

template — When the scope of a policy is defined as template, the policy can be applied to multiple SAPs or network ports.

embedded — When the scope of a policy is defined as embedded, the policy cannot be applied directly to SAP/interface. The policy defines embedded filter rules, which can be embedded by other filter policies. embedded scope is supported for IP and IPv6 filter policies only.

shared-radius-filter-wmark

Syntax **shared-radius-filter-wmark low** *low-watermark* **high** *high-watermark*
no shared-radius-filter-wmark

Context config>filter>ip-filter
config>filter>ipv6-filter

Description This command configures the low and high watermark for the number of RADIUS shared filters reporting

Parameters **low** *low-watermark* **—** Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be raised by the agent.

Values 0 — 8000

high *high-watermark* **—** Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be cleared by the agent.

Values 1— 8000

sub-insert-credit-control

Syntax **sub-insert-credit-control start-entry** *entry-id* **count** *count*
no sub-insert-credit-control

Context config>filter>ip-filter
config>filter>ipv6-filter

Description This command inserts point information for credit control for the filter.

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

Default none

Parameters **entry** *entry-id* **—** Identifies a filter on this system.

Values 1 — 65535

count *count* **—** Specifies the count.

Values 1 — 65535

sub-insert-radius

Syntax **sub-insert-radius start-entry** *entry-id* **count** *count*
no sub-insert-radius

Context config>filter>ip-filter
config>filter>ipv6-filter

Description This command insert point information for RADIUS for the filter.

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

Default none

Parameters **entry** *entry-id* **—** Specifies at what place the filter entries received from RADIUS will be inserted in the filter.

Values 1 — 65535

count *count* **—** Specifies the count.

Values 1 — 65535

sub-insert-shared-radius

Syntax **sub-insert-shared-radius start-entry** *entry-id* **count c***ount*
no sub-insert-shared-radius

Context config>filter>ip-filter
config>filter>ipv6-filter

Description This command configures the insert point for shared host rules from RADIUS.

entry *entry-id* **—** Identifies a filter on this system.

Values 1 — 65535

count *count* **—** Specifies the count.

Values 1 — 65535

sub-insert-wmark

Syntax **sub-insert-wmark low** *low-watermark* **high** *high-watermark*
no sub-insert-wmark

Context config>filter>ip-filter
config>filter>ipv6-filter

Description This command configures the low and high watermark percentage for inserted filter entry usage reporting.

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

Default none

Parameters **low** *low-watermark* — Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be cleared by the agent.

Values 0 — 100

high *high-watermark* **—** Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be raised by the agent.

Values 0 — 100

type

Syntax **type** *filter-type*

Context config>filter>mac-filter

Description This command configures the type of mac-filter as normal, ISID or VID types.

Default normal

Parameters *filter-type* — Specifies which type of entries this MAC filter can contain.

Values **normal** — Regular match criteria are allowed; ISID or VID filter match criteria not allowed.
isid — Only ISID match criteria are allowed.
vid — On.y VID match criteria are allowed on ethernet_II frame types.

General Filter Entry Commands

entry

Syntax **entry** *entry-id* [**time-range** *time-range-name*] [**create**]
no entry *entry-id*

Context config>filter>dhcp-filter
config>filter>ip-filter
config>filter>ipv6-filter
config>filter>mac-filter

Description This command creates or edits an IP (v4), IPv6, or MAC filter entry. Multiple entries can be created using unique entry-id numbers within the filter. Entries must be sequenced 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 filter. Entries removed from the filter are immidately removed from all services or network ports where that filter is applied.

Default none

Parameters *entry-id* — An entry-id uniquely identifies a match criteria and the corresponding action. It is recommended that multiple entries be given *entry-ids* in staggered increments. This allows users to insert a new entry in an existing policy without requiring renumbering of all the existing entries.

Values 1 — 65535

time-range *time-range-name* **—** Specifies the time range name to be associated with this filter entry up to 32 characters in length. The time-range name must already exist in the config>cron context.

create — Keyword required when first creating the configuration context. Once the context is created, one can navigate into the context without the **create** keyword.

log

Syntax **log** *log-id*
no log

Context config>filter>ip-filter>entry
config>filter>ipv6-filter>entry
config>filter>mac-filter>entry

Description This command creates the context to enable filter logging for a filter entry and specifies the destination filter log ID.

The filter log ID must exist before a filter entry can be enabled to use the filter log ID.

The **no** form of the command disables logging for the filter entry.

Default **no log**

Parameters *log-id* — The filter log ID destination expressed as a decimal integer.

Values 101 — 199

IP (v4/v6) Filter Entry Commands

action

Syntax

For IPv4:
action [**drop**]
action forward [**lsp** *lsp-name*]
action forward
action drop packet-length {{**lt | eq | gt**} *packet-length-value* **| range** *packet-length-value packet-length-value*}
action forward next-hop {*ip-address*|**indirect** *ip-address*|**interface** *ip-int-name*}
action forward redirect-policy *policy-name*
action forward {**sap** *sap-id*|**sdp** *sdp-id:vc-id*}
action forward lsp *lsp-name*
action gtp-local-breakout
action nat [**nat-policy** *nat-policy-name*]
action reassemble
action http-redirect *rdr-url-string* [**allow-radius-override**]
no action

For IPv6:
action [**drop**]
action forward
action forward next-hop {*ipv6-address*|**indirect** *ipv6-address*}
action forward lsp *lsp-name*
action forward router {*router-instance* |**service-name** *service-name*}
action forward {**sap** *sap-id*|**sdp** *sdp-id:vc-id*}
action http-redirect *rdr-url-string* [**allow-radius-override**]
action nat nat-type *nat-type* [**nat-policy** *nat-policy-name*]
no action

Context

config>filter>ip-filter>entry
config>filter>ipv6-filter>entry

Description

This command specifies the action to take for packets that match this filter entry. The **action** command must be entered with a keyword specified in order for the entry to be active.

The **no** form of the command removes the specified **action** statement.

Default

no action

Parameters

drop — Specifies packets matching the entry criteria will be dropped.

forward — Specifies packets matching the entry criteria will be forwarded.

next-hop *ip-address* — The IP address of the direct next-hop to which to forward matching packets in dotted decimal notation.

indirect *ip-address* **—** The IP address of the indirect next-hop to which to forward matching packets in dotted decimal notation. The direct next-hop IP address and egress IP interface are determined by a route table lookup.

If the next hop is not available, then a routing lookup will be performed and if a match is found the packet will be forwarded to the result of that lookup. If no match is found a "ICMP destination unreachable" message is send back to the origin.

redirect *policy-name* **—** Specifies the redirect policy configured in the **config>filter>redirect-policy** context.

packet-length {{**lt | eq | gt**} *packet-length-value* **| range** *packet-length-value packet-length-value*} **—** - Specifies packet matching an entry will be dropped if "Total Length" field in packet's IPv4 header matches the **packet-length** condition configured. Otherwise, the packet (packet matching entry condition but not packet-length condition) will be forwarded.

Operators: **lt** – "less than", **eq** – "equal to", **gt** – "greater than", **range** - "specifies an inclusive range" can be used to specify action execution condition. Inclusive range can be defined using range operator.

Values packet-length-value – integers from 0 to 65535. 0 cannot be used with **lt**, and 65535 cannot be used with **gt**. When range is used, the start of the range (first value entered) must be smaller than the end of the range (second value entered).

interface *ip-int-name* **—** The name of the egress IP interface where matching packets will be forwarded from. This parameter is only valid for unnumbered point-to-point interfaces. If the string contains special characters (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

sap *sap-id* **—** Specifies the currently configured VPLS SAP. Only Ethernet SAPs are supported (including q-in-q, BCP, bridged Ethernet in Frame Relay or ATM). Refer to Common CLI Command Descriptions on page 665 for SAP CLI command syntax and parameter descriptions.

sdp *sdp-id:vc-id* **—** specifies an SDP defined in the system. Refer to the 7x50 SR OS Services Guide for information about SDPs.

http-redirect *url* **—** Specifies the HTTP web address that will be sent to the user's browser. Note that http-redirect is not supported on 7750 SR-1 or 7450 ESS-1 models.

The following displays information that can optionally be added as variables in the portal URL (http-redirect url):

- $IP – The customer's IP address.
- $MAC – The customer's MAC address.
- $URL – The original requested URL.
- $SAP – The customer's SAP.
- $SUB – The customer's subscriber identification string".
- $CID — A string that represents the circuit-id or interface-id of the subscriber host (hexadecimal format).

- $RID — A string that represents the remote-id of the subscriber host (hexadecimal format).
- $SAPDESC – A configurable string that represents the configured SAP description.

Values 255 characters maximum

router service-name *service-name* **—** Packets will be routed in the router instance for the specified service-id instead of the routing instance of the ingress interface.

nat — Specifies that matching traffic is to be redirected for NAT performed by Integrated Service Adapter(s) running NAT application.

nat-type *nat-type* **—** Specifies the NAT type to be used when the value of the corresponding filter policy object is **nat**.

Values dslite, nat64

reassemble — Specifies packets matching the filter entry are forwarded to the packet reassembly function in the system.

filter-sample

Syntax [**no**] **filter-sample**

Context config>filter>ip-filter>entry
config>filter>ipv6-filter>entry

Description This command enabled cflowd sampling for packets matching this filter entry.

If the cflowd is either not enabled or set to **cflowd interface** mode, this command is ignored.

The **no** form disables the cflowd sampling using this filter entry.

Default **no filter-sample**

interface-disable-sample

Syntax [**no**] **interface-disable-sample**

Context config>filter>ip-filter>entry
config>filter>ipv6-filter>entry

Description This command disables cflowd sampling for packets matching this filter entry for the IP interface is set to **cflowd interface** mode. This allows the option to not sample specific types of traffic when interface sampling is enabled.

If the cflowd is either not enabled or set to **cflowd acl** mode, this command is ignored.

The **no** form of this command enables sampling.

Default no interface-disable-sample

match

Syntax **match** [**protocol** *protocol-id*]
no match

Context config>filter>ip-filter>entry
config>filter>ipv6-filter>entry

Description This command enables the context to enter match criteria for the filter entry. When the match criteria have been satisfied the action associated with the match criteria is executed.

A **match** context may consist of multiple match criteria, but multiple **match** statements cannot be entered per entry.

The **no** form of the command removes the match criteria for the *entry-id*.

Parameters **protocol —** The **protocol** keyword configures an IP protocol to be used as an IP filter match criterion. The protocol type such as TCP or UDP is identified by its respective protocol number.

protocol-id — Configures the decimal value representing the IP protocol to be used as an IP filter match criterion. Well known protocol numbers include ICMP(1), TCP(6), UDP(17). The **no** form the command removes the protocol from the match criteria.

Values 0 — 255 (values can be expressed in decimal, hexidecimal, or binary - DHB)
keywords: none, crtp, crudp, egp, eigrp, encap, ether-ip, gre, icmp, idrp, igmp, igp, ip, ipv6, ipv6-frag, ipv6-icmp, ipv6-no-nxt, ipv6-opts, ipv6-route, isis, iso-ip, l2tp, ospf-igp, pim, pnni, ptp, rdp, rsvp, stp, tcp, udp, vrrp
* — udp/tcp wildcard

Protocol	Protocol ID	Description
icmp	1	Internet Control Message
igmp	2	Internet Group Management
ip	4	IP in IP (encapsulation)
tcp	6	Transmission Control
egp	8	Exterior Gateway Protocol
igp	9	Any private interior gateway (used by Cisco for IGRP)
udp	17	User Datagram
rdp	27	Reliable Data Protocol
ipv6	41	IPv6
ipv6-route	43	Routing Header for IPv6
ipv6-frag	44	Fragment Header for IPv6
idrp	45	Inter-Domain Routing Protocol
rsvp	46	Reservation Protocol
gre	47	General Routing Encapsulation

Protocol	Protocol ID	Description
ipv6-icmp	58	ICMP for IPv6
ipv6-no-nxt	59	No Next Header for IPv6
ipv6-opts	60	Destination Options for IPv6
iso-ip	80	ISO Internet Protocol
eigrp	88	EIGRP
ospf-igp	89	OSPFIGP
ether-ip	97	Ethernet-within-IP Encapsulation
encap	98	Encapsulation Header
pnni	102	PNNI over IP
pim	103	Protocol Independent Multicast
vrrp	112	Virtual Router Redundancy Protocol
l2tp	115	Layer Two Tunneling Protocol
stp	118	Spanning Tree Protocol
ptp	123	Performance Transparency Protocol
isis	124	ISIS over IPv4
crtp	126	Combat Radio Transport Protocol
crudp	127	Combat Radio User Datagram

match

Syntax **match** [**next-header** *next-header*]
no match

Context config>filter>ipv6-filter>entry

Description This command enables the context to enter match criteria for the filter entry. When the match criteria have been satisfied the action associated with the match criteria is executed.

IA **match** context may consist of multiple match criteria, but multiple **match** statements cannot be entered per entry.

The **no** form of the command removes the match criteria for the *entry-id*.

Parameters *next-header* — Specifies the IPv6 next header to match. Note that this parameter is analogous to the protocol parameter used in IP-Filter match criteria.

Values [0 — 42 | 45 — 49 | 52 — 59 | 61— 255] — protocol numbers accepted in decimal, hexidecimal, or binary - DHB
keywords: none, crtp, crudp, egp, eigrp, encap, ether-ip, gre, icmp, idrp, igmp, igp,

ip, ipv6, ipv6-icmp, ipv6-no-nxt, isis, iso-ip, l2tp, ospf-igp, pim, pnni, ptp, rdp, rsvp, stp, tcp, udp, vrrp
* — udp/tcp wildcard

dscp

Syntax **dscp** *dscp-name*
no dscp

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command configures a DiffServ Code Point (DSCP) name to be used as an IP filter match criterion.

The **no** form of the command removes the DSCP match criterion.

Default **no dscp**

Parameters *dscp-name* — Configure a dscp name that has been previously mapped to a value using the **dscp-name** command. The DiffServ code point may only be specified by its name.

Values be, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cs1, cp9, af11, cp11, af12, cp13, af13, cp15, cs2, cp17, af21, cp19, af22, cp21, af23, cp23

dst-ip

Syntax **dst-ip** {*ip-address/mask* **| ip-address** *ipv4-address-mask* **| ip-prefix-list** *prefix-list-name*]}
dst-ip {*ipv6-address/prefix-length* **| ipv6-address** *ipv6-address-mask* }
no **dst-ip**

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command configures a destination address range to be used as a filter policy match criterion.

To match on the IPv4 or IPv6 destination address, specify the address and its associated mask, e.g., 10.1.0.0/16. The conventional notation of 10.1.0.0 255.255.0.0 can also be used for IPv4.

The **no** form of this command removes the destination IPv4 or IPv6 address match criterion.

Default no destination IP match criteria

Parameters *ip-address* — Specifies the destination IPv4 address specified in dotted decimal notation.

Values ip-address: a.b.c.d

mask — Specify the length in bits of the subnet mask.

Values 1 — 32

ipv4-address-mask — Specify the subnet mask in dotted decimal notation.

Values a.b.c.d (dotted quad equivalent of mask length)

ip-prefix-list — Creates a list of IPv4 prefixes for match criteria in QoS policies. An ip-prefix-list must contain only IPv4 address prefixes.

prefix-list-name — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

ipv6-address — The IPv6 prefix for the IP match criterion in hex digits.

Values 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

prefix-length — The IPv6 prefix length for the ipv6-address expressed as a decimal integer.

Values 1 — 128

mask — Eight 16-bit hexadecimal pieces representing bit match criteria.

Values x:x:x:x:x:x:x (eight 16-bit pieces)

dst-port

Syntax **dst-port {lt | gt | eq}** *dst-port-number*
dst-port *port-list-name*
dst-port range *dst-port-number dst-port-number*
no dst-port

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command configures a destination TCP or UDP port number or port range for an IP filter match criterion. Note that an entry containing Layer 4 match criteria will not match non-initial (2nd, 3rd, etc) fragments of a fragmented packet since only the first fragment contains the Layer 4 information.

The **no** form of the command removes the destination port match criterion.

Default **none**

Parameters **lt** | **gt** | **eq —** Specifies the operator to use relative to *dst-port-number* for specifying the port number match criteria.

lt specifies all port numbers less than *dst-port-number* match.

gt specifies all port numbers greater than *dst-port-number* match.

eq specifies that *dst-port-number* must be an exact match.

eq — Specifies the operator to use relative to *dst-port-number* for specifying the port number match criteria. The **eq** keyword specifies that *dst-port-number* must be an exact match.

dst-port-number — The destination port number to be used as a match criteria expressed as a decimal integer.

Values 0 — 65535

port-list-name — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

range *dst-port-number dst-port-number* **—** Specifies inclusive port range between two dst-port-number values.

flow-label

Syntax **flow-label** *flow-label* [*mask*]
no flow-label

Context config>filter>ipv6-filter>entry>match

Description This command configures the flow-label and optional mask match condition.

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

Default no flow-label

Parameters *flow-label* — Specifies the flow label to be used as a match criterion.

Values 0 — 1048575

mask — Specifies the flow label mask value for this policy IP Filter entry.

Values 0 — 1048575 decimal hex or binary

fragment

Syntax **IPv4:**
fragment {**true**|**false**}
no fragment
IPv6:
fragment {**true**|**false**|**first-only**|**non-first-only**}
no fragment

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command specifies match criterion for fragmented packets.

The **no** form of the command removes the match criterion.

Default **no fragment**

Parameters **true —** Specifies to match on all fragmented IP packets.

false — Specifies to match on all non-fragmented IP packets.

first-only — For IPv6: Matches if a packet is an initial fragment of a fragmented IPv6 packet.

non-first-only — For IPv6: Matches if a packet is a non-initial fragment of a fragmented IPv6 packet.

ah-ext-hdr

ah-ext-hdr {**true**|**false** }
no ah-ext-hdr

Context config>filter>ipv6-filter>entry>match

Description This command enables match on existence of AH Extension Header in the IPv6 filter policy.

The **no** form of this command ignores AH Extension Header presence/absence in a packet when evaluating match criteria of a given filter policy entry.

Default **no ah-ext-hdr**

Parameters **true** — Matches a packet with an AH Extension Header.

false — Match a packet without an AH Extension Header.

esp-ext-hdr

Syntax **esp-ext-hdr** {**true**|**false** }
no esp-ext-hdr

Context config>filter>ipv6-filter>entry>match

Description This command enables match on existence of ESP Extension Header in the IPv6 filter policy.

The **no** form of this command ignores ESP Extension Header presence/absence in a packet when evaluating match criteria of a given filter policy entry.

Default **no esp-ext-hdr**

Parameters **true** — Matches a packet with an ESP Extension Header.

false — Match a packet without an ESP Extension Header.

hop-by-hop-opt

Syntax **hop-by-hop-opt** {**true**|**false**}
no hop-by-hop-opt

Context config>filter>ipv6-filter>entry>match

Description This command enables match on existence of Hop-by-Hop Options Extension Header in the IPv6 filter policy.

The **no** form of this command ignores Hop-by-Hop Options Extension Header presence/absence in a packet when evaluating match criteria of a given filter policy entry.

Default **hop-by-hop-opt**

Parameters **true —** Matches a packet *with* a Hop-by-hop Options Extensions header.

false — Matches a packet *without* a Hop-by-hop Options Extensions header.

icmp-code

Syntax **icmp-code** *icmp-code*
no icmp-code

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description Configures matching on ICMP/ICMPv6 code field in the ICMP/ICMPv6 header of an IP or IPv6 packet as a filter match criterion. Note that an entry containing Layer 4 match criteria will not match non-initial (2nd, 3rd, etc) fragments of a fragmented packet since only the first fragment contains the Layer 4 information.

The **no** form of the command removes the criterion from the match entry.

Default **no icmp-code**

Parameters *icmp-code* — The ICMP/ICMPv6 code values that must be present to match.

Values 0 — 255

icmp-type

Syntax **icmp-type** *icmp-type*
no icmp-type

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command configures matching on the ICMP/ICMPv6 type field in the ICMP/ICMPv6 header of an IP or IPv6 packet as a filter match criterion. Note that an entry containing Layer 4 match criteria will not match non-initial (2nd, 3rd, etc) fragments of a fragmented packet since only the first fragment contains the Layer 4 information.

The **no** form of the command removes the criterion from the match entry.

Default **no icmp-type**

Parameters *icmp-type* — The ICMP/ICMPv6 type values that must be present to match.

Values 0 — 255

ip-option

Syntax **ip-option** *ip-option-value* [*ip-option-mask*]
no ip-option

Context config>filter>ip-filter>entry>match

Description This command configures matching packets with a specific IP option or a range of IP options in the first option of the IP header as an IP filter match criterion.

The option-type octet contains 3 fields:

1 bit copied flag (copy options in all fragments)

2 bits option class

5 bits option number

The **no** form of the command removes the match criterion.

Default none

Parameters *ip-option-value* — Enter the 8 bit option-type as a decimal integer. The mask is applied as an AND to the option byte, the result is compared with the option-value.

The decimal value entered for the match should be a combined value of the eight bit option type field and not just the option number. Thus to match on IP packets that contain the Router Alert option (option number = 20), enter the option type of 148 (10010100).

Values 0 — 255

ip-option-mask — This is optional and may be used when specifying a range of option numbers to use as the match criteria.

This 8 bit mask can be configured using the following formats:

Format Style	Format Syntax	Example
Decimal	`DDD`	`20`
Hexadecimal	`0xHH`	`0x14`
Binary	`0bBBBBBBBB`	`0b0010100`

Default **255 (decimal) (exact match)**

Values 1 — 255 (decimal)

multiple-option

Syntax **multiple-option** {**true | false**}
no multiple-option

Context config>filter>ip-filter>entry>match

Description This command configures matching packets that contain one or more than one option fields in the IP header as an IP filter match criterion.

The **no** form of the command removes the checking of the number of option fields in the IP header as a match criterion.

Default **no multiple-option**

Parameters **true —** Specifies matching on IP packets that contain more than one option field in the header.

false — Specifies matching on IP packets that do not contain multiple option fields present in the header.

option-present

Syntax **option-present** {**true** | **false**}
no option-present

Context config>filter>ip-filter>entry>match

Description This command configures matching packets that contain the option field in the IP header as an IP filter match criterion.

The **no** form of the command removes the checking of the option field in the IP header as a match criterion.

Parameters **true —** Specifies matching on all IP packets that contain the option field in the header. A match will occur for all packets that have the option field present. An option field of zero is considered as no option present.

false — Specifies matching on IP packets that do not have any option field present in the IP header. (an option field of zero). An option field of zero is considered as no option present.

port

Syntax **port** {**lt**|**gt**|**eq**} *port-number*
port port-list *port-list-name*
port range *port-number port-number*
no port

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command configures port match conditions.

Parameters **lt**|**gt**|**eq —** Specifies the lower, greater or equal value for the TCP/UDP port range.

port-number — Specifies the name given to this port list.

Values 0 - 65535

range *port-number port-number* — Specifies inclusive port range between two port-number values.

routing-type0

Syntax **routing-type0** {**true**|**false**}
no routing-type0

Context config>filter>ipv6-filter>entry>match

Description This command enables match on existence of Routing Type Extension Header type 0 in the IPv6 filter policy.

The **no** form of this command ignores Routing Type Extension Header type 0 presence/absence in a packet when evaluating match criteria of a given filter policy entry.

Default **no routing-type0**

Parameters **true** — match if a packet contains Routing Type Extension Header type 0

false — match if a packet does not contain Routing Type Extension Header type 0

src-ip

Syntax **src-ip** {*ip-address/mask* | *ip-address ipv4-address-mask* | **ip-prefix-list** *prefix-list-name*}
src-ip {*ipv6-address/prefix-length* | *ipv6-address ipv6-address-mask* | **ipv6-prefix-list** *prefix-list-name*}
no src-ip

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command configures a source IPv4 or IPv6 address range to be used as an IP filter match criterion.

To match on the source IPv4 or IPv6 address, specify the address and its associated mask, e.g. 10.1.0.0/16 for IPv4. The conventional notation of 10.1.0.0 255.255.0.0 may also be used for IPv4.

The **no** form of the command removes the source IP address match criterion.

Default **no src-ip**

Parameters *ip-address* — Specifies the destination IPv4 address specified in dotted decimal notation.

Values ip-address: a.b.c.d

mask — Specify the length in bits of the subnet mask.

Values 1 — 32

ipv4-address-mask — Specify the subnet mask in dotted decimal notation.

Values a.b.c.d (dotted quad equivalent of mask length)

ip-prefix-list — Creates a list of IPv4 prefixes for match criteria in QoS policies. An ip-prefix-list must contain only IPv4 address prefixes.

prefix-list-name — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

ipv6-address — The IPv6 prefix for the IP match criterion in hex digits.

Values 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

prefix-length — The IPv6 prefix length for the ipv6-address expressed as a decimal integer.

Values 1 — 128

mask — Eight 16-bit hexadecimal pieces representing bit match criteria.

Values x:x:x:x:x:x:x:x (eight 16-bit pieces)

src-port

Syntax **src-port** {**lt** | **gt** | **eq**} *src-port-number*
src-port port-list *port-list-name*
src-port range *src-port-number src-port-number*
no src-port

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command configures a source TCP or UDP port number or port range for an IP filter match criterion. Note that an entry containing Layer 4 match criteria will not match non-initial (2nd, 3rd, etc) fragments of a fragmented packet since only the first fragment contains the Layer 4 information.

The **no** form of the command removes the source port match criterion.

Default no src-port

Parameters **lt** | **gt** | **eq —** Specifies the operator to use relative to *src-port-number* for specifying the port number match criteria.

lt specifies all port numbers less than *src-port-number* match.

gt specifies all port numbers greater than *src-port-number* match.

eq specifies that *src-port-number* must be an exact match.

src-port-number — The source port number to be used as a match criteria expressed as a decimal integer.

Values 0 — 65535

port-list-name — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes. **<<R12.0>>**

range *src-port-number src-port-number* **—** Specifies inclusive port range between two src-port-number values.

src-route-option

Syntax **src-route-option** {**true**|**false**}
no source-route-option

Context config>filter>ip-filter>entry>match

Description This command enables source route option match conditions. When enabled, this filter should match if a (strict or loose) source route option is present/not present at any location within the IP header, as per the value of this object.

Parameters **true —** Enables source route option match conditions.

false — Disables source route option match conditions.

tcp-ack

Syntax **tcp-ack** {**true** | **false**}
no tcp-ack

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command configures matching on the ACK bit being set or reset in the control bits of the TCP header of an IP packet as an IP filter match criterion. Note that an entry containing Layer 4 match criteria will not match non-initial (2nd, 3rd, etc) fragments of a fragmented packet since only the first fragment contains the Layer 4 information.

The **no** form of the command removes the criterion from the match entry.

Default no tcp-ack

Parameters **true —** Specifies matching on IP packets that have the ACK bit set in the control bits of the TCP header of an IP packet.

false — Specifies matching on IP packets that do not have the ACK bit set in the control bits of the TCP header of the IP packet.

tcp-syn

Syntax **tcp-syn** {**true** | **false**}
no tcp-syn

Context config>filter>ip-filter>entry>match
config>filter>ipv6-filter>entry>match

Description This command configures matching on the SYN bit being set or reset in the control bits of the TCP header of an IP packet as an IP filter match criterion. Note that an entry containing Layer 4 match criteria will not match non-initial (2nd, 3rd, etc) fragments of a fragmented packet since only the first fragment contains the Layer 4 information.

The SYN bit is normally set when the source of the packet wants to initiate a TCP session with the specified destination IP address.

The **no** form of the command removes the criterion from the match entry.

Default no tcp-syn

Parameters **true —** Specifies matching on IP packets that have the SYN bit set in the control bits of the TCP header.

false — Specifies matching on IP packets that do not have the SYN bit set in the control bits of the TCP header.

Match List Configuration Commands

match-list

Syntax **match-list**

Context config>filter

Description This command enables the configuration context for match lists to be used in filter policies (IOM and CPM).

ip-prefix-list

Syntax **ip-prefix-list** *ip-prefix-list-name* **create**
no ip-prefix-list *ip-prefix-list-name*

Context config>filter>match-list

Description This command creates a list of IPv4 prefixes for match criteria in IPv4 ACL and CPM filter policies.

The **no** form of this command deletes the specified list.

Operational notes:

An **ip-prefix-list** must contain only IPv4 address prefixes.

An IPv4 prefix match list cannot be deleted if it is referenced by a filter policy.

Please see general description related to match-list usage in filter policies.

Default none

Parameters *ip-prefix-list-name* — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

ipv6-prefix-list

Syntax **ipv6-prefix-list** *ipv6-prefix-list-name* **create**
no ipv6-prefix-list i*pv6-prefix-list-name*

Context config>filter>match-list

Description This command creates a list of IPv6 prefixes for match criteria in ACL and CPM IPv6 filter policies.

The **no** form of this command deletes the specified list.

Operational notes:

An **ipv6-prefix-list** must contain only IPv6 address prefixes.

An IPv6 prefix match list cannot be deleted if it is referenced by a filter policy.

Please see general description related to match-list usage in filter policies.

Parameters *ipv6-prefix-list-name* — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

apply-path

Syntax **apply-path**
no apply-path

Context config>filter>match-list>ip-pfx-list
config>filter>match-list>ipv6-pfx-list

Description This command enables context to configure auto-generation of address prefixes for IPv4 or IPv6 address prefix match lists. The context the command is executed governs whether IPv4 or IPv6 prefixes will be auto-generated.

The **no** form of this command removes all auto-generation configuration under the apply-path context.

Default no apply path

bgp-peers

Syntax **bgp-peers** *index* **group** *reg-exp* **neighbor** *reg-exp*
no bgp-peers *index*

Context config>filter>match-list>ip-pfx-list>apply-path
config>filter>match-list>ipv6-pfx-list>apply-path

Description This command configures auto-generation of IPv4 or IPv6 address prefixes (as required by the context the command is executed within) based on the base router BGP instance configuration.

group:

Configures a match against base router BGP instance group configuration. Regex wildcard match (.*) can be used to match against any group.

neighbor:

Configures a match against base router BGP instance neighbor configuration. Regex wildcard match (.*) can be used to match against any neighbor.

The **no** form of this command removes the bgp-peers configuration for auto-generation of address prefixes for the specified index value.

Default No embedded filter policies are included in a filter policy.

Parameters *index* — An integer from 1 to 255 enumerating bgp-peers auto-generation configuration within this list.

reg-exp — A regular expression defining a macth string to be used to auto generate address prefixes. Matching is performed from the least significant digit. For example a string **10.0** matches all neighbors with addresses starting with **10**; like **10.0.x.x** or **10.0xx.x.x**.

port-list

Syntax **port-list** *port-list-name* **create**
no port-list *port-list-name*

Context config>filter>match-list

Description This command creates a list of TCP/UDP port values or ranges for match criteria in IPv4 and IPv6 ACL and CPM filter policies.

The **no** form of this command deletes the specified list.

Operational notes:

A port-list must contain only TCP/UDP port values or ranges.

A TCP/UDP port match list cannot be deleted if it is referenced by a filter policy.

Please see general description related to match-list usage in filter policies.

Parameters *port-list-name* — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

Default no ports are added to a port list by default.

port

Syntax **port** *port-number*
port range *start end*
no port

Context config>filter>match-list>port-list

Description This command configures a TCP/UDP source or destination port match criterion in IPv4 and IPv6 ACL filter policies. A packet matches this criterion if the packet TCP/UDP (as configured by protocol/next-header match) source OR destination port matches either the specified port value or a port in the specified port range or port-list.

This command is mutually exclusive with **src-port** and **dst-port** commands.

The **no** form of this command deletes the specified port match criterion.

Default **no port**

Parameters *port-number* — A source or destination port to be used as a match criterion specified as a decimal integer.

Values 0 — 65535

range *start end* — an inclusive range of source or destination port values to be used as match criteria.

start of the range and *end* of the range are expressed as decimal integers.

Values 0 — 65535

port-list-name — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

prefix

Syntax **prefix** *ipv6-prefix/prefix-length*
no prefix *ipv6-prefix/prefix-length*

Context config>filter>match-list>ipv6-pfx-list

Description This command adds an IPv6 address prefix to an existing IPv6 address prefix match list.

The **no** form of this command deletes the specified prefix from the list.

Operational notes:

To add set of different prefixes, execute the command with all unique prefixes. The prefixes are allowed to overlap IPv6 address space.

An IPv6 prefix addition will be blocked, if resource exhaustion is detected anywhere in the system because of Filter Policies that use this IPv6 address prefix list.

Default No prefixes are in the list by default

Parameters *ipv6-prefix* — A An IPv6 address prefix written as hexadecimal numbers separated by colons with host bits set to 0. One string of zeros can be omitted so 1010::700:0:217A is equivalent to 1010:0:0:0:0:700:0:217A

Values ipv6-prefix: - IPv6 address prefix
x:x:x:x:x:x:x:x (eight 16-bit pieces)
x:x:x:x:x:x:d.d.d.d
x: [0..FFFF]H
d: [0..255]D

prefix-length — Length of the entered IP prefix.

Values 1 — 128

prefix

Syntax **prefix** *ip-prefix/prefix-length*
no prefix *ip-prefix/prefix-length*

Context config>filter>match-list>ip-prefix-list

Description This command adds an IPv4 address prefix to an existing IPv4 address prefix match list.

The **no** form of this command deletes the specified prefix from the list.

Operational notes:

To add set of unique prefixes, execute the command with all unique prefixes. The prefixes are allowed to overlap IPv4 address space.

An IPv4 prefix addition will be blocked, if resource exhaustion is detected anywhere in the system because of Filter Policies that use this IPv4 address prefix list.

Default none

Parameters *ip-prefix* — A valid IPv4 address prefix in dotted decimal notation.

Values 0.0.0.0 to 255.255.255.255 (host bit must be 0)

prefix-length — Length of the entered IP prefix.

Values 0 — 32

MAC Filter Entry Commands

action

Syntax **action drop**
action forward [**sap** *sap-id* |**sdp** *sdp-id*]
no action

Context config>filter>mac-filter>entry

Description This command configures the action for a MAC filter entry. Multiple action statements entered will overwrite previous actions parameters when defined. To remove a parameter, use the no form of the action command with the specified parameter.

The **no** form of the command removes the specified **action** statement. The filter entry is considered incomplete and hence rendered inactive without the **action** keyword.

Default none

Parameters **drop** — Specifies packets matching the entry criteria will be dropped.

forward — Specifies packets matching the entry criteria will be forwarded. Only Ethernet SAPs are supported (including q-in-q, BCP, bridged Ethernet in Frame Relay or ATM).

If neither drop nor forward is specified, the filter action is no-op and the filter entry is inactive.

sap *sap-id* — Specifies the SAP ID. Refer to Common CLI Command Descriptions on page 665 for SAP CLI command syntax and parameter descriptions.

match

Syntax **match** [**frame-type 802dot3 | 802dot2-llc | 802dot2-snap | ethernet_II**]
no match

Context config>filter>mac-filter>entry

Description This command creates the context for entering/editing match criteria for the filter entry and specifies an Ethernet frame type for the entry.

A **match** context may consist of multiple match criteria, but multiple **match** statements cannot be entered per entry.

The **no** form of the command removes the match criteria for the *entry-id*.

Parameters **frame-type** *keyword* — The **frame-type** keyword configures an Ethernet frame type to be used for the MAC filter match criteria.

Default **802dot3ethernet_II**

Values 802dot3, 802dot2-llc, 802dot2-snap, ethernet_II

802dot3 — Specifies the frame type is Ethernet IEEE 802.3.

802dot2-llc — Specifies the frame type is Ethernet IEEE 802.2 LLC.

802dot2-snap — Specifies the frame type is Ethernet IEEE 802.2 SNAP.

ethernet_II — Specifies the frame type is Ethernet Type II.

MAC Filter Match Criteria

dot1p

Syntax **dot1p** *ip-value* [*mask*]
no dot1p

Context config>filter>mac-filter>entry

Description Configures an IEEE 802.1p value or range to be used as a MAC filter match criterion.

When a frame is missing the 802.1p bits, specifying an dot1p match criterion will fail for the frame and result in a non-match for the MAC filter entry.

The **no** form of the command removes the criterion from the match entry.

SAP Egress

Egress **dot1p** value matching will only match if the customer payload contains the 802.1p bits. For example, if a packet ingresses on a null encapsulated SAP and the customer packet is IEEE 802.1Q or 802.1p tagged, the 802.1p bits will be present for a match evaluation. On the other hand, if a customer tagged frame is received on a dot1p encapsulated SAP, the tag will be stripped on ingress and there will be no 802.1p bits for a MAC filter match evaluation; in this case, any filter entry with a dot1p match criterion specified will fail.

Default no dot1p

Parameters *ip-value* — The IEEE 802.1p value in decimal.

Values 0 — 7

mask — This 3-bit mask can be configured using the following formats:

Format Style	Format Syntax	Example
Decimal	`D`	`4`
Hexadecimal	`0xH`	`0x4`
Binary	`0bBBB`	`0b100`

To select a range from 4 up to 7 specify *p-value* of 4 and a *mask* of 0b100 for value and mask.

Default **7 (decimal)**

Values 1 — 7 (decimal)

dsap

Syntax **dsap** *dsap-value* [*mask*]
no dsap

Context config>filter>mac-filter>entry>match

Description Configures an Ethernet 802.2 LLC DSAP value or range for a MAC filter match criterion.

This is a one-byte field that is part of the 802.2 LLC header of the IEEE 802.3 Ethernet Frame.

The snap-pid field, etype field, ssap and dsap fields are mutually exclusive and may not be part of the same match criteria.

Use the **no** form of the command to remove the dsap value as the match criterion.

Default no dsap

Parameters *dsap-value* — The 8-bit dsap match criteria value in hexadecimal.

Values 0x00 — 0xFF (hex)

mask — This is optional and may be used when specifying a range of dsap values to use as the match criteria.

This 8 bit mask can be configured using the following formats:

Format Style	Format Syntax	Example
Decimal	`DDD`	`240`
Hexadecimal	`0xHH`	`0xF0`
Binary	`0bBBBBBBBB`	`0b11110000`

Default **FF (hex) (exact match)**

0x00 — 0xFF

dst-mac

Syntax **dst-mac** *ieee-address* [*mask*]
no dst-mac

Context config>filter>mac-filter>entry

Description Configures a destination MAC address or range to be used as a MAC filter match criterion.

The **no** form of the command removes the destination mac address as the match criterion.

Default no dst-mac

Parameters *ieee-address* — The MAC address to be used as a match criterion.

Values HH:HH:HH:HH:HH:HH or HH-HH-HH-HH-HH-HH where H is a hexadecimal digit *mask* — A 48-bit mask to match a range of MAC address values.

This 48-bit mask can be configured using the following formats:

Format Style	Format Syntax	Example
Decimal	`DDDDDDDDDDDDDD`	`281474959933440`
Hexadecimal	`0xHHHHHHHHHHHH`	`0xFFFFFF000000`
Binary	`0bBBBBBBB...B`	`0b11110000...B`

To configure so that all packets with a source MAC OUI value of 00-03-FA are subject to a match condition then the entry should be specified as: 0003FA000000 0x0FFFFF000000

Default **0xFFFFFFFFFFFF (exact match)**

Values 0x00000000000000 — 0xFFFFFFFFFFFF

etype

Syntax **etype** *ethernet-type*
no etype

Context config>filter>mac-filter>entry

Description Configures an Ethernet type II Ethertype value to be used as a MAC filter match criterion.

The Ethernet type field is a two-byte field used to identify the protocol carried by the Ethernet frame. For example, 0800 is used to identify the IPv4 packets.

The Ethernet type field is used by the Ethernet version-II frames. IEEE 802.3 Ethernet frames do not use the type field. For IEEE 802.3 frames, use the dsap, ssap or snap-pid fields as match criteria.

The snap-pid field, etype field, ssap and dsap fields are mutually exclusive and may not be part of the same match criteria.

The **no** form of the command removes the previously entered etype field as the match criteria.

Default no etype

Parameters *ethernet-type* — The Ethernet type II frame Ethertype value to be used as a match criterion expressed in hexadecimal.

Values 0x0600 — 0xFFFF

isid

Syntax **isid** *value* [**to** *higher-value*]
no isid

Context config>filter>mac-filter>entry>match

Description This command configures an ISID value or a range of ISID values to be matched by the mac-filter parent. The pbb-etype value for the related SAP (inherited from the ethernet port configuration) or for the related SDP binding (inherited from SDP configuration) will be used to identify the ISID tag.

The **no** form of this command removes the ISID match criterion.

Default no isid

value — Specifies the ISID value, 24 bits. When just one present identifies a particular ISID to be used for matching.

to *higher-value* — Identifies a range of ISIDs to be used as matching criteria.

inner-tag

Syntax **inner-tag** *value* [*vid-mask*]
no inner-tag

Context config>filter>mac-filter>entry>match

Description This command configures the matching of the second tag that is carried transparently through the service. The inner-tag on ingress is the second tag on the frame if there are no service delimiting tags. Inner tag is the second tag before any service delimiting tags on egress but is dependent in the ingress configuration and may be set to 0 even in cases where additional tags are on the frame. This allows matching VLAN tags for explicit filtering or QoS setting when using default or null encapsulations.

The inner-tag is not applicable in ingress on dot1Q SAPs. The inner-tag may be populated on egress depending on the ingress SAP type.

On QinQ SAPs of null and default that do not strip tags inner-tag will contain the second tag (which is still the second tag carried transparently through the service.) On ingress SAPs that strip any tags, inner-tag will contain 0 even if there are more than 2 tags on the frame.

The optional vid_mask is defaulted to 4095 (exact match) but may be specified to allow pattern matching. The masking operation is ((value and vid-mask) = = (tag and vid-mask)). A value of 6 and a mask of 7 would match all VIDs with the lower 3 bits set to 6.

Note for QoS the VID type cannot be specified on the default QoS policy.

The default vid-mask is set to 4095 for exact match.

outer-tag

Syntax **outer-tag** *value* [*vid-mask*]
no outer-tag

Context config>filter>mac-filter>entry>match

Description This command configures the matching of the first tag that is carried transparently through the service. Service delimiting tags are stripped from the frame and outer tag on ingress is the first tag after any service delimiting tags. Outer tag is the first tag before any service delimiting tags on egress. This allows matching VLAN tags for explicit filtering or QoS setting when using default or null encapsulations.

On dot1Q SAPs outer-tag is the only tag that can be matched. On dot1Q SAPs with exact match (sap 2/1/1:50) the outer-tag will be populated with the next tag that is carried transparently through the service or 0 if there is no additional VLAN tags on the frame.

On QinQ SAPs that strip a single service delimiting tag, outer-tag will contain the next tag (which is still the first tag carried transparently through the service.) On SAPs with two service delimiting tags (two tags stripped) outer-tag will contain 0 even if there are more than 2 tags on the frame.

The optional *vid_mask* is defaulted to 4095 (exact match) but may be specified to allow pattern matching. The masking operation is ((value & vid-mask) = = (tag & vid-mask)). A value of 6 and a mask of 7 would match all VIDs with the lower 3 bits set to 6.

Note for QoS the VID type cannot be specified on the default QoS policy.

The default vid-mask is set to 4095 for exact match.

snap-oui

Syntax **snap-oui** [**zero** | **non-zero**]
no snap-oui

Context config>filter>mac-filter>entry

Description This command configures an IEEE 802.3 LLC SNAP Ethernet Frame OUI zero or non-zero value to be used as a MAC filter match criterion.

The **no** form of the command removes the criterion from the match criteria.

Default no snap-oui

Parameters **zero —** Specifies to match packets with the three-byte OUI field in the SNAP-ID set to zero.

non-zero — Specifies to match packets with the three-byte OUI field in the SNAP-ID not set to zero.

snap-pid

Syntax **snap-pid** *pid-value*
no snap-pid

Context config>filter>mac-filter>entry

Description Configures an IEEE 802.3 LLC SNAP Ethernet Frame PID value to be used as a MAC filter match criterion.

This is a two-byte protocol id that is part of the IEEE 802.3 LLC SNAP Ethernet Frame that follows the three-byte OUI field.

The snap-pid field, etype field, ssap and dsap fields are mutually exclusive and may not be part of the same match criteria.

Note: The snap-pid match criterion is independent of the OUI field within the SNAP header. Two packets with different three-byte OUI fields but the same PID field will both match the same filter entry based on a snap-pid match criteria.

The **no** form of the command removes the snap-pid value as the match criteria.

Default no snap-pid

Parameters *pid-value* — The two-byte snap-pid value to be used as a match criterion in hexadecimal.

Values 0x0000 — 0xFFFF

src-mac

Syntax **src-mac** *ieee-address* [*ieee-address-mask*]
no src-mac

Context config>filter>mac-filter>entry

Description Configures a source MAC address or range to be used as a MAC filter match criterion.

The **no** form of the command removes the source mac as the match criteria.

Default no src-mac

Parameters *ieee-address* — Enter the 48-bit IEEE mac address to be used as a match criterion.

Values HH:HH:HH:HH:HH:HH or HH-HH-HH-HH-HH-HH where H is a hexadecimal digit

ieee-address-mask — This 48-bit mask can be configured using:

Format Style	Format Syntax	Example
Decimal	`DDDDDDDDDDDDDD`	`281474959933440`
Hexadecimal	`0xHHHHHHHHHHHH`	`0x0FFFFF000000`
Binary	`0bBBBBBBB...B`	`0b11110000...B`

To configure so that all packets with a source MAC OUI value of 00-03-FA are subject to a match condition then the entry should be specified as: 003FA000000 0xFFFFFF000000

Default **0xFFFFFFFFFFFF** (exact match)

Values 0x00000000000000 — 0xFFFFFFFFFFFF

ssap

Syntax **ssap** *ssap-value* [*ssap-mask*]
no ssap

Context config>filter>mac-filter>entry

Description This command configures an Ethernet 802.2 LLC SSAP value or range for a MAC filter match criterion.

This is a one-byte field that is part of the 802.2 LLC header of the IEEE 802.3 Ethernet Frame.

The snap-pid field, etype field, ssap and dsap fields are mutually exclusive and may not be part of the same match criteria.

The **no** form of the command removes the ssap match criterion.

Default no ssap

Parameters *ssap-value* — The 8-bit ssap match criteria value in hex.

Values 0x00 — 0xFF

ssap-mask — This is optional and may be used when specifying a range of ssap values to use as the match criteria.

This 8 bit mask can be configured using the following formats:

Format Style	Format Syntax	Example
Decimal	`DDD`	`240`
Hexadecimal	`0xHH`	`0xF0`
Binary	`0bBBBBBBBB`	`0b11110000`

Default **none**

Values 0x00 — 0xFF

Policy and Entry Maintenance Commands

copy

Syntax **copy ip-filter src-filter-id [src-entry src-entry-id] to dst-filter-id [dst-entry dst-entry-id] [overwrite]**
copy ipv6-filter *src-filter-id* [**src-entry** *src-entry-id*] **to** *dst-filter-id* [dst-entry *dst-entry-id*] [**overwrite**]
copy mac-filter *src-filter-id* [**src-entry** *src-entry-id*] **to** *dst-filter-id* [dst-entry *dst-entry-id*] [**overwrite**]

Context config>filter

Description This command copies existing filter list entries for a specific filter ID to another filter ID. The **copy** command is a configuration level maintenance tool used to create new filters using existing filters. It also allows bulk modifications to an existing policy with the use of the **overwrite** keyword.
If **overwrite** is not specified, an error will occur if the destination policy ID exists.

Parameters **ip-filter —** Indicates that the *source-filter-id* and the *dest-filter-id* are IP filter IDs.

ipv6-filter — This keyword indicates that the *source-filter-id* and the *dest-filter-id* are IPv6 filter IDs.

mac-filter — Indicates that the *source-filter-id* and the *dest-filter-id* are MAC filter IDs.

source-filter-id — The *source-filter-id* identifies the source filter policy from which the copy command will attempt to copy. The filter policy must exist within the context of the preceding keyword (**ip-filter**, **ipv6-filter** or **mac-filter**).

dest-filter-id — The *dest-filter-id* identifies the destination filter policy to which the copy command will attempt to copy. If the **overwrite** keyword does not follow, the filter policy ID cannot already exist within the system for the filter type the copy command is issued for. If the **overwrite** keyword is present, the destination policy ID may or may not exist.

overwrite — The **overwrite** keyword specifies that the destination filter ID may exist. If it does, everything in the existing destination filter ID will be completely overwritten with the contents of the source filter ID. If the destination filter ID exists, either **overwrite** must be specified or an error message will be returned. If **overwrite** is specified, the function of copying from source to destination occurs in a ‘break before make’ manner and therefore should be handled with care.

filter-name

Syntax **filter-name** *filter-name*
no filter-name

Context config>filter>ip-filter
config>filter>ipv6-filter

Description This command specifies the name to associate with this filter.

Parameters *filter-name* — Specifies the filter name up to 64 characters in length.

renum

Syntax **renum** *old-entry-id new-entry-id*

Context config>filter>ip-filter
config>filter>ipv6-filter
config>filter>mac-filter

Description This command renumbers existing MAC or IP filter entries to properly sequence filter entries. This may be required in some cases since the OS exits when the first match is found and executes the actions according to the accompanying action command. This requires that entries be sequenced correctly from most to least explicit.

Parameters *old-entry-id* — Enter the entry number of an existing entry.

Values 1 — 65535

new-entry-id — Enter the new entry-number to be assigned to the old entry.

Values 1 — 65535

Redirect Policy Commands

destination

Syntax [**no**] **destination** *ip-address*

Context config>filter>redirect-policy

Description This command defines a destination in a redirect policy. More than one destination can be configured. Whether a destination will receive redirected packets depends on the effective priority value after evaluation.

Default none

Parameters *ip-address* — Specifies the IP address to send the redirected traffic.

ping-test

Syntax [**no**] **ping-test**

Context config>filter>destination>ping-test
config>filter>destination>snmp-test

Description This command configures parameters to perform connectivity ping tests to validate the ability for the destination to receive redirected traffic.

Default none

drop-count

Syntax **drop-count** *consecutive-failures* [**hold-down** *seconds*]
no drop-count

Context config>filter>destination>ping-test
config>filter>destination>snmp-test
config>filter>destination>url-test

Description This command specifies the number of consecutive requests that must fail for the destination to be declared unreachable and the time hold-down time to held destination unreachable before repeating tests.

Default drop-count 3 hold-down 0

Parameters *consecutive-failures* — Specifies the number of consecutive ping test failures before declaring the destination down.

Values 1 — 60

hold-down *seconds* **—** The amount of time, in seconds, that the system should be held down if any of the test has marked it unreachable.

Values 0 — 86400

interval

Syntax **interval** *seconds*
no interval

Context config>filter>destination>ping-test
config>filter>destination>snmp-test
config>filter>destination>url-test

Description This command specifies the amount of time, in seconds, between consecutive requests sent to the far end host.

Default 1

Parameters *seconds* — Specifies the amount of time, in seconds, between consecutive requests sent to the far end host.

Values 1 — 60

timeout

Syntax **timeout** *seconds*
no timeout

Context config>filter>destination>snmp-test
config>filter>destination>url-test

Description Specifies the amount of time, in seconds, that is allowed for receiving a response from the far-end host. If a reply is not received within this time the far-end host is considered unresponsive.

Default 1

Parameters *seconds* — Specifies the amount of time, in seconds, that is allowed for receiving a response from the far end host.

Values 1 — 60

priority

Syntax **priority** *priority*
no priority

Context config>filter>destination

Description Redirect policies can contain multiple destinations. Each destination is assigned an initial or base **priority** which describes its relative importance within the policy.

Default 100

Parameters *priority* — The priority, expressed as a decimal integer, used to weigh the destination's relative importance within the policy.

Values 1 — 255

snmp-test

Syntax **snmp-test** *test-name*

Context config>filter>redirect-policy>destination

Description This command enables the context to configure SNMP test parameters.

Default none

Parameters *test-name* — specifies the name of the SNMP test. 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.

oid

Syntax **oid** *oid-string* **community** *community-string*

Context config>filter>redirect-policy>destination>snmp-test

Description This command specifies the OID of the object to be fetched from the destination.

Default none

Parameters *oid-string* — Specifies the object identifier (OID) in the OID field.

community *community-string* **—** The SNMP v2 community string or the SNMP v3 context name used to conduct this SNMP test.

return-value

Syntax **return-value** *return-value* **type** *return-type* [**disable | lower-priority** *priority* **| raise-priority** *priority*]

Context config>filter>redirect-policy>destination>snmp-test

Description This command specifies the criterion to adjust the priority based on the test result. Multiple criteria can be specified with the condition that they are not conflicting or overlap. If the returned value is within the specified range, the priority can be disabled, lowered or raised.

Default none

Parameters *return-value* — Specifies the SNMP value against which the test result is matched.

Values A maximum of 256 characters.

return-type — Specifies the SNMP object type against which the test result is matched.

Values integer, unsigned, string, ip-address, counter, time-ticks, opaque

disable — The keyword that specifies that the destination may not be used for the amount of time specified in the hold-time command when the test result matches the criterion.

lower-priority *priority* **—** Specifies the amount to lower the priority of the destination.

Values 1 — 255

raise-priority *priority* **—** Specifies the amount to raise the priority of the destination.

Values 1 — 255

url-test

Syntax **url-test** *test-name*

Context config>filter>redirect-policy>destination

Description The context to enable URL test parameters. IP filters can be used to selectively cache some web sites.

Default none

Parameters **test-name —** The name of the URL test. 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.

return-code

Syntax **return-code** *return-code-1* [*return-code-2*] [**disable | lower-priority** *priority* **| raise-priority** *priority*]
no return-code *return-code-1* [*return-code-2*]

Context config>filter>redirect-policy>destination>url-test

Description Return codes are returned when the URL test is performed. Values for the specified range are the return codes which can be given back to the system as a result of the test been performed.

For example, error code 401 for HTTP is “page not found.” If, while performing this test, the URL is not reachable, you can lower the priority by 10 points so that other means of reaching this destination are prioritized higher than the older one.

Default none

Parameters *return-code-1, return-code-2* — Specifies a range of return codes. When the URL test return-code falls within the specified range, the corresponding action is performed.

Values	*return-code-1*:	1 — 4294967294
	return-code-2:	2 — 4294967295

disable — Specifies that the destination may not be used for the amount of time specified in the hold-time command when the return code falls within the specified range.

lower-priority *priority* **—** Specifies the amount to lower the priority of the destination when the return code falls within the specified range.

raise-priority *priority* **—** Specifies the amount to raise the priority of the destination when the return code falls within the specified range.

url

Syntax **url** *url-string* [**http-version** *version-string*]

Context config>filter>redirect-policy>destination>url-test

Description This command specifies the URL to be probed by the URL test.

Default none

Parameters *url-string* — Specify a URL up to 255 characters in length.

http-version *version-string* **—** Specifies the HTTP version, 80 characters in length.

shutdown

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

Context config>filter>redirect-policy
config>filter>redirect-policy>destination

Administratively enables/disabled (AdminUp/AdminDown) an entity. Downing an entity does not change, reset or remove any configuration settings or statistics. Many objects must be shutdown before they may be deleted.

The **shutdown** command administratively downs an entity. Administratively downing an entity changes the operational state of the entity to down.

Unlike other commands and parameters where the default state will not be 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 no shutdown

Show Commands

dhcp

Syntax **dhcp** [*filter-id*]

Context show>filter

Description This command displays DHCP filter information.

```
*B:TechPubs>config# show filter dhcp
===============================================================================
DHCP Filters
===============================================================================
Filter-Id   Applied Description
-------------------------------------------------------------------------------
10          No      test-dhcp-filter
-------------------------------------------------------------------------------
Num filter entries: 1
===============================================================================
*B:TechPubs>config#


*B:TechPubs>config# show filter dhcp 10
===============================================================================
DHCP Filter
===============================================================================
Filter-Id    : 10                      Applied      : No
Entries      : 0
Description  : test-dhcp-filter
-------------------------------------------------------------------------------
Filter Match Criteria
-------------------------------------------------------------------------------
No Match Criteria Found
===============================================================================
*B:TechPubs>config#
```

download-failed

Syntax **download-failed**

Context show>filter

Description This command shows all filter entries for which the download has failed.

Output **download-failed Output —** The following table describes the filter download-failed output.

Label	Description
`Filter-type`	Displays the filter type.
`Filter-ID`	Displays the ID of the filter.
`Filter-Entry`	Displays the entry number of the filter.

Sample Output

```
A:ALA-48# show filter download-failed
============================================
Filter entries for which download failed
============================================
Filter-type    Filter-Id      Filter-Entry
--------------------------------------------
ip              1          10
============================================
A:ALA-48#
```

ip

Syntax
ip
ip embedded [**inactive**]
ip *ip-filter-id* **embedded** [**inactive**]
ip *ip-filter-id* [**detail**]
ip *ip-filter-id* **associations**
ip *ip-filter-id* **type** *entry-type*
ip *ip-filter-id* **counters** [**type** *entry-type*]
ip *ip-filter-id* **entry** *entry-id* **counters**
ip *ip-filter-id* **entry** *entry-id* [**detail**]

Context show>filter

Description This command shows IP filter information.

Parameters *ip-filter-id* — Displays detailed information for the specified filter ID and its filter entries.

Values 1 — 65535

entry *entry-id* **—** Displays information on the specified filter entry ID for the specified filter ID only.

Values 1 — 65535

associations — Appends information as to where the filter policy ID is applied to the detailed filter policy ID output.

counters — Displays counter information for the specified filter ID. Note that egress counters count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.

type *entry-type* **—** specifies type of filter entry to display, values:

Values fixed, radius-insert, credit-control-insert, flowspec, embedded, radius-shared

embedded [**failed**] **—** Shows all embeddings, optionally shows failed embedding only, if *filter-id* is not specified shows all embedded filters.

Output **Show Filter (no filter-id specified) —** The following table describes the command output for the command when no filter ID is specified.

Label	Description
`Filter Id`	The IP filter ID
`Scope`	`Template` – The filter policy is of type template.
	`Exclusive` – The filter policy is of type exclusive.
`Applied`	`No` – The filter policy ID has not been applied.
	`Yes` – The filter policy ID is applied.
`Description`	The IP filter policy description.
`In`	Shows embedding filter index
`From`	Shows embedded filters included
`Priority`	Shows priority of embedded filter
`Inserted`	Shows embedded/total number of entries from embedded filter Status: **OK**—embedding operation successful, if any entries are overwritten this will also be indicated. **Failed**—embedding failed, the reason is displayed (out of resources).

Sample Output

```
A:ALA-49# show filter ip
===============================================================================
IP Filters
===============================================================================
Filter-Id Scope    Applied Description
-------------------------------------------------------------------------------
1         Template Yes
3         Template Yes
6         Template Yes
10        Template No
11        Template No
-------------------------------------------------------------------------------
Num IP filters: 5
===============================================================================
A:ALA-49#

*A:Dut-C>config>filter# show filter ip
```

```
===============================================================================
IP Filters                                                       Total:     2
===============================================================================
Filter-Id   Scope    Applied Description
-------------------------------------------------------------------------------
10001       Template Yes
fSpec-1     Template Yes     BGP FlowSpec filter for the Base router
-------------------------------------------------------------------------------
Num IP filters: 2
===============================================================================
*A:Dut-C>config>filter# show filter ip embedded
================================================
IP Filter embedding
================================================
In       From    Priority   Inserted    Status
----------------------------------------------------------------------------------
10       2        50        1/1         OK
         1        100       1/2         OK- 1 entry overwritten

20       2        100       0/5         Failed - out of resources
================================================
*A:Dut-C>config>filter#
```

Output **Show Filter (with filter-id specified) —** The following table describes the command output for the command when a filter ID is specified.

Label	Description
`Filter Id`	The IP filter policy ID.
`Scope`	`Template` — The filter policy is of type template.
	`Exclusive` — The filter policy is of type exclusive.
`Entries`	The number of entries configured in this filter ID.
`Description`	The IP filter policy description.
`Applied`	`No` — The filter policy ID has not been applied.
	`Yes` — The filter policy ID is applied.
`Def. Action`	`Forward` — The default action for the filter ID for packets that do not match the filter entries is to forward.
	`Drop` — The default action for the filter ID for packets that do not match the filter entries is to drop.
`Filter Match Criteria`	`IP` — Indicates the filter is an IP filter policy.
`Entry`	The filter ID filter entry ID. If the filter entry ID indicates the entry is `(Inactive)`, then the filter entry is incomplete as no action has been specified.
`Log Id`	The filter log ID.
`Src. IP`	The source IPv6 address and prefix length match criterion.

Label	Description (Continued)
`Dest. IP`	The destination IPv6 address and prefix length match criterion.
`Next-header`	The next header ID for the match criteria. `Undefined` indicates no next-header specified.
`ICMP Type`	The ICMP type match criterion. `Undefined` indicates no ICMP type specified.
`Fragment`	`False` – Configures a match on all non-fragmented IP packets. `True` – Configures a match on all fragmented IP packets. `Off` – Fragments are not a matching criteria. All fragments and non-fragments implicitly match.
`Sampling`	`Off` – Specifies that traffic sampling is disabled. `On` – Specifies that traffic matching the associated IP filter entry is sampled.
`IP-Option`	Specifies matching packets with a specific IP option or a range of IP options in the IP header for IP filter match criteria.
`TCP-syn`	`False` – Configures a match on packets with the SYN flag set to false. `True` – Configured a match on packets with the SYN flag set to true. `Off` – The state of the TCP SYN flag is not considered as part of the match criteria.
`Match action`	`Default` – The filter does not have an explicit forward or drop match action specified. If the filter entry ID indicates the entry is `Inactive`, the filter entry is incomplete, no action was specified. `Drop` – Drop packets matching the filter entry. `Forward` – The explicit action to perform is forwarding of the packet.
`Ing. Matches`	The number of ingress filter matches/hits for the filter entry.
`Src. Port`	The source TCP or UDP port number or port range.
`Dest. Port`	The destination TCP or UDP port number or port rangee.
`Dscp`	The DiffServ Code Point (DSCP) name.
`ICMP Code`	The ICMP code field in the ICMP header of an IP packet.
`Option-present`	`Off` – Specifies not to search for packets that contain the option field or have an option field of zero.

Label	Description (Continued)
	On – Matches packets that contain the option field or have an option field of zero be used as IP filter match criteria.
Int. Sampling	Off – Interface traffic sampling is disabled.
	On – Interface traffic sampling is enabled.
Multiple Option	Off – The option fields are not checked.
	On – Packets containing one or more option fields in the IP header will be used as IP filter match criteria.
TCP-ack	False – Configures a match on packets with the ACK flag set to false.
	True – Configurs a match on packets with the ACK flag set to true.
	Off – The state of the TCP ACK flag is not considered as part of the match criteria. as part of the match criteria.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Sample Output

```
A:ALA-49>config>filter# show filter ip 3
===============================================================================
IP Filter
===============================================================================
Filter Id    : 3                                Applied        : Yes
Scope        : Template                         Def. Action    : Drop
Entries      : 1
-------------------------------------------------------------------------------
Filter Match Criteria : IP
-------------------------------------------------------------------------------
Entry        : 10
Log Id       : n/a
Src. IP      : 10.1.1.1/24                      Src. Port      : None
Dest. IP     : 0.0.0.0/0                        Dest. Port     : None
Protocol     : 2                                Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
TCP-syn      : Off                              TCP-ack        : Off
Match action : Drop
Ing. Matches : 0                                Egr. Matches   : 0
===============================================================================
A:ALA-49>config>filter#

*A:Dut-C>config>filter# show filter ip fSpec-1 associations
===============================================================================
IP Filter
===============================================================================
Filter Id    : fSpec-1                          Applied        : Yes
Scope        : Template                         Def. Action    : Forward
Radius Ins Pt: n/a
CrCtl. Ins Pt: n/a
Entries      : 2 (insert By Bgp)
```

```
Description  : BGP FlowSpec filter for the Base router
-------------------------------------------------------------------------------
Filter Association : IP
-------------------------------------------------------------------------------
Service Id   : 1                                Type           : IES
- SAP    1/1/3:1.1   (merged in ip-fltr 10001)
===============================================================================
*A:Dut-C>config>filter#


*A:Dut-C>config>filter# show filter ip 10001
===============================================================================
IP Filter
===============================================================================
Filter Id    : 10001                            Applied        : Yes
Scope        : Template                         Def. Action    : Drop
Radius Ins Pt: n/a
CrCtl. Ins Pt: n/a
Entries      : 1
BGP Entries  : 2
Description  : (Not Specified)
-------------------------------------------------------------------------------
Filter Match Criteria : IP
-------------------------------------------------------------------------------
Entry        : 1
Description  : (Not Specified)
Log Id       : n/a
Src. IP      : 0.0.0.0/0                        Src. Port      : None
Dest. IP     : 0.0.0.0/0                        Dest. Port     : None
Protocol     : 6                                Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
Fragment     : Off                              Option-present : Off
Sampling     : Off                              Int. Sampling  : On
IP-Option    : 0/0                              Multiple Option: Off
TCP-syn      : Off                              TCP-ack        : Off
Match action : Forward
Next Hop     : Not Specified
Ing. Matches : 0 pkts
Egr. Matches : 0 pkts

Entry        : fSpec-1-32767  - inserted by BGP FLowSpec
Description  : (Not Specified)
Log Id       : n/a
Src. IP      : 0.0.0.0/0                        Src. Port      : None
Dest. IP     : 0.0.0.0/0                        Dest. Port     : None
Protocol     : 6                                Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
Fragment     : Off                              Option-present : Off
Sampling     : Off                              Int. Sampling  : On
IP-Option    : 0/0                              Multiple Option: Off
TCP-syn      : Off                              TCP-ack        : Off
Match action : Drop
Ing. Matches : 0 pkts
Egr. Matches : 0 pkts

Entry        : fSpec-1-49151  - inserted by BGP FLowSpec
Description  : (Not Specified)
Log Id       : n/a
Src. IP      : 0.0.0.0/0                        Src. Port      : None
```

```
Dest. IP     : 0.0.0.0/0                        Dest. Port     : None
Protocol     : 17                               Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
Fragment     : Off                              Option-present : Off
Sampling     : Off                              Int. Sampling  : On
IP-Option    : 0/0                              Multiple Option: Off
TCP-syn      : Off                              TCP-ack        : Off
Match action : Drop
Ing. Matches : 0 pkts
Egr. Matches : 0 pkts

===============================================================================
*A:Dut-C>config>filter#
===============================================================================
Configured IP Filters                                            Total:     4
===============================================================================
Filter-Id   Scope     Applied Description
-------------------------------------------------------------------------------
1           Template  No
5           Exclusive No
10          Template  Yes
100         Embedded  N/A
===============================================================================
System IP Filters                                                Total:     1
===============================================================================
Filter-Id                     Description
-------------------------------------------------------------------------------
_tmnx_ofs_test                of-switch 'test' embedded filter
-------------------------------------------------------------------------------
Num IP filters: 5
==============================================================================
*A:bksim4001>show>filter# ip _tmnx_ofs_test

===============================================================================
IP Filter
===============================================================================
Filter Id    : _tmnx_ofs_test                   Applied        : No
Scope        : Embedded                         Def. Action    : Drop
Radius Ins Pt: n/a
CrCtl. Ins Pt: n/a
RadSh. Ins Pt: n/a
Entries      : 1
Description  : of-switch 'test' embedded filter
-------------------------------------------------------------------------------
Filter Match Criteria : IP
-------------------------------------------------------------------------------
Entry        : 1000
Description  : (Not Specified)
Log Id       : n/a
Src. IP      : 0.0.0.0/0
Src. Port    : n/a
Dest. IP     : 0.0.0.0/0
Dest. Port   : n/a
Protocol     : Undefined                        Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
Fragment     : Off                              Src Route Opt  : Off
Sampling     : Off                              Int. Sampling  : On
IP-Option    : 0/0                              Multiple Option: Off
TCP-syn      : Off                              TCP-ack        : Off
```

```
Option-pres  : Off
Match action : Drop
Ing. Matches : 0 pkts
Egr. Matches : 0 pkts
```

Output **Show Filter (with time-range specified) —** If a time-range is specified for a filter entry, the following is displayed.

```
A:ALA-49# show filter ip  10
===============================================================================
IP Filter
===============================================================================
Filter Id    : 10                               Applied        : No
Scope        : Template                         Def. Action    : Drop
Entries      : 2
-------------------------------------------------------------------------------
Filter Match Criteria : IP
-------------------------------------------------------------------------------
Entry        : 1010
time-range   : day                              Cur. Status    : Inactive
Log Id       : n/a
Src. IP      : 0.0.0.0/0                        Src. Port      : None
Dest. IP     : 10.10.100.1/24                   Dest. Port     : None
Protocol     : Undefined                        Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
Fragment     : Off                              Option-present : Off
Sampling     : Off                              Int. Sampling  : On
IP-Option    : 0/0                              Multiple Option: Off
TCP-syn      : Off                              TCP-ack        : Off
Match action : Forward
Next Hop     : 138.203.228.28
Ing. Matches : 0                                Egr. Matches   : 0

Entry        : 1020
time-range   : night                            Cur. Status    : Active
Log Id       : n/a
Src. IP      : 0.0.0.0/0                        Src. Port      : None
Dest. IP     : 10.10.1.1/16                     Dest. Port     : None
Protocol     : Undefined                        Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
Fragment     : Off                              Option-present : Off
Sampling     : Off                              Int. Sampling  : On
IP-Option    : 0/0                              Multiple Option: Off
TCP-syn      : Off                              TCP-ack        : Off
Match action : Forward
Next Hop     : 172.22.184.101
Ing. Matches : 0                                Egr. Matches   : 0
===============================================================================
A:ALA-49#
```

Output **Show Filter Associations —** The following table describes the fields that display when the **associations** keyword is specified.

Label	Description
Filter Id	The IP filter policy ID.
Scope	Template – The filter policy is of type Template.
	Exclusive – The filter policy is of type Exclusive.
Entries	The number of entries configured in this filter ID.
Applied	No – The filter policy ID has not been applied.
	Yes – The filter policy ID is applied.
Def. Action	Forward – The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop – The default action for the filter ID for packets that do not match the filter entries is to drop.
Service Id	The service ID on which the filter policy ID is applied.
SAP	The Service Access Point on which the filter policy ID is applied.
(Ingress)	The filter policy ID is applied as an ingress filter policy on the interface.
(Egress)	The filter policy ID is applied as an egress filter policy on the interface.
Type	The type of service of the service ID.
Entry	The filter ID filter entry ID. If the filter entry ID indicates the entry is Inactive, the filter entry is incomplete as no action was specified.
Log Id	The filter log ID.
Src. IP	The source IP address and mask match criterion. 0.0.0.0/0 indicates no criterion specified for the filter entry.
Dest. IP	The destination IP address and mask match criterion. 0.0.0.0/0 indicates no criterion specified for the filter entry.
Protocol	The protocol ID for the match criteria. Undefined indicates no protocol specified.
ICMP Type	The ICMP type match criterion. Undefined indicates no ICMP type specified.
Fragment	False – Configures a match on all non-fragmented IP packets.
	True – Configures a match on all fragmented IP packets.

Label	Description (Continued)
	Off – Fragments are not a matching criteria. All fragments and non-fragments implicitly match.
Sampling	Off – Specifies that traffic sampling is disabled. On – Specifies that traffic matching the associated IP filter entry is sampled.
IP-Option	Specifies matching packets with a specific IP option or a range of IP options in the IP header for IP filter match criteria.
TCP-syn	False – Configures a match on packets with the SYN flag set to false. True – Configured a match on packets with the SYN flag set to true. Off – The state of the TCP SYN flag is not considered as part of the match criteria.
Match action	Default – The filter does not have an explicit forward or drop match action specified. If the filter entry ID indicates the entry is Inactive, the filter entry is incomplete (no action was specified). Drop – Drop packets matching the filter entry. Forward – The explicit action to perform is forwarding of the packet. If the action is Forward, then if configured the nexthop information should be displayed, including Nexthop: <IP address>, Indirect: <IP address> or Interface: <IP interface name>.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Src. Port	The source TCP or UDP port number or port range.
Dest. Port	The destination TCP or UDP port number or port range.
Dscp	The DiffServ Code Point (DSCP) name.
ICMP Code	The ICMP code field in the ICMP header of an IP packet.
Option-present	Off – Specifies not to search for packets that contain the option field or have an option field of zero. On – Matches packets that contain the option field or have an option field of zero be used as IP filter match criteria.
Int. Sampling	Off – Interface traffic sampling is disabled. On – Interface traffic sampling is enabled.
Multiple Option	Off – The option fields are not checked. On – Packets containing one or more option fields in the IP header will be used as IP filter match criteria.

Label	Description (Continued)
TCP-ack	False — Configures a match on packets with the ACK flag set to false. True — configures a match on packets with the ACK flag set to true. Off — The state of the TCP ACK flag is not considered as part of the match criteria.h criteria.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Sample Output

```
A:ALA-49# show filter ip 1 associations
===============================================================================
IP Filter
===============================================================================
Filter Id    : 1                                Applied        : Yes
Scope        : Template                         Def. Action    : Drop
Entries      : 1
-------------------------------------------------------------------------------
Filter Association : IP
-------------------------------------------------------------------------------
Service Id   : 1001                             Type           : VPLS
 - SAP    1/1/1:1001   (Ingress)
Service Id   : 2000                             Type           : IES
 - SAP    1/1/1:2000   (Ingress)
===============================================================================
Filter Match Criteria : IP
-------------------------------------------------------------------------------
Entry        : 10
Log Id       : n/a
Src. IP      : 10.1.1.1/24                      Src. Port      : None
Dest. IP     : 0.0.0.0/0                        Dest. Port     : None
Protocol     : 2                                Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
Fragment     : Off                              Option-present : Off
Sampling     : Off                              Int. Sampling  : On
IP-Option    : 0/0                              Multiple Option: Off
TCP-syn      : Off                              TCP-ack        : Off
Match action : Drop
Ing. Matches : 0                                Egr. Matches   : 0
===============================================================================
A:ALA-49#
```

Output **Show Filter Associations (with TOD-suite specified) —** If a filter is referred to in a TOD Suite assignment, it is displayed in the show filter associations command output:

```
A:ALA-49# show filter ip 160 associations
===============================================================================
IP Filter
===============================================================================
Filter Id    : 160                              Applied        : No
Scope        : Template                         Def. Action    : Drop
```

```
Entries      : 0
-------------------------------------------------------------------------------
Filter Association : IP
-------------------------------------------------------------------------------
Tod-suite "english_suite"
 - ingress, time-range "day" (priority 5)
===============================================================================
A:ALA-49#
```

Output **Show Filter Counters —** The following table describes the output fields when the **counters** keyword is specified..

Label	Description
IP Filter Filter Id	The IP filter policy ID.
Scope	Template — The filter policy is of type Template.
	Exclusive — The filter policy is of type Exclusive.
Applied	No — The filter policy ID has not been applied.
	Yes — The filter policy ID is applied.
Def. Action	Forward — The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop — The default action for the filter ID for packets that do not match the filter entries is to drop.
Filter Match Criteria	IP — Indicates the filter is an IP filter policy.
Entry	The filter ID filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.
	Note that egress counters count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.

Sample Output

```
*A:ALA-48# show filter ipv6 100 counters
===============================================================================
IPv6 Filter
===============================================================================
Filter Id    : 100                              Applied        : No
Scope        : Template                         Def. Action    : Forward
```

```
Entries      : 1
Description  : IPv6 filter configuration
-------------------------------------------------------------------------------
Filter Match Criteria : IPv6
-------------------------------------------------------------------------------
Entry        : 10
Ing. Matches : 9788619 pkts (978861900 bytes)
Egr. Matches : 9788619 pkts (978861900 bytes)
===============================================================================
*A:ALA-48#
```

ipv6

Syntax **ipv6**
ipv6 embedded [**inactive**]
ipv6 *ipv6-filter-id* **embedded** [**inactive**]
ipv6 *ipv6-filter-id* [**detail**]
ipv6 *ipv6-filter-id* **associations**
ipv6 *ipv6-filter-id* **type** *entry-type*
ipv6 *ipv6-filter-id* **counters** [**type** *entry-type*]
ipv6 *ipv6-filter-id* **entry** *entry-id* **counters**

Context show>filter

Description This command shows IPv6 filter information.

Parameters *ipv6-filter-id* — Displays detailed information for the specified IPv6 filter ID and filter entries.

Values 1 — 65535

entry *entry-id* **—** Displays information on the specified IPv6 filter entry ID for the specified filter ID.

Values 1 — 9999

associations — Appends information as to where the IPv6 filter policy ID is applied to the detailed filter policy ID output.

counters — Displays counter information for the specified IPv6 filter ID. Note that egress counters count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.

embedded [**failed**] **—** Shows all embeddings, optionally shows failed embedding only, if *filter-id* is not specified shows all embedded filters.

type *entry-type* **—** specifies type of filter entry to display, values:

Values fixed, radius-insert, credit-control-insert, flowspec, embedded, radius-shared

Output **Show Filter (no filter-id specified) —** The following table describes the command output for the command when no filter ID is specified.

Label	Description
`Filter Id`	The IP filter ID
`Scope`	`Template` – The filter policy is of type template.
	`Exclusive` – The filter policy is of type exclusive.
`Applied`	`No` – The filter policy ID has not been applied.
	`Yes` – The filter policy ID is applied.
`Description`	The IP filter policy description.
`In`	Shows embedding filter index
`From`	Shows embedded filters included
`Priority`	Shows priority of embedded filter
`Inserted`	Shows embedded/total number of entries from embedded filter Status: **OK**—embedding operation successful, if any entries are overwritten this will also be indicated. **Failed**—embedding failed, the reason is displayed (out of resources).
`In`	Shows embedding filter index

Sample Output

```
A:ALA-48# show filter ipv6
===============================================================================
IP Filters
===============================================================================
Filter-Id Scope      Applied Description
-------------------------------------------------------------------------------
100       Template   Yes     test
200       Exclusive  Yes
-------------------------------------------------------------------------------
Num IPv6 filters: 2
===============================================================================
A:ALA-48# show filter ipv6 embedded
================================================
IP Filter embedding
================================================
In       From    Priority  Inserted    Status
----------------------------------------------------------------------------------
10       2        50        1/1         OK
         1        100       1/2         OK- 1 entry overwritten

20       2        100       0/5         Failed - out of resources
================================================
A:ALA-48#
```

```
===============================================================================
Configured IP Filters                                            Total:     4
===============================================================================
Filter-Id   Scope     Applied Description
-------------------------------------------------------------------------------
1           Template  No
5           Exclusive No
10          Template  Yes
100         Embedded  N/A
===============================================================================
System IP Filters                                                Total:     1
===============================================================================
Filter-Id                     Description
-------------------------------------------------------------------------------
_tmnx_ofs_test                of-switch 'test' embedded filter
-------------------------------------------------------------------------------
Num IP filters: 5
==============================================================================
```

Output **Show Filter (with filter-id specified) —** The following table describes the command output for the command when a filter ID is specified.

Label	Description
`Filter Id`	The IP filter policy ID.
`Scope`	`Template` – The filter policy is of type template. `Exclusive` – The filter policy is of type exclusive.
`Entries`	The number of entries configured in this filter ID.
`Description`	The IP filter policy description.
`Applied`	`No` – The filter policy ID has not been applied. `Yes` – The filter policy ID is applied.
`Def. Action`	`Forward` – The default action for the filter ID for packets that do not match the filter entries is to forward. `Drop` – The default action for the filter ID for packets that do not match the filter entries is to drop.
`Filter Match Criteria`	`IP` – Indicates the filter is an IP filter policy.
`Entry`	The filter ID filter entry ID. If the filter entry ID indicates the entry is `(Inactive)`, then the filter entry is incomplete as no action has been specified.
`Log Id`	The filter log ID.
`Src. IP`	The source IP address and mask match criterion. `0.0.0.0/0` indicates no criterion specified for the filter entry.

Label	Description (Continued)
Dest. IP	The destination IP address and mask match criterion. 0.0.0.0/0 indicates no criterion specified for the filter entry.
Protocol	The protocol ID for the match criteria. Undefined indicates no protocol specified.
ICMP Type	The ICMP type match criterion. Undefined indicates no ICMP type specified.
Fragment	False – Configures a match on all non-fragmented IP packets. True – Configures a match on all fragmented IP packets. Off – Fragments are not a matching criteria. All fragments and non-fragments implicitly match.
Sampling	Off – Specifies that traffic sampling is disabled. On – Specifies that traffic matching the associated IP filter entry is sampled.
IP-Option	Specifies matching packets with a specific IP option or a range of IP options in the IP header for IP filter match criteria.
TCP-syn	False – Configures a match on packets with the SYN flag set to false. True – Configured a match on packets with the SYN flag set to true. Off – The state of the TCP SYN flag is not considered as part of the match criteria.
Match action	Default – The filter does not have an explicit forward or drop match action specified. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified. Drop – Drop packets matching the filter entry. Forward – The explicit action to perform is forwarding of the packet. If the action is Forward, then if configured the nexthop information should be displayed, including Nexthop: <IP address>, Indirect: <IP address> or Interface: <IP interface name>.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Src. Port	The source TCP or UDP port number or port range.
Dest. Port	The destination TCP or UDP port number or port range.
Dscp	The DiffServ Code Point (DSCP) name.
ICMP Code	The ICMP code field in the ICMP header of an IP packet.

Label	Description (Continued)
`Option-present`	`Off` – Specifies not to search for packets that contain the option field or have an option field of zero. `On` – Matches packets that contain the option field or have an option field of zero be used as IP filter match criteria.
`Int. Sampling`	`Off` – Interface traffic sampling is disabled. `On` – Interface traffic sampling is enabled.
`Multiple Option`	`Off` – The option fields are not checked. `On` – Packets containing one or more option fields in the IP header will be used as IP filter match criteria.
`TCP-ack`	`False` – Configures a match on packets with the ACK flag set to false. `True` – Configured a match on packets with the ACK flag set to true. `Off` – The state of the TCP ACK flag is not considered as part of the match criteria.
`Egr. Matches`	The number of egress filter matches/hits for the filter entry.

Sample Output

```
A:ALA-48# show filter ipv6 100
===============================================================================
IPv6 Filter
===============================================================================
Filter Id    : 100                              Applied        : Yes
Scope        : Template                         Def. Action    : Forward
Entries      : 1
Description : test
-------------------------------------------------------------------------------
Filter Match Criteria : IPv6
-------------------------------------------------------------------------------
Entry        : 10
Log Id       : 101
Src. IP      : ::/0                             Src. Port      : None
Dest. IP     : ::/0                             Dest. Port     : None
Next Header  : Undefined                        Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
TCP-syn      : Off                              TCP-ack        : Off
Match action : Drop
Ing. Matches : 0                                Egr. Matches   : 0
===============================================================================
A:ALA-48#
```

Output **Show Filter Associations —** The following table describes the fields that display when the **associations** keyword is specified.

Label	Description
`Filter Id`	The IPv6 filter policy ID.
`Scope`	`Template` – The filter policy is of type Template.
	`Exclusive` – The filter policy is of type Exclusive.
`Entries`	The number of entries configured in this filter ID.
`Applied`	`No` – The filter policy ID has not been applied.
	`Yes` – The filter policy ID is applied.
`Def. Action`	`Forward` – The default action for the filter ID for packets that do not match the filter entries is to forward.
	`Drop` – The default action for the filter ID for packets that do not match the filter entries is to drop.
`Service Id`	The service ID on which the filter policy ID is applied.
`SAP`	The Service Access Point on which the filter policy ID is applied.
`(Ingress)`	The filter policy ID is applied as an ingress filter policy on the interface.
`(Egress)`	The filter policy ID is applied as an egress filter policy on the interface.
`Type`	The type of service of the service ID.
`Entry`	The filter ID filter entry ID. If the filter entry ID indicates the entry is `Inactive`, the filter entry is incomplete, no action was specified.
`Log Id`	The filter log ID.
`Src. IP`	The source IP address and mask match criterion. `0.0.0.0/0` indicates no criterion specified for the filter entry.
`Dest. IP`	The destination IP address and mask match criterion. `0.0.0.0/0` indicates no criterion specified for the filter entry.
`Protocol`	The protocol ID for the match criteria. `Undefined` indicates no protocol specified.
`ICMP Type`	The ICMP type match criterion. `Undefined` indicates no ICMP type specified.
`Fragment`	`False` – Configures a match on all non-fragmented IP packets.
	`True` – Configures a match on all fragmented IP packets.
	`Off` – Fragments are not a matching criteria. All fragments and non-fragments implicitly match.
`Sampling`	`Off` – Specifies that traffic sampling is disabled.

Label	Description (Continued)
	On – Specifies that traffic matching the associated IP filter entry is sampled.
IP-Option	Specifies matching packets with a specific IP option or a range of IP options in the IP header for IP filter match criteria.
TCP-syn	False – Configures a match on packets with the SYN flag set to false.
	True – Configures a match on packets with the SYN flag set to true.
	Off – The state of the TCP SYN flag is not considered as part of the match criteria.
Match action	Default – The filter does not have an explicit forward or drop match action specified. If the filter entry ID indicates the entry is Inactive, the filter entry is incomplete, no action was specified.
	Drop – Drop packets matching the filter entry.
	Forward – The explicit action to perform is forwarding of the packet. If the action is Forward, then if configured the nexthop information should be displayed, including Nexthop: <IP address>, Indirect: <IP address> or Interface: <IP interface name>.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Src. Port	The source TCP or UDP port number or port range.
Dest. Port	The destination TCP or UDP port number or port range.
Dscp	The DiffServ Code Point (DSCP) name.
ICMP Code	The ICMP code field in the ICMP header of an IP packet.
Option-present	Off – Specifies not to search for packets that contain the option field or have an option field of zero.
	On – Matches packets that contain the option field or have an option field of zero be used as IP filter match criteria.
Int. Sampling	Off – Interface traffic sampling is disabled.
	On – Interface traffic sampling is enabled.
Multiple Option	Off – The option fields are not checked.
	On – Packets containing one or more option fields in the IP header will be used as IP filter match criteria.
TCP-ack	False – Configures a match on packets with the ACK flag set to false.
	True – Configured a match on packets with the ACK flag set to true.

Label	Description (Continued)
	`Off` – The state of the TCP ACK flag is not considered as part of the match criteria.
`Egr. Matches`	The number of egress filter matches/hits for the filter entry.

Sample Output

```
A:ALA-48# show filter ipv6 1 associations
===============================================================================
IPv6 Filter
===============================================================================
Filter Id    : 1                                Applied        : Yes
Scope        : Template                         Def. Action    : Drop
Entries      : 1
-------------------------------------------------------------------------------
Filter Association : IPv6
-------------------------------------------------------------------------------
Service Id   : 2000                             Type           : IES
 - SAP    1/1/1:2000   (Ingress)
===============================================================================
Filter Match Criteria : IPv6
-------------------------------------------------------------------------------
Entry        : 10
Log Id       : 101
Src. IP      : ::/0                             Src. Port      : None
Dest. IP     : ::/0                             Dest. Port     : None
Next Header  : Undefined                        Dscp           : Undefined
ICMP Type    : Undefined                        ICMP Code      : Undefined
TCP-syn      : Off                              TCP-ack        : Off
Match action : Drop
Ing. Matches : 0                                Egr. Matches   : 0
===============================================================================
A:ALA-48#
```

Output **Show Filter Counters —** The following table describes the output fields when the **counters** keyword is specified..

Label	Description

`IP Filter`
`Filter Id`
	The IP filter policy ID.

`Scope`	`Template` – The filter policy is of type template.
	`Exclusive` – The filter policy is of type exclusive.
`Applied`	`No` – The filter policy ID has not been applied.
	`Yes` – The filter policy ID is applied.

Label	Description (Continued)
Def. Action	Forward — The default action for the filter ID for packets that do not match the filter entries is to forward. Drop — The default action for the filter ID for packets that do not match the filter entries is to drop.
Filter Match Criteria	IP — Indicates the filter is an IP filter policy.
Entry	The filter ID filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry. Note that egress counters count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.

Sample Output

```
A:ALA-48# show filter ipv6 8 counters
===============================================================================
IPv6 Filter
===============================================================================
Filter Id    : 8                                Applied        : Yes
Scope        : Template                         Def. Action    : Forward
Entries      : 4
Description  : Description for Ipv6 Filter Policy id # 8
-------------------------------------------------------------------------------
Filter Match Criteria : IPv6
-------------------------------------------------------------------------------
Entry        : 5
Ing. Matches : 0 pkts
Egr. Matches : 0 pkts

Entry        : 6
Ing. Matches : 0 pkts
Egr. Matches : 0 pkts

Entry        : 8
Ing. Matches : 160 pkts (14400 bytes)
Egr. Matches : 80 pkts (6880 bytes)

Entry        : 10
Ing. Matches : 80 pkts (7200 bytes)
Egr. Matches : 80 pkts (6880 bytes)

====================================================================================
A:ALA-48#
```

log

Syntax **log** *log-id* [**match** *string*] [**bindings**]

Context show>filter

Description This command shows the contents of a memory-based or a file-based filter log.

If the optional keyword **match** and *string* parameter are given, the command displays the given filter log from the first occurence of the given string.

Parameters *log-id* — The filter log ID destination expressed as a decimal integer.

Values 101 — 199

match *string* **—** Specifies to start displaying the filter log entries from the first occurence of *string*.

bindings — Displays the number of filter logs currently instantiated.

Output **Log Message Formatting —** Each filter log entry contains the following information in case summary log feature is not active (as appropriate).

Label	Description
`yyyy/mm/dd hh:mm:ss`	The date and timestamp for the log filter entry where `yyyy` is the year, `mm` is the month, `dd` is the day, `hh` is the hour, `mm` is the minute and `ss` is the second.
`Filter`	The filter ID and the entry ID which generated the filter log entry in the form `Filter_ID:Entry_ID`.
`Desc`	The description of the filter entry ID which generated the filter log entry.
`Interface`	The IP interface on which the filter ID and entry ID was associated which generated the filter log entry.
`Action`	The action of the filter entry on the logged packet.
`Src MAC`	The source MAC address of the logged packet.
`Dst MAC`	The destination MAC of the logged packet.
`EtherType`	The Ethernet type of the logged Ethernet type II packet.
`Src IP`	The source IP address of the logged packet. The source port will be displayed after the IP address as appropriate separated with a colon.
`Dst IP`	The destination IP address of the logged packet. The source port will be displayed after the IP address as appropriate separated with a colon.
`Flags` (IP flags)	`M` – The more fragments IP flag is set in the logged packet. `DF` – The do not fragment IP flag is set in the logged packet.
`TOS`	The TOS byte value in the logged packet.

Label	Description (Continued)
Protocol	The IP protocol of the logged packet (TCP, UDP, ICMP or a protocol number in hex).
Flags (TCP flags)	URG – Urgent bit set. ACK – Acknowledgement bit set. RST – Reset bit set. SYN – Synchronize bit set. FIN – Finish bit set.
HEX	If an IP protocol does not have a supported decode, the first 32 bytes following the IP header are printed in a hex dump. Log entries for non-IP packets include the Ethernet frame information and a hex dump of the first 40 bytes of the frame after the Ethernet header.
Total Log Instances (Allowed)	Specifies the maximum allowed instances of filter logs allowed on the system.
Total Log Instances (In Use)	Specifies the instances of filter logs presently existing on the system.
Total Log Bindings	Specifies the count of the filter log bindings presently existing on the system.
Type	The type of service of the service ID.
Filter ID	Uniquely identifies an IP filter as configured on the system.
Entry ID	The identifier which uniquely identifies an entry in a filter table.
Log	Specifies an entry in the filter log table.
Instantiated	Specifies if the filter log for this filter entry has or has not been instantiated.

If the packet being logged does not have a source or destination MAC address (i.e., POS) then the MAC information output line is omitted from the log entry.

In case log summary is active, the filter log mini-tables contain the following information..

Label	Description
Summary Log LogID	Displays the log ID.
Crit1	Summary criterion that is used as index into the mini-tables of the log.
TotCnt	The total count of logs.
ArpCnt	Displays the total number of ARP messages logged for this log ID.

Label	Description (Continued)
Src... Dst...	The address type indication of the key in the mini-table.
count	The number of messages logged with the specified source/destination address.
address	The address for which count messages where received.

Sample Filter Log Output

```
2007/04/13 16:23:09  Filter: 100:100  Desc: Entry-100
Interface: to-ser1  Action: Forward
Src MAC: 04-5b-01-01-00-02  Dst MAC: 04-5d-01-01-00-02  EtherType: 0800
Src IP: 10.10.0.1:646  Dst IP: 10.10.0.4:49509  Flags:   TOS: c0
Protocol: TCP  Flags: ACK

2007/04/13 16:23:10  Filter: 100:100  Desc: Entry-100
Interface: to-ser1  Action: Forward
Src MAC: 04-5b-01-01-00-02  Dst MAC: 04-5d-01-01-00-02  EtherType: 0800
Src IP: 10.10.0.1:646  Dst IP: 10.10.0.3:646  Flags:   TOS: c0
Protocol: UDP

2007/04/13 16:23:12  Filter: 100:100  Desc: Entry-100
Interface: to-ser1  Action: Forward
Src MAC: 04-5b-01-01-00-02  Dst MAC: 01-00-5e-00-00-05  EtherType: 0800
Src IP: 10.10.13.1  Dst IP: 224.0.0.5  Flags:   TOS: c0
Protocol: 89
Hex: 02 01 00 30 0a 0a 00 01 00 00 00 00 ba 90 00 00
     00 00 00 00 00 00 00 00 ff ff ff 00 00 03 02 01

A:ALA-A>config# show filter log bindings
===============================================================================
Filter Log Bindings
===============================================================================
Total Log Instances (Allowed)          : 2046
Total Log Instances (In Use)           : 0
Total Log Bindings                     : 0
-------------------------------------------------------------------------------
Type  FilterId EntryId   Log    Instantiated
-------------------------------------------------------------------------------
No Instances found
===============================================================================
A:ALA-A>config#
```

Note: A summary log will be printed only in case TotCnt is different from 0. Only the address types with at least 1 entry in the minitable will be printed.

```
A:ALA-A>config# show filter log 190
===============================================================================
Summary Log[190] Crit1: SrcAddr TotCnt:       723 ArpCnt:     83
 Mac          8  06-06-06-06-06-06
 Mac          8  06-06-06-06-06-05
 Mac          8  06-06-06-06-06-04
 Mac          8  06-06-06-06-06-03
 Mac          8  06-06-06-06-06-02
  Ip         16  6.6.6.1
  Ip         16  6.6.6.2
  Ip         16  6.6.6.3
  Ip         16  6.6.6.4
  Ip          8  6.6.6.5
Ipv6          8  3FE:1616:1616:1616:1616:1616::
Ipv6          8  3FE:1616:1616:1616:1616:1616:FFFF:FFFF
Ipv6          8  3FE:1616:1616:1616:1616:1616:FFFF:FFFE
Ipv6          8  3FE:1616:1616:1616:1616:1616:FFFF:FFFD
Ipv6          8  3FE:1616:1616:1616:1616:1616:FFFF:FFFC
================================================================================
A:ALA-A
```

mac

Syntax **mac** [*mac-filter-id* [**associations | counters**] [**entry** *entry-id*]]

Context show>filter

Description This command displays MAC filter information.

Parameters *mac-filter-id* — Displays detailed information for the specified filter ID and its filter entries.

Values 1— 65535

associations — Appends information as to where the filter policy ID is applied to the detailed filter policy ID output.

counters — Displays counter information for the specified filter ID.

entry *entry-id* **—** Displays information on the specified filter entry ID for the specified filter ID only.

Values 1 — 65535

Output **No Parameters Specified —** When no parameters are specified, a brief listing of IP filters is produced. The following table describes the command output for the command.

Filter ID Specified — When the filter ID is specified, detailed filter information for the filter ID and its entries is produced. The following table describes the command output for the command.

Label	Description
`Filter Id`	The IP filter ID
`Scope`	`Template` – The filter policy is of type Template.
	`Exclusiv` – The filter policy is of type Exclusive.
`Applied`	`No` – The filter policy ID has not been applied.
	`Yes` – The filter policy ID is applied.
`Description`	The MAC filter policy description.

Label	Description

`MAC Filter`
`Filter Id`
	The MAC filter policy ID.

`Scope`	`Template` – The filter policy is of type Template.
	`Exclusiv` – The filter policy is of type Exclusive.
`Description`	The IP filter policy description.
`Applied`	`No` – The filter policy ID has not been applied.
	`Yes` – The filter policy ID is applied.
`Def. Action`	`Forward` – The default action for the filter ID for packets that do not match the filter entries is to forward.
	`Drop` – The default action for the filter ID for packets that do not match the filter entries is to drop.
`Filter Match Criteria`	`MAC` – Indicates the filter is an MAC filter policy.
`Entry`	The filter ID filter entry ID. If the filter entry ID indicates the entry is `(Inactive)`, then the filter entry is incomplete as no action has been specified.
`Description`	The filter entry description.
`FrameType`	`Ethernet` – The entry ID match frame type is Ethernet IEEE 802.3. `Ethernet II` – The entry ID match frame type is Ethernet Type II.
`Src MAC`	The source MAC address and mask match criterion. When both the MAC address and mask are all zeroes, no criterion specified for the filter entry.
`Dest MAC`	The destination MAC address and mask match criterion. When both the MAC address and mask are all zeroes, no criterion specified for the filter entry.

Label	Description (Continued)
Dot1p	The IEEE 802.1p value for the match criteria. Undefined indicates no value is specified.
Ethertype	The Ethertype value match criterion.
DSAP	The DSAP value match criterion. Undefined indicates no value specified.
SSAP	SSAP value match criterion. Undefined indicates no value specified.
Snap-pid	The Ethernet SNAP PID value match criterion. Undefined indicates no value specified.
Esnap-oui-zero	Non-Zero – Filter entry matches a non-zero value for the Ethernet SNAP OUI. Zero – Filter entry matches a zero value for the Ethernet SNAP OUI. Undefined – No Ethernet SNAP OUI value specified.
Match action	Default – The filter does not have an explicit forward or drop match action specified. If the filter entry ID indicates the entry is Inactive, the filter entry is incomplete, no action was specified. Drop – Packets matching the filter entry criteria will be dropped. Forward – Packets matching the filter entry criteria is forwarded.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Sample Detailed Output

```
===============================================================================
Mac Filter : 200
===============================================================================
Filter Id     : 200                            Applied       : No
Scope         : Exclusive                      D. Action     : Drop
Description : Forward SERVER sourced packets
-------------------------------------------------------------------------------
Filter Match Criteria : Mac
-------------------------------------------------------------------------------
Entry         : 200                            FrameType     : 802.2SNAP
Description   : Not Available
Src Mac       : 00:00:5a:00:00:00 ff:ff:ff:00:00:00
Dest Mac      : 00:00:00:00:00:00 00:00:00:00:00:00
Dot1p         : Undefined                      Ethertype     : 802.2SNAP
DSAP          : Undefined                      SSAP          : Undefined
Snap-pid      : Undefined                      ESnap-oui-zero : Undefined
Match action  : Forward
Ing. Matches  : 0                              Egr. Matches  : 0
Entry         : 300 (Inactive)                 FrameType     : Ethernet
Description   : Not Available
Src Mac       : 00:00:00:00:00:00 00:00:00:00:00:00
Dest Mac      : 00:00:00:00:00:00 00:00:00:00:00:00
Dot1p         : Undefined                      Ethertype     : Ethernet
```

```
DSAP          : Undefined                      SSAP          : Undefined
Snap-pid      : Undefined                      ESnap-oui-zero : Undefined
Match action  : Default
Ing. Matches  : 0                              Egr. Matches  : 0
===============================================================================
```

Filter Associations — The associations for a filter ID will be displayed if the **associations** keyword is specified. The assocation information is appended to the filter information. The following table describes the fields in the appended associations output.

Label	Description
`Filter Association`	`Mac` — The filter associations displayed are for a MAC filter policy ID.
`Service Id`	The service ID on which the filter policy ID is applied.
`SAP`	The Service Access Point on which the filter policy ID is applied.
`Type`	The type of service of the Service ID.
`(Ingress)`	The filter policy ID is applied as an ingress filter policy on the interface.
`(Egress)`	The filter policy ID is applied as an egress filter policy on the interface.

Sample Output

```
A:ALA-49# show filter mac 3 associations
===============================================================================
Mac Filter
===============================================================================
Filter ID: 3                              Applied       : Yes
Scope    : Template                       Def. Action   : Drop
Entries  : 1
-------------------------------------------------------------------------------
Filter Association : Mac
-------------------------------------------------------------------------------
Service Id: 1001                          Type          : VPLS
- SAP 1/1/1:1001   (Egress)
===============================================================================
A:ALA-49#
```

Filter Entry Counters Output — When the **counters** keyword is specified, the filter entry output displays the filter matches/hit information. The following table describes the command output for the command.

Sample Output

Label	Description
Mac Filter Filter Id	The MAC filter policy ID.
Scope	Template — The filter policy is of type Template. Exclusive — The filter policy is of type Exclusive.
Description	The MAC filter policy description.
Applied	No — The filter policy ID has not been applied. Yes — The filter policy ID is applied.
Def. Action	Forward — The default action for the filter ID for packets that do not match the filter entries is to forward. Drop — The default action for the filter ID for packets that do not match the filter entries is to drop.
Filter Match Criteria	Mac — Indicates the filter is an MAC filter policy.
Entry	The filter ID filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
FrameType	Ethernet — The entry ID match frame type is Ethernet IEEE 802.3. 802.2LLC — The entry ID match frame type is Ethernet IEEE 802.2 LLC. 802.2SNAP — The entry ID match frame type is Ethernet IEEE 802.2 SNAP. Ethernet II — The entry ID match frame type is Ethernet Type II.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

```
A:ALA-49# show filter mac 8 counters
===============================================================================
Mac Filter
===============================================================================
Filter Id   : 8                                Applied         : Yes
Scope       : Template                         Def. Action     : Forward
Entries     : 2
Description : Description for Mac Filter Policy id # 8
-------------------------------------------------------------------------------
Filter Match Criteria : Mac
-------------------------------------------------------------------------------
Entry       : 8                                FrameType       : Ethernet
Ing. Matches: 80 pkts (5440 bytes)
```

```
Egr. Matches: 62 pkts (3968 bytes)

Entry       : 10                              FrameType       : Ethernet
Ing. Matches: 80 pkts (5440 bytes)
Egr. Matches: 80 pkts (5120 bytes)
```

li-mac

Syntax **li-mac** [*li-mac-filter-id* [**associations | counters**] [**entry** *entry-id*]]

Context show>filter

Description This command displays Lawful Intercept MAC filter information.

Parameters *li-mac-filter-id* — Displays detailed information for the specified Lawful Intercept filter ID and its filter entries.

Values 1— 65535

associations — Appends information as to where the Lawful Intercept filter policy ID is applied to the detailed filter policy ID output.

counters — Displays counter information for the specified Lawful Intercept filter ID.

entry *entry-id* **—** Displays information on the specified Lawful Intercept filter entry ID for the specified filter ID only.

Values 1 — 65535

Output **No Parameters Specified —** When no parameters are specified, a brief listing of IP filters is produced. The following table describes the command output for the command.

Filter ID Specified — When the filter ID is specified, detailed filter information for the filter ID and its entries is produced. The following table describes the command output for the command.

Label	Description
`Filter Id`	The IP filter ID
`Scope`	`Template` – The filter policy is of type Template.
	`Exclusiv` – The filter policy is of type Exclusive.
`Applied`	`No` – The filter policy ID has not been applied.
	`Yes` – The filter policy ID is applied.
`Description`	The MAC filter policy description.

Label	Description

`MAC Filter`
`Filter Id`
	The MAC filter policy ID.

Label	Description (Continued)
`Scope`	`Template` – The filter policy is of type Template. `Exclusiv` – The filter policy is of type Exclusive.
`Description`	The IP filter policy description.
`Applied`	`No` – The filter policy ID has not been applied. `Yes` – The filter policy ID is applied.
`Def. Action`	`Forward` – The default action for the filter ID for packets that do not match the filter entries is to forward. `Drop` – The default action for the filter ID for packets that do not match the filter entries is to drop.
`Filter Match Criteria`	`MAC` – Indicates the filter is an MAC filter policy.
`Entry`	The filter ID filter entry ID. If the filter entry ID indicates the entry is `(Inactive)`, then the filter entry is incomplete as no action has been specified.
`Description`	The filter entry description.
`FrameType`	`Ethernet` – The entry ID match frame type is Ethernet IEEE 802.3. `Ethernet II` – The entry ID match frame type is Ethernet Type II.
`Src MAC`	The source MAC address and mask match criterion. When both the MAC address and mask are all zeroes, no criterion specified for the filter entry.
`Dest MAC`	The destination MAC address and mask match criterion. When both the MAC address and mask are all zeroes, no criterion specified for the filter entry.
`Dot1p`	The IEEE 802.1p value for the match criteria. `Undefined` indicates no value is specified.
`Ethertype`	The Ethertype value match criterion.
`DSAP`	The DSAP value match criterion. `Undefined` indicates no value specified.
`SSAP`	SSAP value match criterion. `Undefined` indicates no value specified.
`Snap-pid`	The Ethernet SNAP PID value match criterion. `Undefined` indicates no value specified.
`Esnap-oui-zero`	`Non-Zero` – Filter entry matches a non-zero value for the Ethernet SNAP OUI. `Zero` – Filter entry matches a zero value for the Ethernet SNAP OUI. `Undefined` – No Ethernet SNAP OUI value specified.

Label	Description (Continued)
Match action	Default — The filter does not have an explicit forward or drop match action specified. If the filter entry ID indicates the entry is Inactive, the filter entry is incomplete, no action was specified. Drop — Packets matching the filter entry criteria will be dropped. Forward — Packets matching the filter entry criteria is forwarded.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Sample Detailed Output

```
# show li filter li-mac "testLiMacFilter"

===============================================================================
LI Mac Filter
===============================================================================
Filter Id   : testLiMacFilter                  Associated      : Yes
Entries     : 4
Description : test LI Mac filter setup
-------------------------------------------------------------------------------
Filter Match Criteria : Mac
-------------------------------------------------------------------------------
Entry       : 10                               FrameType       : Ethernet
Description : entry 10
Src Mac     : 01:02:03:04:05:06 ff:ff:ff:ff:ff:ff
Dest Mac    :
LI Source   : Yes
Ing. Matches: 0 pkts
Egr. Matches: 0 pkts

Entry       : 20                               FrameType       : Ethernet
Description : entry 20
Src Mac     :
Dest Mac    : 01:02:03:04:05:06 ff:ff:ff:ff:ff:ff
LI Source   : Yes
Ing. Matches: 0 pkts
Egr. Matches: 0 pkts

Entry       : 30                               FrameType       : Ethernet
Description : test 30
Src Mac     :
Dest Mac    :
LI Source   : Yes
Ing. Matches: 0 pkts
Egr. Matches: 0 pkts

Entry       : 50                               FrameType       : Ethernet
Description : entry 50
Src Mac     : 00:00:01:66:00:00 00:00:0f:ff:00:00
Dest Mac    :
LI Source   : No
Ing. Matches: 0 pkts
Egr. Matches: 0 pkts
```

Filter Associations — The associations for a filter ID will be displayed if the **associations** keyword is specified. The assocation information is appended to the filter information. The following table describes the fields in the appended associations output.

Label	Description
Filter Association	Mac — The filter associations displayed are for a MAC filter policy ID.
Service Id	The service ID on which the filter policy ID is applied.
SAP	The Service Access Point on which the filter policy ID is applied.
Type	The type of service of the Service ID.
(Ingress)	The filter policy ID is applied as an ingress filter policy on the interface.
(Egress)	The filter policy ID is applied as an egress filter policy on the interface.

Sample Output

```
# show li filter li-mac "testLiMacFilter" association

===============================================================================
LI Mac Filter
===============================================================================
Filter Id   : testLiMacFilter                  Associated      : Yes
Entries     : 4
Description : test LI Mac filter setup
-------------------------------------------------------------------------------
Filter Association : Mac
-------------------------------------------------------------------------------
mac filter 1
  Service Id  : 60                             Type            : VPLS
    - SAP    1/1/6:7  (Ingress)
    - SAP    1/1/6:9  (Egress)
```

Filter Entry Counters Output — When the **counters** keyword is specified, the filter entry output displays the filter matches/hit information. The following table describes the command output for the command.

Sample Output

Label	Description
Mac Filter Filter Id	The MAC filter policy ID.
Scope	Template – The filter policy is of type Template.
	Exclusive – The filter policy is of type Exclusive.
Description	The MAC filter policy description.
Applied	No – The filter policy ID has not been applied.
	Yes – The filter policy ID is applied.
Def. Action	Forward – The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop – The default action for the filter ID for packets that do not match the filter entries is to drop.
Filter Match Criteria	Mac – Indicates the filter is an MAC filter policy.
Entry	The filter ID filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
FrameType	Ethernet – The entry ID match frame type is Ethernet IEEE 802.3.
	802.2LLC – The entry ID match frame type is Ethernet IEEE 802.2 LLC.
	802.2SNAP – The entry ID match frame type is Ethernet IEEE 802.2 SNAP.
	Ethernet II – The entry ID match frame type is Ethernet Type II.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

```
# show li filter li-mac "testLiMacFilter" counters

===============================================================================
LI Mac Filter
===============================================================================
Filter Id   : testLiMacFilter                  Associated      : Yes
Entries     : 4
Description : test LI Mac filter setup
-------------------------------------------------------------------------------
Filter Match Criteria : Mac
-------------------------------------------------------------------------------
Entry       : 10
Description : entry 10
```

```
Ing. Matches: 0 pkts
Egr. Matches: 0 pkts

Entry       : 20
Description : entry 20
Ing. Matches: 0 pkts
Egr. Matches: 0 pkts

Entry       : 30
Description : test 30
Ing. Matches: 0 pkts
Egr. Matches: 0 pkts

Entry       : 50
Description : entry 50
Ing. Matches: 0 pkts
Egr. Matches: 0 pkts
```

redirect-policy

Syntax **redirect-policy** {*redirect-policy-name* [**dest** *ip-address*] [**association**]}

Context show>filter

Description This command shows redirect filter information.

Parameters *redirect-policy-name* — Displays information for the specified redirect policy.

dest *ip-address* **—** Directs the router to use a specified IP address for communication.

association — Appends association information.

Output **Redirect Policy Output —** The following table describes the fields in the redirect policy command output.

Label	Description
Redirect Policy	Specifies a specific redirect policy.
Applied	Specifies whether the redirect policy is applied to a filter policy entry.
Description	Displays the user-provided description for this redirect policy.
Active Destination	ip address – Specifies the IP address of the active destination. none – Indicates that there is currently no active destination.
Destination	Specifies the destination IP address.
Oper Priority	Specifies the operational value of the priority for this destination. The highest operational priority across multiple destinations is used as the preferred destination.
Admin Priority	Specifies the configured base priority for the destination.

Label	Description (Continued)
Admin State	Specifies the configured state of the destination. Out of Service — Tests for this destination will not be conducted.
Oper State	Specifies the operational state of the destination.
Ping Test	Specifies the name of the ping test.
Timeout	Specifies the amount of time in seconds that is allowed for receiving a response from the far-end host. If a reply is not received within this time the far-end host is considered unresponsive.
Interval	Specifies the amount of time in seconds between consecutive requests sent to the far end host.
Drop Count	Specifies the number of consecutive requests that must fail for the destination to declared unreachable.
Hold Down	Specifies the amount of time in seconds that the system should be held down if any of the test has marked it unreachable.
Hold Remain	Specifies the amount of time in seconds that the system will remain in a hold down state before being used again.
Last Action at	Displays a time stamp of when this test received a response for a probe that was sent out.
SNMP Test	Specifies the name of the SNMP test.
URL Test	Specifies the name of the URL test.

Sample Output

```
A:ALA-A>config>filter# show filter redirect-policy
===============================================================================
Redirect Policies
===============================================================================
Redirect Policy                  Applied Description
-------------------------------------------------------------------------------
wccp                             Yes
redirect1                        Yes     New redirect info
redirect2                        Yes     Test test test test
===============================================================================
ALA-A>config>filter#


ALA-A>config>filter# show filter redirect-policy redirect1
===============================================================================
Redirect Policy
===============================================================================
Redirect Policy: redirect1                        Applied      : Yes
Description    : New redirect info
Active Dest    : 10.10.10.104
-------------------------------------------------------------------------------
```

```
Destination    : 10.10.10.104
-------------------------------------------------------------------------------
Description    : SNMP_to_104
Admin Priority : 105                              Oper Priority: 105
Admin State    : Up                               Oper State   : Up

SNMP Test      : SNMP-1
Interval       : 30                               Timeout      : 1
Drop Count     : 30
Hold Down      : 120                              Hold Remain  : 0
Last Action at : None Taken
-------------------------------------------------------------------------------
Destination    : 10.10.10.105
-------------------------------------------------------------------------------
Description    : another test
Admin Priority : 95                               Oper Priority: 105
Admin State    : Up                               Oper State   : Down

Ping Test
Interval       : 1                                Timeout      : 30
Drop Count     : 5
Hold Down      : 0                                Hold Remain  : 0
Last Action at : 03/19/2007 00:46:55              Action Taken : Disable
-------------------------------------------------------------------------------
Destination    : 10.10.10.106
-------------------------------------------------------------------------------
Description    : (Not Specified)
Admin Priority : 90                               Oper Priority: 90
Admin State    : Up                               Oper State   : Down

URL Test       : URL_to_Proxy
Interval       : 10                               Timeout      : 10
Drop Count     : 3
Hold Down      : 0                                Hold Remain  : 0
Last Action at : 03/19/2007 05:04:15              Action Taken : Disable
Priority Change: 0                                Return Code  : 0
===============================================================================
A:ALA-A>config>filter#


A:ALA-A>show filter redirect-policy redirect1 dest 10.10.10.106
===============================================================================
Redirect Policy
===============================================================================
Redirect Policy: redirect1                        Applied      : Yes
Description    : New redirect info
Active Dest    : 10.10.10.104
-------------------------------------------------------------------------------
Destination    : 10.10.10.106
-------------------------------------------------------------------------------
Description    : (Not Specified)
Admin Priority : 90                               Oper Priority: 90
Admin State    : Up                               Oper State   : Down

URL Test       : URL_to_Proxy
Interval       : 10                               Timeout      : 10
Drop Count     : 3
Hold Down      : 0                                Hold Remain  : 0
Last Action at : 03/19/2007 05:04:15              Action Taken : Disable
```

```
Priority Change: 0                              Return Code  : 0
===============================================================================
ALA-A#
```

match-list

Syntax **match-list**

Context show>filter

Description This command displays information for match lists used in filter policies (IOM and CPM).

ip-prefix-list

Syntax **ip-prefix-list** [*prefix-list-name*]
ip-prefix-list *prefix-list-name* **references**

Context show>filter>match-list

Description This command displays IPv4 prefixes information for match criteria in IPv4 ACL and CPM filter policies.

Parameters *ip-prefix-list-name* — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

ipv6-prefix-list

Syntax **ipv6-prefix-list** [*prefix-list-name*]
ipv6-prefix-list *prefix-list-name* **references**

Context show>filter>match-list

Description This command displays IPv6 prefixes information for match criteria in IPv6 ACL and CPM filter policies.

Parameters *ip-prefix-list-name* — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

port-list

Syntax **port-list** [*port-list-name*]
port-list p*ort-list-name* **references**

Context show>filter>match-list

Description This command displays TCP/UDP port values or ranges for match criteria in IPv4 and IPv6 ACL and CPM filter policies.

Parameters *port-list-name* — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

Clear Commands

ip

Syntax **ip** *ip-filter-id* [**entry** *entry-id*] [**ingress | egress**]

Context clear>filter

Description Clears the counters associated with the IP filter policy.

By default, all counters associated with the filter policy entries are reset. The scope of which counters are cleared can be narrowed using the command line parameters.

Default clears all counters associated with the IP filter policy entries.

Parameters *ip-filter-id* — The IP filter policy ID.

Values 1 — 65535

entry-id — Specifies that only the counters associated with the specified filter policy entry will be cleared.

Values 1 — 65535

ingress — Specifies to only clear the ingress counters.

egress — Specifies to only clear the egress counters.

ipv6

Syntax **ipv6** *ip-filter-id* [**entry** *entry-id*] [**ingress | egress**]

Context clear>filter

Description Clears the counters associated with the IPv6 filter policy.

By default, all counters associated with the filter policy entries are reset. The scope of which counters are cleared can be narrowed using the command line parameters.

Default Clears all counters associated with the IPv6 filter policy entries.

Parameters *ip-filter-id* — The IP filter policy ID.

Values 1 — 65535

entry-id — Specifies that only the counters associated with the specified filter policy entry will be cleared.

Values 1 — 65535

ingress — Specifies to only clear the ingress counters.

egress — Specifies to only clear the egress counters.

log

Syntax **log** *log-id*

Context clear

Description Clears the contents of a memory or file based filter log.

This command has no effect on a syslog based filter log.

Parameters *log-id* — The filter log ID destination expressed as a decimal integer.

Values 101 — 199

mac

Syntax **mac** *mac-filter-id* [**entry** *entry-id*] [**ingress | egress**]

Context clear>filter

Clears the counters associated with the MAC filter policy.

By default, all counters associated with the filter policy entries are reset. The scope of which counters are cleared can be narrowed using the command line parameters.

Default Clears all counters associated with the MAC filter policy entries

Parameters *mac-filter-id* — The MAC filter policy ID.

Values 1 — 65535

entry-id — Specifies that only the counters associated with the specified filter policy entry will be cleared.

Values 1 — 65535

ingress — Specifies to only clear the ingress counters.

egress — Specifies to only clear the egress counters.

Monitor Commands

filter

Syntax **filter ip** *ip-filter-id* **entry** *entry-id* [**interval** *seconds*] [**repeat** *repeat*] [**absolute | rate**]

Context monitor

Description This command monitors the counters associated with the IP filter policy.

Parameters *ip-filter-id* — The IP filter policy ID.

Values 1 — 65535

entry-id — Specifies that only the counters associated with the specified filter policy entry will be monitored.

Values 1 — 65535

interval — Configures the interval for each display in seconds.

Default 10 seconds

Values 3 — 60

repeat *repeat* — Configures how many times the command is repeated.

Default 10

Values 1 — 999

absolute — When the **absolute** keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.

rate — When the **rate** keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.

filter

Syntax **filter ipv6** *ipv6-filter-id* **entry** *entry-id* [**interval** *seconds*] [**repeat** *repeat*] [**absolute | rate**]

Context monitor

Description This command monitors the counters associated with the IPv6 filter policy.

Parameters *ipv6-filter-id* — The IP filter policy ID.

Values 1 — 65535

entry-id — Specifies that only the counters associated with the specified filter policy entry will be moniitored.

Values 1 — 65535

interval — Configures the interval for each display in seconds.

Default 5 seconds

Values 3 — 60

repeat *repeat* — Configures how many times the command is repeated.

Default 10

Values 1 — 999

absolute — When the **absolute** keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.

rate — When the **rate** keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.

filter

Syntax **filter mac** *mac-filter-id* **entry** *entry-id* [**interval** *seconds*] [**repeat** *repeat*] [**absolute** | **rate**]

Context monitor

Description This command monitors the counters associated with the MAC filter policy.

Parameters *mac-filter-id* — The MAC filter policy ID.

Values 1 — 65535

entry-id — Specifies that only the counters associated with the specified filter policy entry will be cleared.

Values 1 — 65535

interval — Configures the interval for each display in seconds.

Default 5 seconds

Values 3 — 60

repeat *repeat* — Configures how many times the command is repeated.

Default 10

Values 1 — 999

absolute — When the **absolute** keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.

rate — When the **rate** keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.

Hybrid OpenFlow Switch

In This Chapter

Alcatel-Lucent supports Hybrid OpenFlow Switch (H-OFS) functionality. The hybrid model allows operators to deploy Software Defined Network (SDN) traffic steering using OpenFlow (OF) atop of the existing routing/switching infrastructure.

Topics in this chapter include:

Hybrid OpenFlow Switching

The hybrid OpenFlow model allows operators to deploy Software Defined Network (SDN) traffic steering using OpenFlow atop of the existing routing/switching infrastructure. Some of the main benefits of the hybrid model include:

- Increased flexibility and speed for new service deployment—H-OFS implements flexible, policy-driven, standard-based Hybrid OpenFlow Switch traffic steering that allows deployment of new services and on-demand services through policy updates rather than service and infrastructure programming.
- Evolutionary capex/opex-optimized SDN deployment—The H-OFS functionality can be deployed on the existing hardware through software upgrade, realizing benefits of FlexPath programmability. The OpenFlow traffic placement is focused access only (i.e. flexible, fast, on-demand service deployment) while network infrastructure provides robustness, resiliency, scale and security.

In a basic mode of operation, a single OpenFlow Switch instance is configured on the router and controlled by a single OpenFlow controller.

The OF controller(s) and router exchange OpenFlow messages using the OpenFlow protocol (version 1.3.1) over the TCP/IPv4 control channel. Both out-of-band (default) and in-band management is supported for connectivity to the controller. An OpenFlow message is processed by the OpenFlow switch instance on the router that installs all supported H-OFS traffic steering rules in a flow table for the H-OFS instance. A single table per H-OFS instance is supported initially. The OpenFlow switch maps the flow table rules to IPv4 and IPv6 filter policies to achieve traffic steering.

The H-OFS allows operators to:

- Steer IPv4/v6 unicast traffic arriving on a Layer 3 interface in a GRT context (base router or IES interfaces) onto a specified RSVP-TE P2P LSP.
- Steer IPv4/IPv6 unicast traffic arriving on a Layer 3 interface in a GRT context (base router or IES service) onto a specified MPLS-TP LSP.
- Drop traffic.
- Forward traffic using regular processing.

The router allows operators to control traffic using OF, as follows:

- Operator can select a subset of interfaces on the router to have OF rules enabled, by embedding given instance of H-OFS in filter policies used only by those interfaces.
- For the interfaces with a given H-OFS instance enabled, operator can:

→ Steer all traffic arriving on all interfaces with this H-OFS enabled by programming the flow table with match all entry that redirects the traffic. Steer a subset of traffic arriving on all interfaces with this H-OFS enabled by programming the flow table with match rules that select subset of traffic (as per the router supported filter match criteria).

To enable rules in a given H-OFS on an existing service router interface, an operator must:

1. Create an ingress line card policy
2. Assign that line card ingress filter policy to the 7x50 service/router interface
3. Embed H-OFS instance into those line card policies
4. Program OF rules as required

The following interface services support OF functionality:

- L3 SAP/network interfaces for IES services
- L3 Network interfaces in base router context

OpenFlow functionality is supported in addition to all existing functionality on a given interface and can be enabled with no impact on forwarding performance. Operators can move from CLI/ SNMP programmed steering rules to OpenFlow operational model in service without service disruption.

Redundant Controllers and Multiple Switch Instances

The operator can configure one or more instances of an H-OFS (using SNMP/CLI interfaces) with each instance controlled by an OF-controller over a unique OF channel (using openflow protocol). One OF controller can control multiple H-OFS instances (using dedicated channels), or a dedicated OF controller per switch can be deployed. For each switch, up to two OF controllers can be deployed for redundancy. If two controllers are programmed, they operate in OFPCR_ROLE_EQUAL role. Figure 22 depicts this architecture:

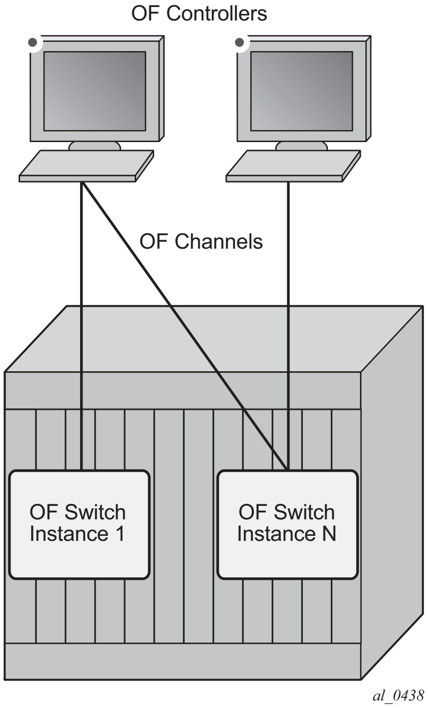


Figure 22: SROS Router/Switch OF Controller/Switch Architecture Overview

Hybrid OpenFlow Switch Steering using Filter Policies

A router H-OFS instance is embedded into line card IPv4 and IPv6 filter policies to achieve OF-controlled Policy Based Routing (PBR). When H-OFS instance is created, embedded filters (IP and IPv6) required for that instance are automatically created. The filters are created with names, as follows:

“_tmnx_ofs_<ofs_name>”, with the same name for IPv4 and IPv6 filters used.

If embedded filters cannot be allocated due to the lack of filter policy instances, the creation of an H-OFS instance will fail. When the H-OFS instance is deleted, the corresponding embedded filters are freed.

The H-OFS can be embedded only in ingress filter policies on line cards/platforms supporting embedded filters (FP2-based or newer) and for services supporting H-OFS. Embedding of an H-OFS in filter policies on unsupported services is blocked, embedding of an H-OFS in filter policies in unsupported direction or on unsupported hardware follows the general filter policy misconfiguration behavior and is not recommended. Unsupported match fields are ignored. Other match criteria may cause a packet to match an entry.

As soon as an H-OFS instance is created, the controller can program OF rules for that instance. For instance, the rules can be created prior to the H-OFS instance embedding into a filter policy or prior to a filter policy with H-OFS instance embedded being assign to an interface. This allows operator to either pre-program H-OFS steering rules, or to disable the rules without removing them from a flow table by removing the embedding. An error is returned to controller if it attempts to program rules not supported by the system. The following lists examples of the errors returned:

- unsupported instr: [OFPET_BAD_INSTRUCTION, OFPBIC_UNSUP_INST]
- unsupported action: [OFPET_BAD_ACTION, OFPBAC_BAD_TYPE]□
- unsupported output port   : [OFPET_BAD_ACTION, OFPBAC_BAD_OUT_PORT]□
- unsupported match field: [OFPET_BAD_MATCH, OFPBMC_BAD_FIELD]□
- unsupported match value: [OFPET_BAD_MATCH, OFPBMC_BAD_VALUE]□
- output port invalid/deleted after flow_mod is sent to filter: OFPET_BAD_ACTION, OFPBAC_BAD_OUT_PORT]□

As the OF controller updates traffic steering rules, the Hybrid OpenFlow Switch updates the flow table rules. This automatically triggers programming of the embedded filter, which consequently causes instantiation of the rules for all services/interfaces that have a filter policy embedding this H-OFS instance. Embedding filter policy configuration/operational rules apply also to embedded filters auto-created for an H-OFS instance (see Embedded Filter Support for ACL Filter Policies section of this guide). Note that MPLS cannot be deleted if OFS rules are created that redirect to an LSP.

The auto-created embedded filters can be viewed through CLI but cannot be modified and/or deleted through filter policy CLI/SNMP. Operator can see the above embedded filters under show filter context, including the details on the filters themselves, entries programmed, interface association, statistics, etc.

The following picture depicts the H-OFS to service operator-configurable mapping example.

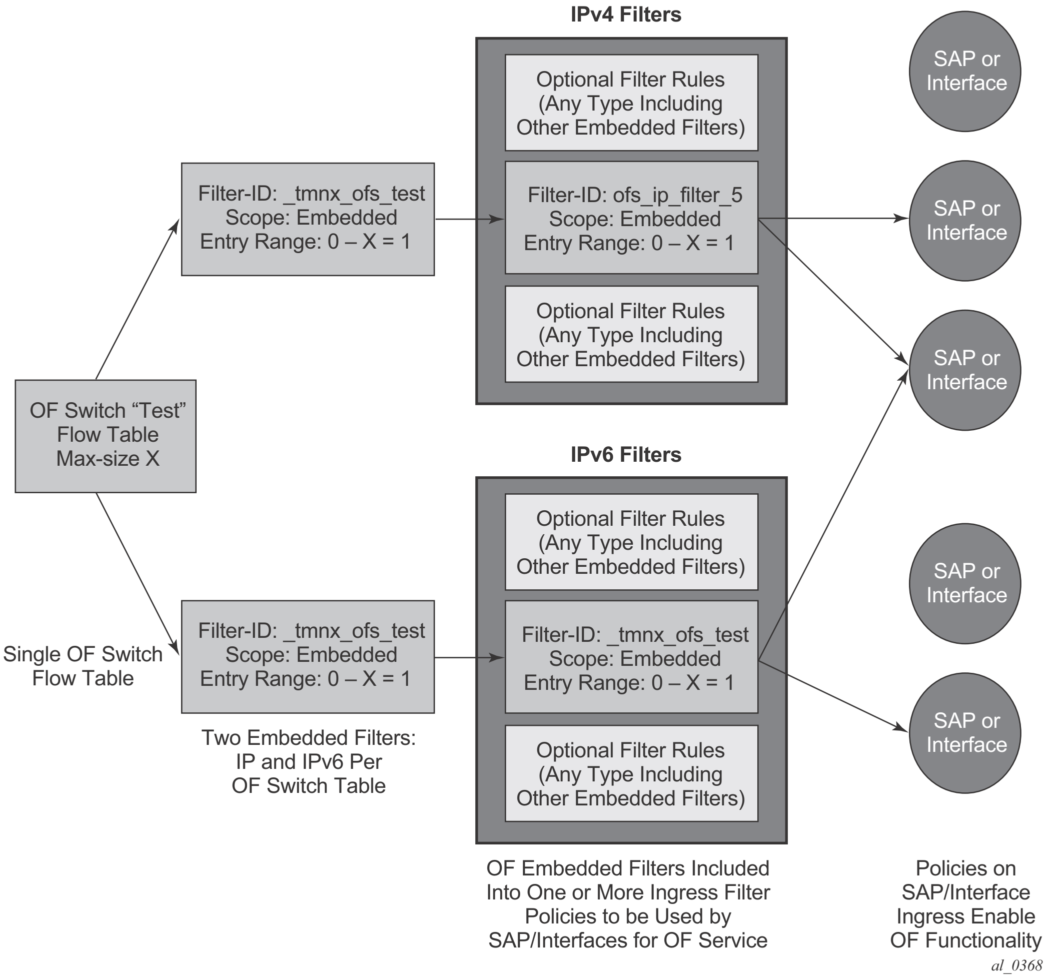

IPv4 Filters
Optional Filter Rules (Any Type Including Other Embedded Filters)
Filter-ID: _tmnx_ofs_test Scope: Embedded Entry Range: 0 – X = 1
Filter-ID: ofs_ip_filter_5 Scope: Embedded Entry Range: 0 – X = 1
Optional Filter Rules (Any Type Including Other Embedded Filters)
SAP or Interface
SAP or Interface
SAP or Interface
OF Switch “Test” Flow Table Max-size X
IPv6 Filters
Optional Filter Rules (Any Type Including Other Embedded Filters)
Filter-ID: _tmnx_ofs_test Scope: Embedded Entry Range: 0 – X = 1
Filter-ID: _tmnx_ofs_test Scope: Embedded Entry Range: 0 – X = 1
Optional Filter Rules (Any Type Including Other Embedded Filters)
SAP or Interface
SAP or Interface
Single OF Switch Flow Table
Two Embedded Filters: IP and IPv6 Per OF Switch Table
OF Embedded Filters Included Into One or More Ingress Filter Policies to be Used by SAP/Interfaces for OF Service
Policies on SAP/Interface Ingress Enable OF Functionality
al_0368

Figure 23: OF Flow Table Mapping to Router/Switch Service Infrastructure Example

The router allows mixing H-OFS rules from one or more H-OFS instances in a single filter policy. Co-existence of H-OFS rules in a single policy with CLI/SNMP programmed rules and/or BGP flowspec programmed rules in a single line card filter policy is also supported. Note that for mixing of the rules from multiple management entities, the controller should not program an entry in its Flow Table that would match all traffic, as this would stop evaluation of the filter policy.

The router supports HA for the OF Flow Table content and statistics. On an activity switch the channel goes down and is re-established by the newly active CPM. “Fail secure mode” operation takes place during channel re-establishment (OpenFlow rules continue to be applied to the arriving traffic). OF controller is expected to re-synchronize the OF table when the channel is re-established.On a router reboot, H-OFS Flow Table rules and statistics are purged. The same takes place when H-OFS instance is shutdown. The H-OFS instance cannot be deleted unless the H-OFS instance is removed first from all embedding filter policies.

Hybrid OpenFlow Switch Traffic Steering Details

As described in the previous section, an update to an OpenFlow Switch's flow table, results in the embedded filter update(s), which triggers update to all filter policies embedding those filters. The router automatically downloads the new set of rules to the line cards as defined through service configuration. The rules became part of ingress line card pipeline as depicted by the below picture:

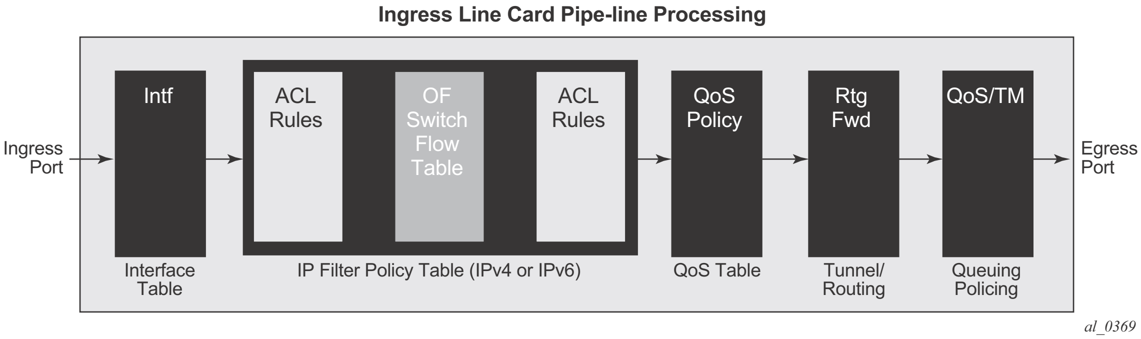


Figure 24: OpenFlow Switch Embedding in Ingress Pipeline Processing

Redirect to LSP

The router supports traffic steering to an LSP. The following details the OF encoding to be used by an OF controller:

`flow_mod: instruction=write_action, action=output_port, port=LOGICAL`, where:

`LOGICAL` port encodes an LSP follows:

0`100  0000  0000 0000 xxxx xxxx xxxx xxxx`, where the first octet indicates the router's logical port, the second octet indicates the platform's tunnel (set to all 0's), and the remaining two octets encode LSP identifier: `TunnelID` for RSVP-TE (static or dynamic) or `Tunnel Number` for MPLS-TP. OpenFlow apply-action can also be used instead of write-action to achieve LSP redirect.

A received LSP in a flow rule is compared against those in the H-OFS logical port table, if the table does not contain the LSP the rule programming fails. Otherwise, the rule is installed in an ACL filter. As long as any path within the LSP is UP, the redirect rule will forward unicast IP(v6) traffic on the currently used best LSP path by adding LSP transport label and, in case of IPv6 traffic, additionally adding explicit NULL label.

When an LSP in the H-OFS logical port table goes down, the OF Switch removes the LSP from its logical port table and may notify the controller of that fact if the logical port status reporting is enabled. It is up to the OF controller to decide whether to remove rules using this LSP or not. If the rules are left in the flow table, the traffic that was to be redirected to this LSP will instead be subject to a forward action for this flow rule. Note that if the controller does not remove the entries and the system re-uses the LSP identified for another LSP, the rules left in the flow table will start redirecting traffic onto this new LSP.

In some deployments, an SDN controller may need to learn from the router H-OFS logical ports status. To support that function, the OF switch supports optional status reporting using asynchronous OF protocol messages for ports status change.

Forward action

An OF controller can program forward action, when a specific flow is to be forwarded using regular router forwarding. Note that this would be a default behavior if the filter-policy embedding this OF switch instance has a default-action forward and no filter policy rule matches the flow. To implement forward action, the following OF encoding is used

`flow_mod: instruction=write_action, action=output_port, port=NORMAL`, where:

`NORMAL` is a OF reserved value. OpenFlow apply-action can also be used instead of write-action to achieve forward action.

Drop action

An OF controller can program a drop action, when packets of a specific flow are to be dropped. To implement drop action, the following OF encoding is used:

- A wildcard rule with empty action-set

Configuration Notes

The following information describes OF implementation caveats:

- SROS Hybrid OpenFlow Switch requires S/W upgrade only and can be enabled on any SROS router/switch running IOM-2 (with restrictions) or newer line cards. For full functionality, performance and future scale IOM3-XP or newer line cards and CPM4 or newer control cards are recommended.
- Some platforms may not support all OF functionality based on underlying H/W. For example, if underlying H/W does not support IPv6, then OF IPv6 functionality will not be supported, if underlying H/W does not support redirect to LSP, redirect action will be ignored.
- Each flow in an OF flow table must have unique priority. Overlap is not supported
- Timed expiry of the flow entries is not supported
- The implementation is compliant by design with OpenFlow specification as applicable to supported router functionality only. No proprietary extensions are employed to achieve the supported functionality.

OpenFlow Command Reference

Command Hierarchies

- OpenFlow Commands on page 591
- Show Commands on page 591
- Tools Commands on page 591

OpenFlow Commands

```
config
    — open-flow filter-id [create]
        — [no] of-switch ofs-name
            — [no] controller ip-address:port
            — description description-string
            — no description
            — echo-interval seconds
            — no echo-interval
            — echo-multiple value
            — no echo-multiple
            — [no] logical-port-status [rsvp-te|mpls-tp]
        — [no] flowtable of-table-id
            — max-size size
            — no max-size
            — no-match-action {drop | fall-through}
            — no no-match-action
        — [no] logical-port-status {rsvp-te | mpls-tp}
        — [no] shutdown
```

Show Commands

```
show
    — open-flow
        — of-switch
        — of-switch ofs-name controller ip-address:port detail
        — of-switch ofs-name status controller [ip-address:port]
        — of-switch ofs-name controller
        — of-switch ofs-name flowtable
        — of-switch ofs-name status
        — of-switch ofs-name port
```

Tools Commands

```
tools
    — dump
        — open-flow
            — of-switch [ofs-name] [flowtable of-table-id] [cookie cookie-id] [priority priority]
```

Configuration Commands

Generic Commands

open-flow

Syntax **open-flow**

Context config

Description This command enables configuration content for OpenFlow Hybrid Switch compatiblity.

The **no** form of the command removes the OpenFlow configuration from the context.

of-switch

Syntax [**no**] **of-switch** *ofs-name*

Context config>open-flow

Description This command creates an OpenFlow switch instance.

The **no** form of the command deletes the OpenFlow switch instance from the context.

Default no of-switch

Parameters *string* — Specifies the name of the OpenFlow switch instance, a string up to 32 characters.

controller

Syntax [**no**] **controller** *ip-address:port*

Context config>open-flow>of-switch

Description This command configures the OpenFlow controller for this OpenFlow switch. Up to two controllers can be configured per OpenFlow switch instance.

The **no** form of this command deletes the controller for this OpenFlow switch instance.

Default no controller

Parameters *ip-address:port* — Specifies the IP address and TCP port for the OpenFlow channel to the the controller.

description

Syntax **description** *string*
no description

Context config>open-flow>of-switch

Description This command allows the user to configure a description string for the specified OpenFlow controller instance.

The **no** form of this command deletes the description of the specified OpenFlow controller instance.

Default no controller

Parameters *string* — Specifies a description of the OpenFlow switch instance, a string up to 256 characters.

echo-interval

Syntax **echo-interval** *seconds*
no echo-interval

Context config>open-flow>of-switch

Description This command configures the Echo Request interval for monitoring the OpenFlow control channels to the controller(s) for this OpenFlow switch instance.

The **no** form of this command restores default value .

Default 10

Parameters *seconds* — Specifies an interval, in seconds.

Values 1—3600

echo-multiple

Syntax **echo-multiple** *value*
no echo-multiple

Context config>open-flow>of-switch

Description This command configures the number of consecutive Echo Reply messages that must be lost to declare OF control channel down.

The **no** form of this command restores default value.

Default 3

Parameters *value* — Specifies the threshold value for the number of consecutive Echo Rely messages lost.

Values 3—100

logical-port-status

Syntax [**no**] **logical-port-status** [**rsvp-te** | **mpls-tp**]

Context config>open-flow>of-switch

Description This command enables status change reporting to the OpenFlow controller for the specified logical port type. To report on multiple logical port types, the command needs to be executed multiple times with different logical port specified as required.

The **no** form of this command disables status reporting for specified or all (no argument) logical ports.

Default no logical-port-status

Parameters **rsvp-te —** Enables reporting on RSVP-TE LSP logical ports.

mpls-te — Enables reporting on MPLS-TE logical ports.

shutdown

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

Context config>open-flow>of-switch

Description This command administratively enables or disables the OpenFlow switch instance. Disabling the switch purges all flowtable entries.

Default shutdown

flowtable

Syntax [**no**] **flowtable** *of-table-id*

Context config>open-flow>of-switch

Description This command configures the flow table parameters for this OpenFlow switch instance.

The **no** form of this command restores flow table configuration default settings.

Default no flowtable

Parameters *of-table-id* — Specifies an identifier of the OpenFlow table, a string up to 256 characters.

max-size

Syntax **max-size** *size*
no max-size

Context config>open-flow>of-switch>flowtable

Description This command configures the size for the specified flow table. The OpenFlow switch instance must be shutdown to modify this parameter.

The **no** form of this command restores the default size.

Default no max-size

Parameters *size* — Specifies the maxiumum size limit for the flow table.

Values 1—1000

no-match-action

Syntax **no-match-action** {**drop | fall-through**}
no no-match-action

Context config>open-flow>of-switch>flowtable

Description This command configures the action for the Flow Table when a packet does not match any entry for the controller. The OpenFlow switch instance must be shutdown to modify this parameter.

The **no** form of this command restores the default action.

Default no-match-action fall-through

Parameters **drop —** Packets that do not match entries in the flow table as programmed by the OpenFlow switch will be dropped

fall-through — Packets that do not match entries in the flow table as programmed by the OpenFlow switch will be forwarded using regular processing of the router. Note that fall-through applies if an error occurs that prevents a flow-table from being installed in a filter policy.

Show Commands

open-flow

Syntax **open-flow**

Context show

Description Displays OpenFlow switch hybrid information.

of-switch

Syntax
of-switch
of-switch *ofs-name* **controller** *ip-address:port* **detail**
of-switch *ofs-name* **status controller** [*ip-address:port*]
of-switch *ofs-name* **controller**
of-switch *ofs-name* **flowtable**
of-switch *ofs-name* **status**
of-switch *ofs-name* **port**

Context show>open-flow

Description This command displays information related to H-OFS configuration and operations as per parameters specified.

Parameters none — Displays a summary for H-OFS instances configured.

ofs-name — Specifies the name of the configured H-OFS instance, up to 32 characters.

controller *ip-address:port* **—** Displays information on the controller for the specified H-OFS instance.

Values	ip-address:	a.b.c.d
	port:	1—65535

detail — Displays detailed information.

status — Displays status information for the specified H-OFS switch or its controller.

flowtable — Displays information about flowtables for the specified H-OFS instance.

port — Displays information about the logical OpenFlow ports registered with the specified H-OFS instance.

Sample Output

```
*A:Dut-A# show open-flow of-switch "s1" status

===============================================================================
Open Flow Switch Information
```

```
===============================================================================
Switch Name        : s1
Data Path ID       : 0                   Admin Status       : Up
Echo Interval      : 10 seconds          Echo Multiple      : 3
Logical Port Type  : all
Buffer Size        : 256                 Num. of Tables     : 1
Description        : test-sw1
Capabilities Supp. : flow-stats table-stats port-stats
===============================================================================

*A:Dut-A# show open-flow of-switch "s1" controller

===============================================================================
Open Flow Controller Summary
===============================================================================
IP Address                                        Port
-------------------------------------------------------------------------------
10.20.1.2                                         6633
10.20.1.3                                         6633
-------------------------------------------------------------------------------
Number of Controllers : 2
-------------------------------------------------------------------------------
===============================================================================

*A:Dut-A# show open-flow of-switch "s1" controller 10.20.1.2:6633 detail

===============================================================================
Open Flow Controller Information
===============================================================================
IP Address        : 10.20.1.2         Port              : 6633
Role              : equal             Generation ID     : 0

-------------------------------------------------------------------------------
Open Flow Channel Information
-------------------------------------------------------------------------------
Channel ID            : 1                 Version           : 4
Connection Type       : primary           Operational Status: Up
Operational Flags     : socketStateEstablished helloReceived helloTransmitted
                        handshake
Async Fltr Packet In
 (Master or Equal)    : tableMiss applyAction
 (Slave)              : (Not Specified)
Async Fltr Port Status
 (Master or Equal)    : portAdd portDelete portModify
 (Slave)              : portAdd portDelete portModify
Async Fltr Flow Rem
 (Master or Equal)    : idleTimeOut hardTimeOut flowModDelete groupDelete
 (Slave)              : (Not Specified)

Echo Time Expiry      : 0d 00:00:10       Hold Time Expiry  : 0d 00:00:30
Conn. Uptime          : 0d 00:00:00       Conn. Retry           : 0d 00:00:00

-------------------------------------------------------------------------------
Open Flow Channel Stats - Channel ID(1)
-------------------------------------------------------------------------------
Packet Type      Transmitted Packets  Received Packets     Error Packets
-------------------------------------------------------------------------------
Hello            1                    1                    0
Error            0                    0                    0
```

```
Echo Request     0                    70                   0
Echo Reply       70                   0                    0
Experimenter     0                    0                    0
Feat. Request    0                    1                    0
Feat. Reply      1                    0                    0
Get Cfg Request  0                    1                    0
Get Cfg Reply    1                    0                    0
Set Config       0                    1                    0
Packet In        0                    0                    0
Flow Removed     0                    0                    0
Port Status      0                    0                    6
Packet Out       0                    0                    0
Flow Modify      0                    0                    0
Group Modify     0                    0                    0
Port Modify      0                    0                    0
Table Modify     0                    0                    0
Multipart Req    0                    0                    0
Multipart Reply  0                    0                    0
Barrier Request  0                    0                    0
Barrier Reply    0                    0                    0
Get Q Cfg Req    0                    0                    0
Get Q Cfg Reply  0                    0                    0
Role Request     0                    0                    0
Role Reply       0                    0                    0
Get Async Req    0                    0                    0
Get Async Reply  0                    0                    0
Set Async        0                    0                    0
Meter Modify     0                    0                    0
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
===============================================================================

*A:Dut-A# show open-flow of-switch "s1" flowtable

===============================================================================
Flow Table Information
===============================================================================
Flow Table ID      : 0                  Max-Size                 : 1000
No-Match Action    : fall-through       Curr Num. of Entries     : 1
                                        Max. Num. of Entries     : 54
===============================================================================

*A:Dut-A# show open-flow of-switch "s1" port

===============================================================================
Open Flow Port Stats
===============================================================================
Port ID     Port Name                 Transmitted Packets  Transmitted Bytes
-------------------------------------------------------------------------------
1073741825  to_B                      0                    0
1073741826  to_C                      0                    0
1073741827  to_D                      0                    0
1073741828  to_E                      0                    0
1073741829  to_F                      0                    0
1073742824  1                         0                    0
===============================================================================
```

Debug Commands

open-flow

Syntax **open-flow**

Context tools>dump

Description This command enables dumping of the open-flow information.

of-switch

Syntax **of-switch** [*ofs-name*] [**flowtable** *of-table-id*] [**cookie** *cookie-id*] [**priority** *priority*]

Context tools>dump>open-flow

Description This command can be used to dump information for a given open-flow switch or its flowtable. Prioirty and cookie filters are provided no focus on part of a flow table.

Parameters *ofs-name* — Specifies the name of the OFS instance, up to 32 characters.

of-table-id — Specifies the identifier for the OpenFlow table.

cookie-id — Specifies the identifier for the OpenFlow cookies.

priority — Specifies the priority for the OpenFlow switch.

Sample Output

```
*A:Dut-C#  tools dump open-flow of-switch "OFS1"
===============================================================================
Switch: OFS1
===============================================================================
Table     : 0                           Flow Pri  : 0
Cookie    : 0x0000000000000000
Controller: :::0
Filter Hnd: 0xC30000010000005A                Filter Pri: 90

EthType   : *
Src IP    : *
Dst IP    : *
IP Proto  : *                           DSCP      : *
Src Port  : *                           Dst Port  : *
ICMP Type : *                           ICMP Code : *
Label     : *
IPv6ExtHdr: (Not Specified)

Action    : Fall-through

Flow Flags: IPv4/6 [!E] [RO] [DEF]
Up Time   : 0d 20:46:31                 Add TS    : 1023777
```

```
Mod TS    : 0                         Stats TS  : 8502534
#Packets  : 0                         #Bytes    : 0
-------------------------------------------------------------------------------
Table     : 0                         Flow Pri  : 89
Cookie    : 0x0000000000000000
Controller: 20.11.2.1:6631
Filter Hnd: 0x4300000100000001        Filter Pri: 1

EthType   : 0x86dd
Src IP    : 3FFE::101:2:0:0:0:0/128
Dst IP    : 3FFE::303:2:0:0:0:0/128
IP Proto  : *                         DSCP      : be
Src Port  : *                         Dst Port  : *
ICMP Type : *                         ICMP Code : *
Label     : 0x00000                   Label Mask: *
IPv6ExtHdr: Frag,

Action    : Drop

Flow Flags: IPv6
Up Time   : 0d 00:00:06               Add TS    : 8502321
Mod TS    : 0                         Stats TS  : 8502534
#Packets  : 0                         #Bytes    : 0
-------------------------------------------------------------------------------
Number of flows: 2
===============================================================================
```

Cflowd

In This Chapter

This chapter provides information to configure Cflowd.

Topics in this chapter include:

Cflowd Overview

Cflowd is a tool used to sample IPv4, IPv6, MPLS, and Ethernet traffic data flows through a router. Cflowd enables traffic sampling and analysis by ISPs and network engineers to support capacity planning, trends analysis, and characterization of workloads in a network service provider environment.

Cflowd is also useful for traffic engineering, network planning and analysis, network monitoring, developing user profiles, data warehousing and mining, as well as security-related investigations. Collected information can be viewed several ways such as in port, AS, or network matrices, and pure flow structures. The amount of data stored depends on the cflowd configurations.

Cflowd maintains a list of data flows through a router. A flow is a uni-directional traffic stream defined by several characteristics such as source and destination IP addresses, source and destination ports, inbound interface, IP protocol and TOS bits.

When a router receives a packet for which it currently does not have a flow entry, a flow structure is initialized to maintain state information regarding that flow, such as the number of bytes exchanged, IP addresses, port numbers, AS numbers, etc. Each subsequent packet matching the same parameters of the flow contribute to the byte and packet count of the flow until the flow is terminated and exported to a collector for storage.

Cflowd is not supported on the 7750 SR-1 chassis.

Operation

Figure 25 depicts the basic operation of the cflowd feature. This sample flow is only used to describe the basic steps that are performed. It is not intended to specify implementation.

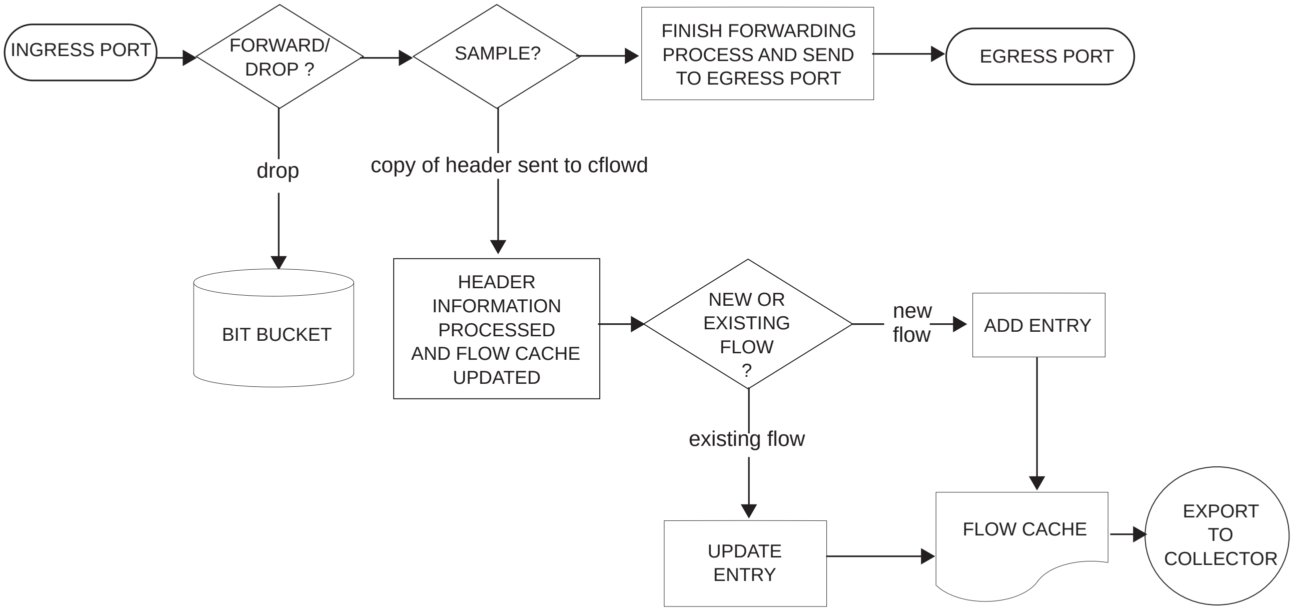


Figure 25: Basic Cflowd Steps

1. As a packet ingresses a port, a decision is made to forward or drop the packet.
2. If the packet is forwarded, it is then decided if the packet should be sampled for cflowd.
3. If a new flow is found, a new entry is added to the cache. If the flow already exists in the cache, the flow statistics are updated.
4. If a new flow is detected and the maximum number of entries are already in the flow cache, the earliest expiry entry is removed. The earliest expiry entry/flow is the next flow that will expire due to the active or inactive timer expiration.
5. If a flow has been inactive for a period of time equal to or greater then the inactive timer (default 15 seconds), then the entry is removed from the flow cache.
6. If a flow has been active for a period of time equal to or greater than the active timer (default 30 minutes), then the entry is removed from the flow cache.

When a flow is exported from the cache, the collected data is sent to an external collector which maintains an accumulation of historical data flows that network operators can use to analyze traffic patterns.

Data is exported in one of the following formats:

- Version 5 — Generates a fixed export record for each individual flow captured.
- Version 8 — Aggregates multiple individual flows into a fixed aggregate record.
- Version 9 — Generates a variable export record, depending on user configuration and sampled traffic type (IPv4, IPv6, or MPLS), for each individual flow captured.
- Version 10 (IPFIX) — Generates a variable export record, depending on user configuration and sampled traffic type (IPv4, IPv6, or MPLS), for each individual flow captured.

Figure 26 depicts Version 5, Version 8, Version 9, and Version 10 flow processing.

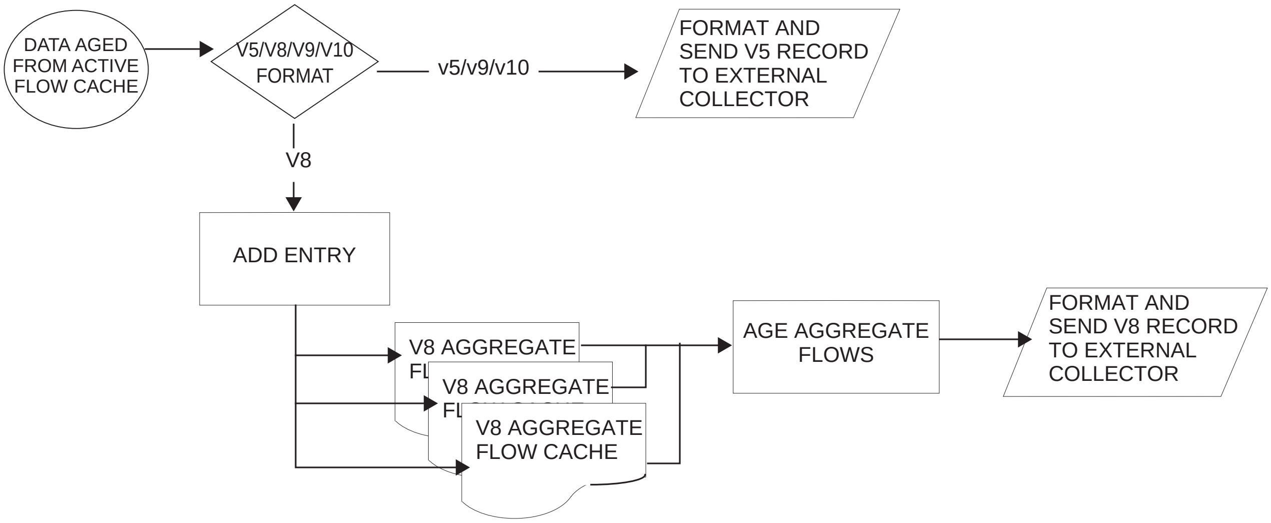

DATA AGED FROM ACTIVE FLOW CACHE
V5/V8/V9/V10 FORMAT
v5/v9/v10
FORMAT AND SEND V5 RECORD TO EXTERNAL COLLECTOR
V8
ADD ENTRY
V8 AGGREGATE FL
V8 AGGREGATE FL
V8 AGGREGATE FLOW CACHE
AGE AGGREGATE FLOWS
FORMAT AND SEND V8 RECORD TO EXTERNAL COLLECTOR

Figure 26: V5, V8, V9, V10, and Flow Processing

1. As flows are expired from the active flow cache, the export format must be determined, either Version 5, Version 8, Version 9, and Version 10.
2. If the export format is Version 5 or Version 9 and Version 10, no further processing is performed and the flow data is accumulated to be sent to the external collector.
3. If the export format is Version 8, then the flow entry is added to one or more of the configured aggregation matrices.

As the entries within the aggregate matrices are aged out, they are accumulated to be sent to the external flow collector in Version 8 format.

The sample rate and cache size are configurable values. The cache size default is 64K flow entries.

A flow terminates when one of the following conditions is met:

- When the inactive timeout period expires (default: 15 seconds). A flow is considered terminated when no packets are seen for the flow for N seconds.
- When an active timeout expires (default: 30 seconds). Default active timeout is 30 minutes. A flow terminates according to the time duration regardless of whether or not there are packets coming in for the flow.
- When the user executes a **clear cflowd** command.
- When other measures are met that apply to aggressively age flows as the cache becomes too full (such as `overflow` *`percent`*).

Version 8

There are several different aggregate flow types including:

- AS matrix
- Destination prefix matrix
- Source prefix matrix
- Prefix matrix
- Protocol/port matrix.

V8 is an aggregated export format. As individual flows are aged out of the raw flow cache, the data is added to the aggregate flow cache for each configured aggregate type. Each of these aggregate flows are also aged in a manner similar to the method the active flow cache entries are aged. When an aggregate flow is aged out, it is sent to the external collector in the V8 record format.

Version 9

The Version 9 format is a more flexible format and allows for different templates or sets of cflowd data to be sent based on the type of traffic being sampled and the template set configured.

Version 9 is interoperable with RFC 3954, *Cisco Systems NetFlow Services Export Version 9*.

Version 10

Version 10 is a new format and protocol that inter-operates with the specifications from the IETF as the IP Flow Information Export (IPFIX) standard. Like Version 9, the version 10 format uses templates to allow for different data elements regarding a flow that is to be exported and to handle different type of data flows such as IPv4, IPv6, and MPLS.

Version 10 is interoperable with RFC 5150 and 5102.

Cflowd Filter Matching

In the filter-matching process, normally, every packet is matched against filter (access list) criteria to determine acceptability. With cflowd, only the first packet of a flow is checked. If the first packet is forwarded, an entry is added to the cflowd cache. Subsequent packets in the same flow are then forwarded without needing to be matched against the complete set of filters. Specific performance varies depending on the number and complexity of the filters.

Cflowd Configuration Process Overview

Figure 27 displays the process to configure Cflowd parameters.

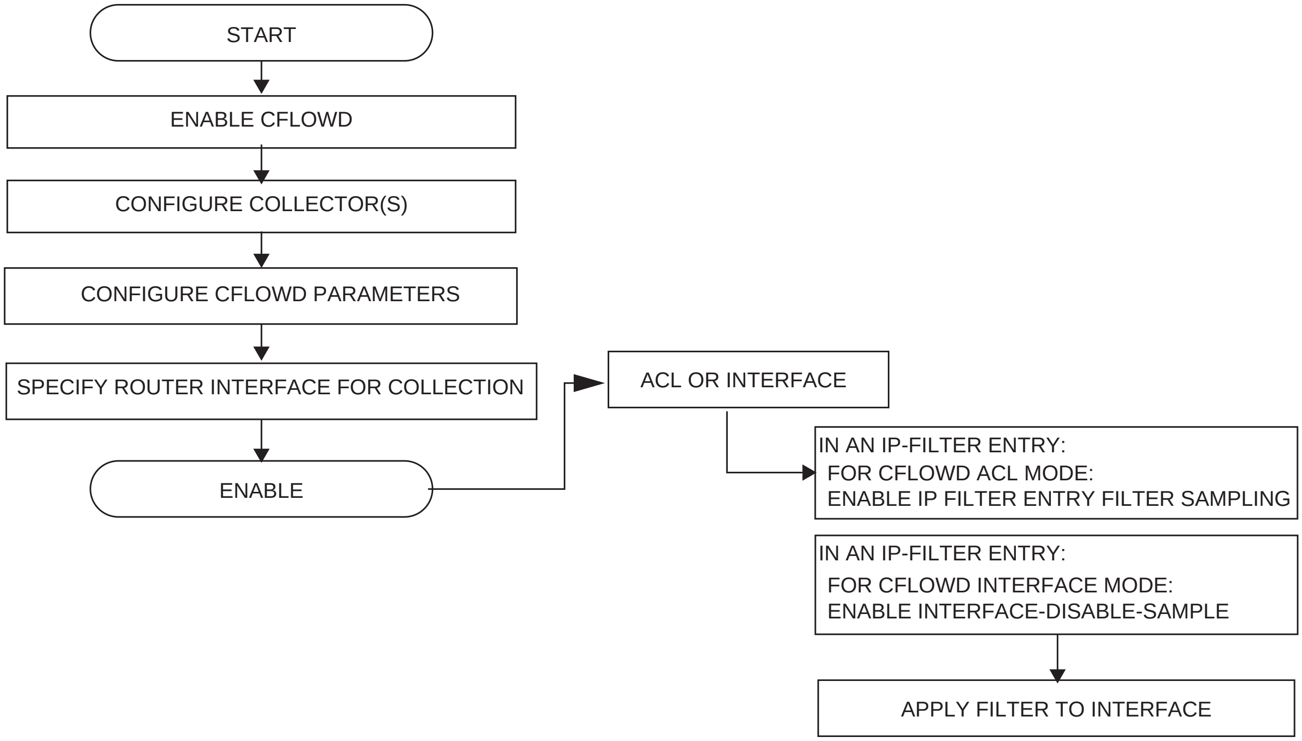

START
ENABLE CFLOWD
CONFIGURE COLLECTOR(S)
CONFIGURE CFLOWD PARAMETERS
SPECIFY ROUTER INTERFACE FOR COLLECTION
ENABLE
ACL OR INTERFACE
IN AN IP-FILTER ENTRY:
FOR CFLOWD ACL MODE:
ENABLE IP FILTER ENTRY FILTER SAMPLING
IN AN IP-FILTER ENTRY:
FOR CFLOWD INTERFACE MODE:
ENABLE INTERFACE-DISABLE-SAMPLE
APPLY FILTER TO INTERFACE

Figure 27: Cflowd Configuration and Implementation Flow

There are three modes in which cflowd can be enabled to sample traffic on a given interface:

- Cflowd interface, where all traffic entering a given port will be subjected to sampling as the configured sampling rate
- Cflowd interface plus the definition of IP filters which specify an action of interface-disable-sample, in which traffic that matches these filter entries will not be subject to cflowd sampling.
- Cflowd ACL, where IP filters must be created with entries containing the action filter-sampled. In this mode only traffic matching these filter entries will be subject to the cflowd sampling process.

Configuration Notes

The following cflowd components must be configured for cflowd to be operational:

- Cflowd is enabled globally.
- At least one collector must be configured and enabled.
- A cflowd option must be specified and enabled on a router interface.
- Sampling must be enabled on either:
  → An IP filter which is applied to a port or service.
  → An interface on a port or service.

Configuring Cflowd with CLI

This section provides information to configure cflowd using the command line interface.

Topics in this section include:

Cflowd Configuration Overview

The 7750 SR OS implementation of cflowd supports the option to analyze traffic flow. The implementation also supports the use of traffic/access list (ACL) filters to limit the type of traffic that is analyzed.

Cflowd is not supported on the 7750 SR-1 chassis.

Traffic Sampling

Traffic sampling does not examine all packets received by a router. Command parameters allow the rate at which traffic is sampled and sent for flow analysis to be modified. The default sampling rate is every 1000th packet. Excessive sampling over an extended period of time, for example, more than every 1000th packet, can burden router processing resources.

The following data is maintained for each individual flow in the raw flow cache:

- Source IP address
- Destinations IP address
- Source port
- Destination port
- Input interface
- Output interface
- IP protocol
- TCP flags
- First timestamp (of the first packet in the flow)
- Last timestamp (timestamp of last packet in the flow prior to expiry of the flow)
- Source AS number for peer and origin (taken from BGP)
- Destination AS number for peer and origin (taken from BGP)
- IP next hop
- BGP next hop
- ICMP type and code
- IP version
- Source prefix (from routing)
- Destination prefix (from routing)
- MPLS label stack from label 1 to 6

Within the raw flow cache, the following characteristics are used to identify an individual flow:

- Ingress interface
- Source IP address
- Destination IP address
- Source transport port number
- Destination transport port number
- IP protocol type
- IP TOS byte
- Virtual router id
- ICMP type and code
- MPLS labels

The 7750 SR OS implementation allows you to enable cflowd either at the interface level or as an action to a filter. By enabling cflowd at the interface level, all IP packets forwarded by the interface are subject to cflowd analysis. By setting cflowd as an action in a filter, only packets matching the specified filter are subject to cflowd analysis. This provides the network operator greater flexibility in the types of flows that are captured.

Collectors

A collector defines how data flows should be exported from the flow cache. A maximum of 5 collectors can be configured. Each collector is identified by a unique IP address and UDP port value. Each collector can only export traffic in one version type, either V5, V8, V9, or V10.

The parameters within a collector configuration can be modified or the defaults retained.

The autonomous-system-type command defines whether the autonomous system information to be included in the flow data is based on the originating AS or external peer AS of the flow.

Aggregation

V8 aggregation allows for flow data to be aggregated into larger, less granular flows. Use aggregation commands to specify the type of data to be collected. These aggregation types are only applicable to flows being exported to a v8 collector.

The following aggregation schemes are supported:

- AS matrix — Flows are aggregated based on source and destination AS and ingress and egress interface.

- Protocol-port — Flows are aggregated based on the IP protocol, source port number, and destination port number.
- Source prefix — Flows are aggregated based on source prefix and mask, source AS, and ingress interface.
- Destination prefix — Flows are aggregated based on destination prefix and mask, destination AS, and egress interface.
- Source-destination prefix — Flows are aggregated based on source prefix and mask, destination prefix and mask, source and destination AS, ingress interface and egress interface.
- Raw — Flows are not aggregated and are sent to the collector in a V5 record.

Basic Cflowd Configuration

This section provides information to configure cflowd and configuration examples of common configuration tasks. In order to sample traffic, the minimal cflowd parameters that need to be configured are:

- Cflowd must be enabled.
- At least one collector must be configured and enabled.
- Sampling must be enabled on either:
  - → An IP filter entry and applied to a service or an port.
  - → An interface applied to a port.

The following example displays a cflowd configuration.

```
A:ALA-1>config>cflowd# info detail
----------------------------------------------
           active-timeout 30
           cache-size 65536inactive-timeout 15
           overflow 1
           rate 1000
           collector 10.10.10.103:2055 version 9
               no aggregation
               autonomous-system-type origin
               description "V9 collector"
               no shutdown
           exit
           template-retransmit 330
           exit
           no shutdown
----------------------------------------------
A:ALA-1>config>cflowd#
```

Common Configuration Tasks

This section provides a brief overview of the tasks that must be performed to configure cflowd and provides the CLI commands. In order to begin traffic flow sampling, cflowd must be enabled and at least one collector must be configured.

Global Cflowd Components

The following common (global) attributes apply to all instances of cflowd:

- Active timeout - Controls the maximum amount of time a flow record can be active before it will be automatically exported to defined collectors.
- Inactive timeout - Controls the minimum amount of time before a flow is declared inactive. If no traffic is sampled for an existing flow for the inactive timeout duration, the flow is decalred inactive and marked to be exported to the defined collectors.
- Cache size - Defines the maximum size of the flow cache.
- Overflow - Defines the percentage of flow records that are exported to all collectors if the flow cache size is exceeded.
- Rate - Defines the system wide sampling rate for cflowd.
- Template retransmit - Defines the interval (in seconds) at which the v9 and v10 template are retransmitted to all configured v9 or v10 collectors.

Configuring Cflowd

Use the CLI syntax displayed below to perform the following tasks:

- Enabling Cflowd on page 620
- Configuring Global Cflowd Parameters on page 621
- Configuring Cflowd Collectors on page 622
- Enabling Cflowd on Interfaces and Filters on page 633

CLI Syntax:

```
config>cflowd#
  active-timeout minutes
  cache-size num-entries
  inactive-timeout seconds
  template-retransmit seconds
  overflow percent
  rate sample-rate
  collector ip-address[:port] {version [5 | 8 | 9 |10]}
     aggregation
        as-matrix
        destination-prefix
        protocol-port
        raw
        source-destination-prefix
        source-prefix
     template-set {basic | mpls-ip}
     autonomous-system-type [origin | peer]
     description description-string
     no shutdown
  no shutdown
```

Enabling Cflowd

Cflowd is disabled by default. Executing the command configure cflowd will enable cflowd, by default cflowd is not shutdown but must be configured including at least one collector to be active.

Use the following CLI syntax to enable cflowd:

CLI Syntax:

```
config# cflowd
  no shutdown
```

The following example displays the default values when cflowd is initially enabled. No collectors or collector options are configured.

```
A:ALA-1>config# info detail
...
#------------------------------------------
echo "Cflowd Configuration"
#------------------------------------------
    cflowd
        active-timeout 30
        cache-size 65536
        inactive-timeout 15
        overflow 1
        rate 1000
        template-retransmit 600
        no shutdown
    exit
#------------------------------------------
A:ALA-1>config#
```

Configuring Global Cflowd Parameters

The following cflowd parameters apply to all instances where cflowd (traffic sampling) is enabled.

Use the following CLI commands to configure cflowd parameters:

CLI Syntax:

```
config>cflowd#
  active-timeout minutes
  cache-size num-entries
  inactive-timeout seconds
  overflow percent
  rate sample-rate
  template-retransmit seconds
  no shutdown
```

The following example displays a common cflowd component configuration:

```
A:ALA-1>config>cflowd# info
#------------------------------------------
        active-timeout 20
        inactive-timeout 10
        overflow 10
        rate 100
#------------------------------------------
A:ALA-1>config>cflowd#
```

Configuring Cflowd Collectors

To configure cflowd collector parameters, enter the following commands:

CLI Syntax:

```
config>cflowd#
   collector ip-address[:port] [version version]
      aggregation
         as-matrix
         destination-prefix
         protocol-port
         raw
         source-destination-prefix
         source-prefix
      autonomous-system-type [origin | peer]
      description description-string
      no shutdown
      template-set {basic | mpls-ip}
```

The following example displays a basic cflowd configuration:

```
A:ALA-1>config>cflowd# info
-----------------------------------------
active-timeout 20
        inactive-timeout 10
        overflow 10
        rate 100
        collector 10.10.10.1:2000 version 8
            aggregation
                as-matrix
                raw
            exit
            description "AS info collector"
        exit
        collector 10.10.10.2:5000 version 8
            aggregation
                protocol-port
                source-destination-prefix
            exit
            autonomous-system-type peer
            description "Neighbor collector"
        exit
-----------------------------------------
A:ALA-1>config>cflowd#
```

Version 9 Collector example:

```
collector 10.10.10.9:2000 version 9
           description "v9collector"
           template-set mpls-ip
           no shutdown
exit
```

Version 9 and Version 10 Templates

If the collector is configured to use either version 9 or 10 (IPFIX) formats, the flow data is sent to the designated collector using one of the pre-defined templates. The template used is based on the type of flow for which the data was collected (IPv4, IPv6, MPLS or Ethernet (Layer 2)), and the configuration of the **template-set** parameter. Table 8 indicates the relationship between these values and the corresponding template used to export the flow data.

Table 8: Template-Set

Traffic type	Basic	MPLS-IP
IPv4	Basic IPv4	MPLS-IPv4
IPv6	Basic IPv6	MPLS-IPv6
MPLS	Basic MPLS	MPLS-IP
Ethernet	L2-IP	L2-IP

Each flow exported, to a collector configured for either v9 or v10 formats, will be sent using one of the above flow template sets. As described above, which template is used is based on the flow type and how the collector's template-set parameter is configured.

The following tables specify the fields present in each template:

Table 9: Basic IPv4 Template

Field Name	Field ID
IPv4 Src Addr	8
IPv4 Dest Addr	12
IPv4 Nexthop	15
BGP Nexthop	18
Ingress Interface	10
Egress Interface	14
Packet Count	2
Byte Count	1
Start Time	22
End Time	21

Table 9: Basic IPv4 Template (Continued)

Flow Start Milliseconds[1]	152
Flow End Milliseconds[1]	153
Src Port	7
Dest Port	11
Forwarding Status	89
TCP control Bits (Flags)	6
IPv4 Protocol	4
IPv4 TOS	5
IP version	60
ICMP Type & Code	32
Direction	61
BGP Source ASN	16
BGP Dest ASN	17
Source IPv4 Prefix Length	9
Dest IPv4 Prefix Length	13

[1] Only sent to collectors configured for v10 format

Table 10: MPLS-IPv4 Template

Field Name	Field ID
IPv4 Src Addr	8
IPv4 Dest Addr	12
IPv4 Nexthop	15
BGP Nexthop	18
Ingress Interface	10
Egress Interface	14

Table 10: MPLS-IPv4 Template (Continued)

Field Name	Field ID
Packet Count	2
Byte Count	1
Start Time	22
End Time	21
Flow Start Milliseconds[1]	152
Flow End Milliseconds	153
Src Port	7
Dest Port	11
Forwarding Status	89
TCP control Bits (Flags)	6
IPv4 Protocol	4
IPv4 TOS	5
IP version	60
ICMP Type & Code	32
Direction	61
BGP Source ASN	16
BGP Dest ASN	17
Source IPv4 Prefix Length	9
Dest IPv4 Prefix Length	13
MPLS Top Label Type	46
MPLS Top Label IPv4 Addr	47
MPLS Label 1	70
MPLS Label 2	71
MPLS Label 3	72

Table 10: MPLS-IPv4 Template (Continued)

Field Name	Field ID
MPLS Label 4	73
MPLS Label 5	74
MPLS Label 6	75

[1] Only sent to collectors configured for v10 format

Table 11: Basic IPv6 Template

Field Name	Field ID
IPv6 Src Addr	27
IPv6 Dest Addr	28
IPv6 Nexthop	62
IPv6 BGP Nexthop	63
IPv4 Nexthop	15
IPv4 BGP Nexthop	18
Ingress Interface	10
Egress Interface	14
Packet Count	2
Byte Count	1
Start Time	22
End Time	21
Flow Start Milliseconds[1]	152
Flow End Milliseconds[1]	153
Src Port	7
Dest Port	11
Forwarding Status	89
TCP control Bits (Flags)	6

Table 11: Basic IPv6 Template

Field Name	Field ID
Protocol	4
IPv6 Extension Hdr	64
IPv6 Next Header	193
IPv6 Flow Label	31
TOS	5
IP version	60
IPv6 ICMP Type & Code	139
Direction	61
BGP Source ASN	16
BGP Dest ASN	17
IPv6 Src Mask	29
IPv6 Dest Mask	30

1.Only sent to collectors configured for v10 format

Table 12: MPLS-IPv6 Template

Field Name	Field ID
IPv6 Src Addr	27
IPv6 Dest Addr	28
IPv6 Nexthop	62
IPv6 BGP Nexthop	63
IPv4 Nexthop	15
IPv4 BGP Nexthop	18
Ingress Interface	10
Egress Interface	14
Packet Count	2

Table 12: MPLS-IPv6 Template

Field Name	Field ID
Byte Count	1
Start Time	22
End Time	21
Flow Start Milliseconds[1]	152
Flow End Milliseconds[1]	153
Src Port	7
Dest Port	11
Forwarding Status	89
TCP control Bits (Flags)	6
Protocol	4
IPv6 Extension Hdr	64
IPv6 Next Header	193
IPv6 Flow Label	31
TOS	5
IP version	60
IPv6 ICMP Type & Code	139
Direction	61
BGP Source ASN	16
BGP Dest ASN	17
IPv6 Src Mask	29
IPv6 Dest Mask	30
MPLS Label 1	70
MPLS Label 2	71
MPLS Label 3	72

Table 12: MPLS-IPv6 Template

Field Name	Field ID
MPLS Label 4	73
MPLS Label 5	74
MPLS Label 6	75

1.Only sent to collectors configured for v10 format

Table 13: Basic MPLS Template

Field Name	Field ID
Start Time	22
End Time	21
Flow Start Milliseconds[1]	152
Flow End Milliseconds[1]	153
Ingress Interface	10
Egress Interface	14
Packet Count	2
Byte Count	1
Direction	61
MPLS Label 1	70
MPLS Label 2	71
MPLS Label 3	72
MPLS Label 4	73
MPLS Label 5	74
MPLS Label 6	75

[1] Only sent to collectors configured for v10 format

Table 14: MPLS-IP Template

Field Name	Field ID
IPv4 Src Addr	8
IPv4 Dest Addr	12
IPv4 Nexthop	15
IPv6 Src Addr	27
IPv6 Dest Addr	28
IPv6 Nexthop	62
Ingress Interface	10
Egress Interface	14
Packet Count	2
Byte Count	1
Start Time	22
End Time	21
Flow Start Milliseconds[1]	152
Flow End Milliseconds[1]	153
Src Port	7
Dest Port	11
TCP control Bits (Flags)	6
IPv4 Protocol	4
IPv4 TOS	5
IP version	60
ICMP Type & Code	32
Direction	61
MPLS Top Label Type	46
MPLS Top Label IPv4 Addr	47

Table 14: MPLS-IP Template

Field Name	Field ID
MPLS Label 1	70
MPLS Label 2	71
MPLS Label 3	72
MPLS Label 4	73
MPLS Label 5	74
MPLS Label 6	75

[1] Only sent to collectors configured for v10 format

Table 15: Ethernet (L2-IP) Flow Template[1]

Field Name	Field ID
MAC Src Addr	56
MAC Dest Addr	80
Ingress Physical Interface	252
Egress Physical Interface	253
Dot1q VLAN ID	243
Dot1q Customer VLAN ID	245
Post Dot1q VLAN ID	254
Post Dot1q Customer VLAN Id	255
IPv4 Src Addr	8
IPv4 Dest Addr	12
IPv6 Src Addr	27
IPv6 Dest Addr	28
Packet Count	2
Byte Count	1

Table 15: Ethernet (L2-IP) Flow Template[1]

Field Name	Field ID
Flow Start Milliseconds	152
Flow End Milliseconds	153
Src Port	7
Dest Port	11
TCP control Bits (Flags)	6
Protocol	4
IPv6 Option Header	64
IPv6 Next Header	196
IPv6 Flow Label	31
TOS	5
IP Version	60
ICMP Type Code	32

[1] Ohe Ethernet (L2-IP) flow template is only supported and exported to IPFIX (v10) collectors.

Enabling Cflowd on Interfaces and Filters

This section discusses the following cflowd configuration management tasks:

- Specifying Cflowd Options on an IP Interface on page 634
  - → Interface Configurations on page 634
  - → Service Interfaces on page 635
- Specifying Sampling Options in Filter Entries on page 636
  - → Interface Configurations on page 634
- Dependencies on page 637

Specifying Cflowd Options on an IP Interface

When cflowd is enabled on an interface, all packets forwarded by the interface are subject to analysis according to the global cflowd configuration and sorted according to the collector configuration(s).

Refer to Table 16, Cflowd Configuration Dependencies, on page 638 for configuration combinations.

When the cflowd interface option is configured in the **config>router>interface** context, the following requirements must be met to enable traffic sampling on the specific interface:

1. Cflowd must be enabled.
2. At least one cflowd collector must be configured and enabled.
3. The **interface>cflowd interface** option must be selected. For configuration information, refer to the Filter Policy Overview section of the 7750 SR OS Router Configuration Guide.
4. To omit certain types of traffic from being sampled when the interface sampling is enabled, the **config>filter>ip-filter>entry>interface-disable-sample** option may be enabled via an ip-filter or ipv6-filter. The filter must be applied to the service or network interface on which the traffic to be omitted is to ingress the system.

Interface Configurations

CLI Syntax:
```
config>router>if#
  cflowd {acl|interface}
  no cflowd
```

Depending on the option selected, either `acl` or `interface`, cflowd extracts traffic flow samples from an IP filter or an interface for analysis. All packets forwarded by the interface are analyzed according to the cflowd configuration.

`The acl` option must be selected in order to enable traffic sampling on an IP filter. Cflowd (`filter-sample`) must be enabled in at least one IP filter entry.

`The interface` option must be selected in order to enable traffic sampling on an interface. If cflowd is not enabled (`no cflowd`) then traffic sampling will not occur on the interface.

Service Interfaces

CLI Syntax:
```
config>service>vpls service-id# interface ip-int-name
  cflowd {acl|interface}
```

When enabled on a service interface, cflowd collects routed traffic flow samples through a router for analysis. Cflowd is supported on IES and VPRN services interfaces only. Layer 2 traffic is excluded. All packets forwarded by the interface are analyzed according to the cflowd configuration. On the interface level, cflowd can be associated with a filter (ACL) or an IP interface.

Specifying Sampling Options in Filter Entries

Packets are matched against filter entries to determine acceptability. With cflowd, only the first packet of a flow is compared. If the first packet matches the filter criteria, then an entry is added to the cflowd cache. Subsequent packets in the same flow are also sampled based on the cache entry.

Since a filter can be applied to more than one interface (when configured with a **scope template**), the **interface-disable-sample** option is intended to enable or disable traffic sampling on an interface-by-interface basis. The command can be enabled or disabled as needed instead creating numerous filter versions.

To enable for filtr traffic sampling, the following requirements must be met::

1. Cflowd must be enabled globally.
2. At least one cflowd collector must be configured and enabled.
3. On the IP interface being used, the **interface>cflowd acl** option must be selected. (See Interfcace Configuration) For configuration information, refer to the IP Router Confguration Overview section of the 7750 SR OS Router Configuration Guide.
4. On the IP filter being used, the **entry>filter-sample** option must be explicitly enabled for the entries matching the traffic that should be sampled. The default is **no filter-sample**. (See Filter Configuration for more information).
5. The filter must be applied to a service or a network interface. The service or port must be enabled and operational.

Filter Configurations

CLI Syntax:
```
config>filter>ip-filter>entry#
  [no] filter-sample
  [no] interface-disable-sample
```

When a filter policy is applied to a service or a network interface, sampling can be configured so that traffic matching the associated IP filter entry is sampled when the IP interface is set to cflowd ACL mode and the **filter-sample** command is enabled. If cflowd is either not enabled (**no filter-sample**) or set to the **cflowd interface** mode, then sampling does not occur.

When the **interface-disable-sample** command is enabled, then traffic matching the associated IP filter entry is not sampled if the IP interface is set to cflowd ACL mode.

Dependencies

In order for cflowd to be operational, the following requirements must be met:

- Cflowd must be enabled on a global level. If cflowd is disabled, any traffic sampling instances are also disabled.
- At least one collector must be configured and enabled in order for traffic sampling to occur on an enabled entity.
- If a specific collector UDP port is not identified then, by default, flows are sent to port 2055.

Cflowd can also be dependent on the following entity configurations:

- Interface Configurations on page 634
- Service Interfaces on page 635
- Filter Configurations on page 636

Depending on the combination of interface and filter entry configurations determine if and when flow sampling occurs. Table 16 displays the expected results when specific features are enabled and disabled.

Table 16: Cflowd Configuration Dependencies

Interface Setting	router>interface cflowd [acl | interface] Setting	Command ip-filter entry	Expected Results
IP-filter mode	ACL	`filter-sampled`	Traffic matching is sampled at specified rate.
IP-filter mode	`ACL`	`no filter-sampled`	No traffic is sampled on this interface.
IP-filter mode or cflowd not enabled on interface	`ACL`	`interface-disable-sample`	Command is ignored. No sampling occurs.
Interface mode	`interface`	`interface-disable-sample`	Traffic matching this IP filter entry is not sampled.
Interface mode	`interface`	`none`	All IP traffic ingressing the interface is subject to sampling.
Interface mode	`interface`	`filter sampled`	Filter level action is ignored. All traffic ingressing the interface is subject to sampling.

Cflowd Configuration Management Tasks

This section discusses the following cflowd configuration management tasks:

- Modifying Global Cflowd Components on page 639
- Modifying Cflowd Collector Parameters on page 640

Modifying Global Cflowd Components

Cflowd parameter modifications apply to all instances where cflowd or traffic sampling is enabled. Changes are applied immediately. Use the following cflowd commands to modify global cflowd parameters:

CLI Syntax:

```
config>cflowd#
  active-timeout minutes
  no active-timeout
  cache-size num-entries
  no cache-size
  inactive-timeout seconds
  no inactive-timeout
  overflow percent
  no overflow
  rate sample-rate
  no rate
  [no] shutdown
  template-retransmit seconds
  no template-retransmit
```

The following example displays the cflowd command usage to modify configuration parameters:

Example:

```
config>cflowd# active-timeout 60
config>cflowd# no inactive-timeout
config>cflowd# overflow 2
config>cflowd# rate 10
```

The following example displays the common cflowd component configuration:

```
A:ALA-1>config>cflowd# info
#------------------------------------------
        active-timeout 60
        overflow 2
        rate 10
#------------------------------------------
A:ALA-1>config>cflowd#
```

Modifying Cflowd Collector Parameters

Use the following commands to modify cflowd collector and aggregation parameters:

CLI Syntax:

```
config>cflowd#
  collector ip-address[:port] [version version]
  no collector ip-address[:port]
     [no] aggregation
        [no] as-matrix
        [no] destination-prefix
        [no] protocol-port
        [no] raw
        [no] source-destination-prefix
        [no] source-prefix
     [no] autonomous-system-type [origin | peer]
     [no] description description-string
     [no] shutdown
     template-set {basic | mpls-ip | l2-ip}
```

If a specific collector UDP port is not identified then, by default, flows are sent to port 2055.

The following displays basic cflowd modifications:

```
A:ALA-1>config>cflowd# info
-----------------------------------------
     active-timeout 60
        overflow 2
        rate 10
        collector 10.10.10.1:2000 version 5
            description "AS info collector"
        exit
        collector 10.10.10.2:5000 version 8
            aggregation
                source-prefix
                raw
            exit
            description "Test collector"
        exit
-----------------------------------------
A:ALA-1>config>cflowd#
```

Cflowd Command Reference

Command Hierarchies

Configuration Commands

```
config
    — [no] cflowd
            — active-timeout minutes
            — no active-timeout
            — cache-size num-entries
            — no cache-size
            — collector ip-address[:port] [version {[5 |  8 |  9 |10]}
            — no collector ip-address[:port]
                    — [no] aggregation
                            — [no] as-matrix
                            — [no] destination-prefix
                            — [no] protocol-port
                            — [no] raw
                            — [no] source-destination-prefix
                            — [no] source-prefix
                    — autonomous-system-type {origin | peer}
                    — no autonomous-system-type
                    — description description-string
                    — no description
                    — [no] shutdown
                    — template-set   {basic | mpls-ip | l2-ip}
            — export-mode [automatic | manual]
            — inactive-timeout seconds
            — no inactive-timeout
            — overflow percent
            — no overflow
            — rate sample-rate
            — no rate
            — [no] shutdown
            — template-retransmit seconds
            — no template-retransmit
```

Show Commands

```
show
     — cflowd
                — collector [ip-address[:port]] [detail]
                — interface [ip-int-name | ip-address]
                — status
```

Tools Commands

```
tools
     — dump
                — cflowd
                          — top-protocols [clear]
                          — top-flows [ipv4 | ipv6 | mpls] [clear]
                          — packet-size [ipv4 | ipv6] [clear]
```

Clear Commands

```
clear
     — cflowd
```

Cflowd Configuration Commands

Global Commands

cflowd

Syntax [**no**] **cflowd**

Context **config>cflowd**

Description This command creates the context to configure cflowd.

The **no** form of this command removes all configuration under cflowd including the deletion of all configured collectors. This can only be executed if cflowd is in a shutdown state.

Default no cflowd

active-timeout

Syntax **active-timeout** *minutes*
no active-timeout

Context config>cflowd

Description This command configures the maximum amount of time before an active flow is aged out of the active cache. If an individual flow is active for this amount of time, the flow is aged out and a new flow will be created on the next packet sampled for that flow.

Note: Existing flows do not inherit the new active-timeout value if this parameter is changed while cflowd is active. The active-timeout value for a flow is set when the flow is first created in the active cache table and does not change dynamically.

The **no** form of this command resets the inactive timeout back to the default value.

Default **30**

Parameters *minutes* — The value expressed in minutes before an active flow is exported.

Values 1 — 600

cache-size

Syntax **cache-size** *num-entries*
no cache-size

Context config>cflowd

Description This command specifies the maximum number of active flows to maintain in the flow cache table.

The **no** form of this command resets the number of active entries back to the default value.

Default **65536** (64K)

Parameters *num-entries* — The number of entries maintained in the cflowd cache.

Values	1000 - 1000000	(SF/CPM5)
	1000 - 250000	(SF/CPM3 and 7750 SR-c12/4)
	1000 - 128k	(all other platforms)

collector

Syntax **collector** *ip-address*[:*port*] {**version** [**5 | 8 | 9 | 10**]}
no collector

Context config>cflowd

Description This command defines a flow data collector for cflowd data. The IP address of the flow collector must be specified. The UDP port number is an optional parameter. If it is not set, the default of 2055 is used for all collector versions. To connect to a IPFIX (version 10) collector using the IPFIX default port, specify port 4739 when configuring the collector. The version must be specified. A maximum of 5 collectors can be configured.

The **no** form of this command removes the flow collector definition from the config and stops the export of data to the collector. The collector needs to be shutdown to be deleted.

Default none

Parameters *ip-address* — Specifies the address of a remote Cflowd collector host to receive the exported Cflowd data.

Values <ip-address[:port]> : ip-address - a.b.c.d[:port] (IPv4)
x:x:x:x:x:x:x:x (IPv6)
[x:x:x:x:x:x:x:x]:port (IPv6)
x - [0..FFFF]H

port — Specifies the UDP port number on the remote Cflowd collector host to receive the exported Cflowd data.

Values 1— 65535

Default 2055

version — Specifies the version of the flow data collector.

Values Netflow v5, v8, v9, v10 (IPFIX) format

Default 5

aggregation

Syntax [**no**] **aggregation**

Context config>cflowd>collector

Description This command configures the type of aggregation scheme to be exported.

Specifies the type of data to be aggregated and to the collector.

To configure aggregation, you must decide which type of aggregation scheme to configure: autonomous system, destination prefix, protocol port, raw, source destination, or source prefix.

This can only be configured if the collector version is configured as V8.

The **no** form of this command removes all aggregation types from the collector configuration.

Default **no aggregation**

as-matrix

Syntax [**no**] **as-matrix**

Context config>cflowd>collector>aggregation

Description This command specifies that the aggregation data should be based on autonomous system (AS) information. An AS matrix contains packet and byte counters for traffic from either source-destination autonomous systems or last-peer to next-peer autonomous systems.

The **no** form of this command removes this type of aggregation from the collector configuration.

Default no as-matrix

destination-prefix

Syntax [**no**] **destination-prefix**

Context config>cflowd>collector>aggregation

Description This command specifies that the aggregation data is based on destination prefix information.

The **no** form removes this type of aggregation from the collector configuration.

Default none

protocol-port

Syntax [**no**] **protocol-port**

Context config>cflowd>collector>aggregation

Description This command specifies that flows be aggregated based on the IP protocol, source port number, and destination port number.

The **no** form of this command removes this type of aggregation from the collector configuration.

Default none

raw

Syntax [**no**] **raw**

Context config>cflowd>collector>aggregation

Description This command configures raw (unaggregated) flow data to be sent in Version 5.

The **no** form of this command removes this type of aggregation from the collector configuration.

Default none

source-destination-prefix

Syntax [**no**] **source-destination-prefix**

Context config>cflowd>collector>aggregation

Description This command configures cflowd aggregation based on source and destination prefixes.

The **no** form of this command removes this type of aggregation from the collector configuration.

Default none

source-prefix

Syntax [**no**] **source-prefix**

Context config>cflowd>collector>aggregation

Description This command configures cflowd aggregation based on source prefix information.

The **no** form of this command removes this type of aggregation from the collector configuration.

Default none

autonomous-system-type

Syntax **autonomous-system-type** {**origin** | **peer**}
no autonomous-system-type

Context config>cflowd>collector

Description This command defines whether the autonomous system (AS) information included in the flow data is based on the originating AS or external peer AS of the routes.

This option is only allowed if the collector is configured as Version 5 or Version 8.

The **no** form of this command resets the AS type to the default value.

Default **autonomous-system-type origin**

Parameters **origin —** Specifies that the AS information included in the flow data is based on the originating AS.

peer — Specifies that the AS information included in the flow data is based on the peer AS.

description

Syntax **description** *description-string*
no description

Context config>cflowd>collector

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

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

Default No description is associated with the configuration context.

Parameters *description-string* — The description character string. Allowed values are any string up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, $, spaces, etc.), the entire string must be enclosed within double quotes.

shutdown

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

Context config>cflowd
config>cflowd>collector

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

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

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

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

template-set

Syntax **template-set** {**basic | mpls-ip | l2-ip**}

Context config>cflowd>collector

Description This command specifies the set of templates sent to the collector when using cflowd Version 9 or Version 10.

Default **basic**

Parameters **basic —** Basic flow data is sent.

mpls-ip — Extended flow data is sent that includes IP and MPLS flow information.

l2-ip — Extended flow data is sent that includes Layer 2 (ethernet) and IP flow information.This template is only applicable for v10(IPFIX) collectors.

export-mode

Syntax **export-type** [**automatic | manual**]

Context config>cflowd

Description This command can be used to control how exports are generated by the cflowd process. The default behavior is for flow data to be exported automatically based on the active and inactive time-out values. The alternative mode is manual in which case flow data is only exported when the command “tools perform cflowd manual-export” is issued. The only exception is if the cflowd cache overflows, in which case the normal automatic export process is used.

Default export-mode automatic

Parameters **automatic —** Cflowd flow data is automatically generated.

manual — Cflowd flow data is exported only when manual triggered.

inactive-timeout

Syntax **inactive-timeout** *seconds*
no inactive-timeout

Context config>cflowd

Description This command specifies the amount of time, in seconds, that must elapse without a packet matching a flow in order for the flow to be considered inactive.

The **no** form of this command resets the inactive timeout back to the default of 15 seconds.

Note: Existing flows will not inherit the new inactive-timeout value if this parameter is changed while cflowd is active. The inactive-timeout value for a flow is set when the flow is first created in the active cache table and does not change dynamically.

Default **15**

Parameters *seconds* — Specifies the amount of time, in seconds, that must elapse without a packet matching a flow in order for the flow to be considered inactive.

Values 10 — 600

overflow

Syntax **overflow** *percent*
no overflow

Context config>cflowd

Description This command specifies the percentage of the flow cache entries removed when the maximum number of entries is exceeded. The entries removed are the entries that have not been updated for the longest amount of time.

The **no** form of this command resets the number of entries cleared from the flow cache on overflow to the default value.

Default **1 %**

Parameters *percent* — Specifies the percentage of the flow cache entries removed when the maximum number of entries is exceeded.

Values 1 — 50 percent

rate

Syntax **rate** *sample-rate*
no rate

Context config>cflowd

Description This command specifies the rate (N) at which traffic is sampled and sent for flow analysis. A packet is sampled every N packets; for example, when *sample-rate* is configured as 1, then all packets are sent to the cache. When *sample-rate* is configured as 100, then every 100th packet is sent to the cache.

The **no** form of this command resets the sample rate to the default value.

Default 1000

Parameters *sample-rate* — Specifies the rate at which traffic is sampled.

Values 1 — 10000

template-retransmit

Syntax **template-retransmit** *seconds*
no template-retransmit

Context config>cflowd

Description This command specifies the interval for sending template definitions.

Default 600

Parameters *seconds* — The value expressed in seconds before sending template definitions.

Values 10 — 600

Show Commands

collector

Syntax **collector** [*ip-addr*[**:***port*]] [**detail**]

Context show>cflowd

Description This command displays administrative and operational status of data collector configuration.

Parameters *ip-addr* — Display only information about the specified collector IP address.

Default all collectors

:*port* **—** Display only information the collector on the specified UDP port.

Default all UDP ports

Values 1 — 65535

detail — Displays details about either all collectors or the specified collector.

Output **cflowd Collector Output —** The following table describes the show cflowd collector output fields:

Table 17: Show Cflowd Collector Output Fields

Label	Description
`Host Address`	The IP address of a remote Cflowd collector host to receive the exported Cflowd data.
`Port`	The UDP port number on the remote Cflowd collector host to receive the exported Cflowd data.
`AS Type`	The style of AS reporting used in the exported flow data. `origin` – Reflects the endpoints of the AS path which the flow is following. `peer` – Reflects the AS of the previous and next hops for the flow.
`Version`	Specifies the configured version for the associated collector.
`Admin`	The desired administrative state for this Cflowd remote collector host.
`Oper`	The current operational status of this Cflowd remote collector host.
`Recs Sent`	The number of Cflowd records that have been transmitted to this remote collector host.
`Collectors`	The total number of collectors using this IP address.

Sample Output

```
A:SR1 # show cflowd collector detail
===============================================================================
Cflowd Collectors (detail)
===============================================================================
Address : 138.120.135.103
Port : 2055
Description : Test v9 Collector
Version : 9
Admin State : up
Oper State : up
Packets Sent : 51
Last Changed : 09/03/2009 17:24:04
Last Pkt Sent : 09/03/2009 18:07:10
Template Set : Basic
-------------------------------------------------------------------------------
Traffic Type       Template Sent          Sent       Open       Errors
-------------------------------------------------------------------------------
IPv4               09/03/2009 18:07:29      51                 1           0
MPLS               No template sent          0                 0           0
IPv6               No template sent          0                 0           0
===============================================================================


A:R51-CfmA# show cflowd collector

===============================================================================
Cflowd Collectors
===============================================================================
Host Address    Port  Version   AS Type   Admin   Oper            Sent
-------------------------------------------------------------------------------
138.120.135.103 2055  v5        peer      up      up              1380 records
138.120.135.103 9555  v8        origin    up      up                90 records
138.120.135.103 9996  v9          -       up      up                 0 packets
138.120.214.224 2055  v5        origin    up      up              1380 records
-------------------------------------------------------------------------------
Collectors : 4
===============================================================================
```

Table 18: Show Cflowd Collector Detailed Output Fields

Label	Description
`Address`	The IP address of a remote Cflowd collector host to receive the exported Cflowd data.
`Port`	The UDP port number on the remote Cflowd collector host to receive the exported Cflowd data.
`Description`	A user-provided descriptive string for this Cflowd remote collector host.
`Version`	The version of the flow data sent to the collector.

Table 18: Show Cflowd Collector Detailed Output Fields (Continued)

Label	Description (Continued)
AS Type	The style of AS reporting used in the exported flow data. origin – Reflects the endpoints of the AS path which the flow is following. peer – Reflects the AS of the previous and next hops for the flow.
Admin State	The desired administrative state for this Cflowd remote collector host.
Oper State	The current operational status of this Cflowd remote collector host.
Records Sent	The number of Cflowd records that have been transmitted to this remote collector host.
Last Changed	The time when this row entry was last changed.
Last Pkt Sent	The time when the last Cflowd packet was sent to this remote collector host.
Aggregation Type	The bit mask which specifies the aggregation scheme(s) used to aggregate multiple individual flows into an aggregated flow for export to this remote host collector. none – No data will be exported for this remote collector host. raw – Flow data is exported without aggregation in version 5 format. All other aggregation types use version 8 format to export the flow data to this remote host collector.
Collectors	The total number of collectors using this IP address.
Sent	The number of packets with flow date sent to the associated collector.
Open	This counter shows the number of partially filled packets which have some flow data but are not yet filled or have been timed out (60 seconds maximum).
Error	This counter increments when there was an error during exporting of the collector packet. The most common reason will be a UDP unreachable destination for the configured collector.

```
A:R51-CfmA# show cflowd collector detail
===============================================================================
Cflowd Collectors  (detail)
===============================================================================
Address                     : 138.120.135.103
Port                        : 2055
Description                 : Test v5 Collector
Version                     : 5
AS Type                     : peer
Admin State                 : up
Oper State                  : up
```

```
Records Sent                 : 1260
Last Changed                 : 09/03/2009 17:24:04
Last Pkt Sent                : 09/03/2009 18:07:10
-------------------------------------------------------------------------------
                                              Sent          Open       Errors
-------------------------------------------------------------------------------
                                                42             0            0
===============================================================================
Address                      : 138.120.135.103
Port                         : 9555
Description                  : Test v8 Collector
Version                      : 8
AS Type                      : origin
Admin State                  : up
Oper State                   : up
Records Sent                 : 82
Last Changed                 : 09/03/2009 17:24:04
Last Pkt Sent                : 09/03/2009 18:06:41
-------------------------------------------------------------------------------
Aggregation Type              Status          Sent          Open       Errors
-------------------------------------------------------------------------------
as-matrix                    Disabled             0             0            0
protocol-port                Disabled             0             0            0
source-prefix                 Enabled            21             0            0
destination-prefix            Enabled            21             0            0
source-destination-prefix    Disabled             0             0            0
raw                          Disabled             0             0            0
===============================================================================
Address                      : 138.120.135.103
Port                         : 9996
Description                  : Test v9 Collector
Version                      : 9
Admin State                  : up
Oper State                   : up
Packets Sent                 : 51
Last Changed                 : 09/03/2009 17:24:04
Last Pkt Sent                : 09/03/2009 18:07:10
Template Set                 : Basic
-------------------------------------------------------------------------------
Traffic Type            Template Sent          Sent          Open       Errors
-------------------------------------------------------------------------------
IPv4              09/03/2009 18:07:29            51             1            0
MPLS                 No template sent             0             0            0
IPv6                 No template sent             0             0            0
===============================================================================
A:R51-CfmA#
```

interface

Syntax **interface** [*ip-addr* **|** *ip-int-name*]

Context show>cflowd

Description Displays the administrative and operational status of the interfaces with cflowd enabled.

Parameters *ip-addr* — Display only information for the IP interface with the specified IP address.

Default all interfaces with cflowd enabled.

ip-int-name — Display only information for the IP interface with the specified name.

Default all interfaces with cflowd enabled.

Output **cflowd Interface Output —** The following table describes the show cflowd interface output fields.

Label	Description
`Interface`	Displays the physical port identifier.
`IPv4 Address`	Displays the primary IPv4 address for the associated IP interface.
`IPv6 Address`	Displays the primary IPv6 address for the associated IP interface.
`Router`	Displays the virtual router index (Base = 0).
`IF Index`	Displays the Global IP interface index.
`Mode`	Displays the cflowd sampling type and direction. intf — Interface based sampling acl — ACL based sampling ingr — Ingress sampling egr — Egress sampling both — Both ingress and egress sampling
`Admin`	Displays the administrative state of the interface.
`Opr-IPv4`	Displays the operational state for IPv4 sampling.
`Opr-IPv6`	Displays the operational state for IPv6 sampling.

Sample Output

```
B:sr-002# show cflowd interface [ip-addr | ip-int-name]
===============================================================================
Cflowd Interfaces
===============================================================================
Interface                         Router       IF Index   Mode      Admin
  IPv4 Address                                                        Oper IPv4
  IPv6 Address                                                        Oper IPv6
-------------------------------------------------------------------------------
ipv4ipv6NamedIf                   Base          381       intf/ing   Up
    5.5.5.5/24                                                        Up
    55::55/128                                                        Up
ipv4NamedIf                       5             254       acl-egr   Up
    10.10.10.10/24                                                    Up
    N/A                                                               Down
ipv6NamedIf                       Base          380       i/f-both  Up
    N/A                                                               Down
    1234:5678::9/128                                                  Up
-------------------------------------------------------------------------------
Interfaces : 3
===============================================================================
B:sr-002# show cflowd interface 11.10.1.2
===============================================================================
Cflowd Interfaces
===============================================================================
Interface:  To_Sr1
IP address: 11.10.1.2/24
Admin/Oper state:  Up/Up
Sampling Mode: (ingress | egress | both)
Total Flows seen: 1302000
Pkts sampled (ingress/egress) :  60103/70102
Bytes sampled (ingress/egress) :  6010300/7010200
Active flows (ingress/egress) :  6010/7010


B:sr-002# show cflowd interface
===============================================================================
Cflowd Interfaces
===============================================================================
Interface                         IP Address        Mode        Admin   Oper
-------------------------------------------------------------------------------
To_Sr1                            1.10.1.2/24       Interface   Up      Up
To_C2                             1.12.1.2/24       Interface   Up      Up
To_Cisco_7600                     1.13.1.2/24       Interface   Up      Up
To_E                              1.11.1.2/24       Interface   Up      Up
To_G2                             150.153.1.1/24    Interface   Up      Up
To_Sr1_Sonet                      150.140.1.2/24    Interface   Up      Down
Main                              120.1.1.1/24      Filter      Down    Down
New                               120.2.1.1/24      Filter      Up      Up
-------------------------------------------------------------------------------
Interfaces : 8
===============================================================================
B:sr12-002#
```

status

Syntax **status**

Context show>cflowd

Description This command displays basic information regarding the administrative and operational status of cflowd.

Output **cflowd Status Output —** The following table describes the show cflowd status output fields:

Table 19: Cflowd Status Output

Label	Description
`Cflowd Admin Status`	The desired administrative state for this Cflowd remote collector host.
`Cflowd Oper Status`	The current operational status of this Cflowd remote collector host.

Table 19: Cflowd Status Output (Continued)

Label	Description (Continued)
`Active Timeout`	The maximum amount of time, in minutes, before an active flow will be exported. If an individual flow is active for this amount of time, the flow is exported and a new flow is created.
`Inactive Timeout`	Inactive timeout in seconds.
`Template Retrans-mit`	The time in seconds before template definitions are sent.
`Cache Size`	The maximum number of active flows to be maintained in the flow cache table.
`Overflow`	The percentage number of flows to be flushed when the flow cache size has been exceeded.
`Sample Rate`	The rate at which traffic is sampled and forwarded for Cflowd analysis. `one (1)` – All packets are analyzed. `1000 (default)` – Every 1000th packet is analyzed.
`Active Flows`	The current number of active flows being collected.
`Total Pkts Rcvd`	The rate at which traffic is sampled and forwarded for Cflowd analysis.
`Total Pkts Dropped`	The total number of packets dropped.
`Aggregation Info:`	
`Type`	The type of data to be aggregated and to the collector.
`Status`	`enabled` – Specifies that the aggregation type is enabled.
	`disabled` – Specifies that the aggregation type is disabled.
`Sent`	The number of packets with flow date sent to the associated collector.
`Open`	This counter shows the number of partially filled packets which have some flow data but are not yet filled or have been timed out (60 seconds maximum).
`Error`	This counter increments when there was an error during exporting of the collector packet. The most common reason will be a UDP unreachable destination for the configured collector.
`Overflow events`	The number of times the active cache overflowed.
`Dropped Flows`	Equal to “total flows trashed” in cflowdStatsTotal.

Sample Output

```
sr1# show cflowd status
===============================================================================
Cflowd Status
===============================================================================
Cflowd Admin Status : Enabled
Cflowd Oper Status : Enabled
Active Timeout : 1 minutes
Inactive Timeout : 30 seconds
Template Retransmit : 60 seconds
Cache Size : 65536 entries
Overflow : 1%
Sample Rate : 1
Active Flows : 34000
Overflow events 10
Dropped Flows: 0
Pkts Rcvd : 801600
Total Pkts Dropped : 0
                           Raw
Times flow created        160000
Times flow matched        224428382
Total flows flushed       150000
===============================================================================
Version Info
===============================================================================
Version       Status        Sent   Open   Errors
-------------------------------------------------------------------------------
5             Enabled       92     0      0
8             Enabled       46     0      0
9             Enabled       56     1      0
10            Enabled       39     1      0
===============================================================================

===============================================================================
Cflowd Status
===============================================================================
Cflowd Admin Status  : Enabled
Cflowd Oper Status   : Enabled
Active Timeout       : 1 minutes
Inactive Timeout     : 30 seconds
Template Retransmit  : 60 seconds
Cache Size           : 65536 entries
Overflow             : 1%
Sample Rate          : 1
Active Flows         : 34
Total Pkts Rcvd      : 801600
Total Pkts Dropped   : 0

===============================================================================
Version Info
===============================================================================
Version                    Status     Sent          Open          Errors
-------------------------------------------------------------------------------
     5                     Enabled    92            0             0
     8                     Enabled    46            0             0
     9                     Enabled    56            1             0
    10                     Enabled    39            1             0
===============================================================================
```

Tools Commands

top-protocols

Syntax **top-protocols**

Context tools>dump>cflowd [**clear]**

Description This command displays the summary information for the top 20 protocol traffic seen in the cflowd cache. All statistics are calculated based on the data collected since the last clearing of the cflowd stats with clear keyword for this command.

If the clear optional keyword is given, then the top-flows are displayed, and then this cache is cleared.

Output **Tools Dump Cflowd Top-protocols Output —** The following table describes the tools dump cflowd top-protocols output fields:

Table 20: Tools Dump Cflowd Output Fields

Label	Description
`Protocol ID`	Displays the IPv4 or IPv6 protocol type. This will either print the well known protocol name or the decimal protocol number.
`Total Flows`	Displays the total number of flows recorded since the last clearing of cflowd statistics with this protocol type.
`Flows/Sec`	Displays the average number of flows detected for the associated protocol type. (Total flows / number of seconds since last clear)
`Packets/Flow`	Displays the average number of packets per flow. (Total number of packets / total flows)
`Bytes/Pkts`	Displays the average number of bytes per packet for the associated protocol type. (Total number of bytes for the associated protocol / total number of packets seen for the associated protocol)
`Packets/Sec`	Displays the average number of packets seen for the associated protocol type. (Number of packets / time since last clear)
`Duration/Flow`	Displays the average lifetime of a flow for the associated protocol type. (Number of seconds since last clear / total flows)
`Bandwidth Total (%)`	Displays the percentage of bandwidth consumed by the associated protocol type. (Total protocol bytes / total bytes of all flows)

Sample Output

```
SR# tools dump cflowd top-protocols

The top 20 IPv4 protocols seen by cflowd are:
      Current Time: 08/29/2011 15:36:15
Last Cleared Time: 08/29/2011 15:35:08
Protocol ID     Total   Flows   Packets   Bytes   Packets   Duration   % Total
--------        Flows    /Sec     /Flow    /Pkt      /Sec      /Flow   Bandwidth
--------------------------------------------------------------------------------
UDP                 2       0         6     100         0          6         75%
pr1                   1       0         6      64         0          6         24%
--------------------------------------------------------------------------------
TOTALS              3       0         6      88         0          6        100%
```

top-flows

Syntax **top-flows** [**ipv4 | ipv6 | mpls**] [**clear**]

Context tools>dump>cflowd

Description This command displays the top 20 (highest traffic volume) flows for IPv4, IPv6 or MPLS traffic types collected since the cflowd top-flow table was last cleared or initialized.

Output **Tools Dump Cflowd Top-Flows Output —** The following table describes the tools dump cflowd top-flows output fields:

Table 21: Tools Dump Cflowd Top-flows Out put Fields

Label	Description
Ingress	Displays the ingress interface ID.
Src IP	Displays the source IP address of the flow (IPv4 or IPv6).
Egress	Displays the egress interface ID.
Dest IP	Displays the destination IP address of the flow (IPv4 or IPv6).
Pr Proto	Displays the protocol type for flow.
TOS	Displays the Type of Service/DSCP buts filed markings.
Flgs	Displays the protocol flag markings.
Pkts	Displays the total number of packets sampled for this flow (since stats were last cleared).
vRtr-ID	Displays the vRouter context the flow was sample in.

Table 21: Tools Dump Cflowd Top-flows Out put Fields

Label	Description

`S-Port`
`Src Port`
	Displays the source protocol port number.

`Msk`	Displays the route prefix length for route to source IP address.
`AS`	Displays the Autonomous Systems number for the source route (the AS is either originating AS or peer AS depending on cflowd configuration).

`D-Port`
`Dst Port`
	DIsplays the destination protocol port number.

`Msk`	Displays the route prefix length for route to destination IP address (Forwarding route).
`AS`	Displays the Autonomous Systems number for the destination route (the AS is either originating AS or peer AS depending on cflowd configuration)
`Nexthop`	Displays the next-hop address used to forward traffic associated with the flow.
`Avg pkt size`	Displays the average packet size of a sampled traffic associated with this flow (total number of packets sampled / total number of packets sampled).
`Active`	Displays the number of seconds the flow has been active.

Sample Output

```
1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
Sr1# tools dump cflowd top-flows ipv4

Ingress i/f   SrcIP          Egress i/f     DstIP           Pr  TOS  Flgs  Pkts
 vRtr-ID   S-Port Msk AS     D-Port Msk AS  NextHop         Avg Pkt Size Active
----------------------------------------------------------------------------------
1000          52.52.52.1      2001          123.123.123.122 0x01 55   0x10  3748
 10201     0000   /8  50         0000 /8  40  202.120.130.2       220     3600
……
```

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
Sr1# tools dump cflowd top-flows ipv6
SrcIP (up to IPv6)                       Ingress i/f  Src Port   vRtr ID     ToS
DstIP (upto IPv6)                        Egress i/f   Dst Port    Proto    Flags
   Nexthop (uptoIPv6)                      Total Pkts     Avg Pkt  Active(sec)
2001:0db8:85a3:0000:0000:8a2e:0370:7334  60005        10020        0        0x12
2001:0db8:85a3:0000:0000:8a2e:0280:1234  60325        20010        17       0x23
   2001:0db8:85a3:0000:0000:8a2e:1234:5678 1234567890     1500     13600
……
```

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
Sr1# tools dump cflowd top-flows mpls
Label-1    Label-2    Label-3    Label-4    Total Pkts     Avg Pkt   Active(s)
  SrcIP (up to IPv6)                    Ingress i/f  Src Port    ToS
  DstIP (upto IPv6)                     Egress i/f   Dst Port    Proto    Flags
--------------------------------------------------------------------------------
```

packet-size

Syntax **packet-size** [**ipv4 | ipv6**] [**clear**]

Context tools>dump>cflowd

Description This command displays packet size distribution for sampled IP traffic. Values are displays in decimal format (1.0 = 100%, .500 = 50%). Separate statistics are maintained and shown for IPv4 and IPv6 traffic.

Sample Output

```
SR-12# tools dump cflowd packet-size ipv4
 IP packet size distribution (801600 total packets):
   1-32   64   96  128  160  192  224  256  288  320  352  384  416  448  480
   .000 .250 .000 .000 .010 .100 .500 .090 .000 .000 .000 .000 .000 .000 .000

    512  544  576 1024 1536 2048 2560 3072 3584 4096 4608 9000
   .000 .000 .000 .050 .000 .000 .000 .000 .000 .000 .000 .000
```

Clear Commands

cflowd

Syntax **cflowd**

Context clear

Description Clears the raw and aggregation flow caches which are sending flow data to the configured collectors. This action will trigger all the flows to be discarded. The cache restarts flow data collection from a fresh state. This command also clears global stats collector stats listed in the cflowd show commands.

Common CLI Command Descriptions

In This Chapter

This section provides information about common Command Line Interface (CLI) syntax and command usage.

Topics in this chapter include:

- SAP syntax on page 666

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* — Specifies the physical port identifier portion of the SAP definition.

The *sap-id* can be configured in one of the following formats:

Type	Syntax	Example
port-id	*slot*/*mda*/*port*[.*channel*]	1/1/5
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-61:102 *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, fr, ppp
		bundle-num	1 — 336
	bpgrp-id	bpgrp-*type-bpgrp-num*	
		bpgrp	keyword
		type	ima, fr, ppp
		bpgrp-num	1 — 2000
	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	
	ipsec-id	ipsec-*id*.[private | public]:*tag*	
		ipsec	keyword
		id	1 — 4
		tag	0 — 4094

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 — 336

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 — 2000

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)

sap ipsec-*id*.private|public:*tag* **—** This parameter associates an IPSec group SAP with this interface. This is the public side for an IPSec tunnel. Tunnels referencing this IPSec group in the private side may be created if their local IP is in the subnet of the interface subnet and the routing context specified matches with the one of the interface.

This context will provide a SAP to the tunnel. The operator may associate an ingress and egress QoS policies as well as filters and virtual scheduling contexts. Internally this creates an Ethernet SAP that will be used to send and receive encrypted traffic to and from the MDA. Multiple tunnels can be associated with this SAP. The “tag” will be a dot1q value. The operator may see it as an identifier. The range is limited to 1 — 4095.

Standards and Protocol Support

Note that this Standards Compliance list is subject to change.

Ethernet Standards

IEEE 802.1ab-REV/D3 Station and Media Access Control Connectivity Discovery

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

ITU-T Y.1731 OAM functions and mechanisms for Ethernet based networks

ITU-T G.8031 Ethernet linear protection switching

ITU-T G.8032 Ethernet Ring Protection Switching (version 2)

OSPF

RFC 1765 OSPF Database Overflow

RFC 2328 OSPF Version 2

RFC 2370 Opaque LSA Support

RFC 2740 OSPF for IPv6 (OSPFv3)

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

RFC 4203 OSPF Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS) - (support of Link Local/Remote Identifiers and SRLG sub-TLVs)

RFC 5185 OSPF Multi-Area Adjacency

RFC5243 OSPF Database Summary List Optimization

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 2558 Multiprotocol Extensions for BGP-4

RFC 2918 Route Refresh Capability for BGP-4

RFC 3107 Carrying Label Information in 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

RFC 4486 Subcodes for BGP Cease Notification Message

RFC 4577 OSPF as the Provider/Customer Edge Protocol for BGP/MPLS IP Virtual Private Networks (VPNs)

RFC 4659 BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN

RFC 4684 Constrained Route Distribution for Border Gateway Protocol/MultiProtocol Label Switching (BGP/MPLS) Internet Protocol (IP) Virtual Private Networks (VPNs)

RFC 4724 Graceful Restart Mechanism for BGP – GR helper

RFC 4760 Multi-protocol Extensions for BGP

RFC 4798 Connecting IPv6 Islands over IPv4 MPLS Using IPv6 Provider Edge Routers (6PE)

RFC 4893 BGP Support for Four-octet AS Number Space

RFC 5004 Avoid BGP Best Path Transitions from One External to Another

RFC 5065 Confederations for BGP (obsoletes 3065)

RFC 5291 Outbound Route Filtering Capability for BGP-4

RFC 5575 Dissemination of Flow Specification Rules

RFC 5668 4-Octet AS Specific BGP Extended Community

draft-ietf-idr-add-paths Advertisement of Multiple Paths in BGP Advertisement of the Best External Route in BGP

draft-ietf-idr-best-external

IS-IS

ISO/IEC 10589:2002, Second Edition Intermediate System to Intermediate System Intra-Domain Routeing Information Exchange Protocol

RFC 1195 Use of OSI IS-IS for Routing in TCP/IP and Dual Environments

RFC 2973 IS-IS Mesh Groups

RFC 3359 Reserved Type, Length and Value (TLV) Codepoints in Intermediate System to Intermediate System

RFC 3719 Recommendations for Interoperable Networks using Intermediate System to Intermediate System (IS-IS)

RFC 3787 Recommendations for Interoperable IP Networks using

Intermediate System to Intermediate System (IS-IS)

RFC 4971 Intermediate System to Intermediate System (IS-IS) Extensions for Advertising Router Information

RFC 5120 M-ISIS: Multi Topology (MT) Routing in IS-IS

RFC 5301 Dynamic Hostname Exchange Mechanism for IS-IS

RFC 5302 Domain-wide Prefix Distribution with Two-Level IS-IS

RFC 5303 Three-Way Handshake for IS-IS Point-to-Point Adjacencies

RFC 5304 IS-IS Cryptographic Authentication

RFC 5305 IS-IS Extensions for Traffic Engineering TE

RFC 5306 Restart Signaling for IS-IS

RFC 5307 IS-IS Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)

RFC 5309 Point-to-Point Operation over LAN in Link State Routing Protocols

RFC 5310 IS-IS Generic Cryptographic Authentication

RFC 6213 IS-IS BFD-Enabled TLV

RFC 6329 IS-IS Extensions Supporting IEEE 802.1aq Shortest Path Bridging

draft-ietf-isis-mi-02 IS-IS Multi-Instance

IPSec

RFC 2401 Security Architecture for the Internet Protocol

RFC 2406 IP Encapsulating Security Payload (ESP)

RFC 2409 The Internet Key Exchange (IKE)

RFC 2560 X.509 Internet Public Key Infrastructure
Online Certificate Status Protocol - OCSP

RFC 3706 IKE Dead Peer Detection

RFC 3947 Negotiation of NAT-Traversal in the IKE

RFC 3948 UDP Encapsulation of IPsec ESP Packets

RFC 4210 Internet X.509 Public Key Infrastructure
Certificate Management Protocol (CMP)

RFC 4211 Internet X.509 Public Key Infrastructure
Certificate Request Message Format (CRMF)

RFC 5996 Internet Key Exchange Protocol Version 2 (IKEv2)

RFC 5998 An Extension for EAP-Only Authentication in IKEv2

draft-ietf-ipsec-isakmp-xauth-06 – Extended Authentication within ISAKMP/Oakley (XAUTH)

draft-ietf-ipsec-isakmp-modecfg-05 – The ISAKMP Configuration Method

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 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 4443 Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification

RFC 4552 Authentication/Confidentiality for OSPFv3

RFC 4659 BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN

RFC 5072 IP Version 6 over PPP

RFC 5095 Deprecation of Type 0 Routing Headers in IPv6

draft-ietf-isis-ipv6-05

draft-ietf-isis-wg-multi-topology-xx.txt

Multicast

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 Rendevous 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

RFC 4608 Source-Specific Protocol Independent Multicast in 232/8

RFC 4610 Anycast-RP Using Protocol Independent Multicast (PIM)

draft-ietf-pim-sm-bsr-06. Bootstrap Router (BSR) Mechanism for PIM

draft-rosen-vpn-mcast-15.txt Multicast in MPLS/BGP IP VPNs

draft-ietf-l3vpn-2547bis-mcast-07: Multicast in MPLS/BGP IP VPNs

draft-ietf-l3vpn-2547bis-mcast-bgp-05: BGP Encodings and Procedures for Multicast in MPLS/BGP IP VPNs

RFC 3956: Embedding the Rendezvous Point (RP) Address in an IPv6 Multicast Address

MPLS-GENERAL

RFC 2430 A Provider Architecture DiffServ & TE

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 3031 MPLS Architecture

RFC 3032 MPLS Label Stack Encoding

RFC 3140 Per-Hop Behavior Identification Codes

RFC 3443 Time To Live (TTL) Processing in Multi-Protocol Label Switching (MPLS) Networks

RFC 4182 Removing a Restriction on the use of MPLS Explicit NULL

RFC 4023 Encapsulating MPLS in IP or Generic Routing Encapsulation (GRE)

RFC 5332 MPLS Multicast Encapsulations

MPLS — LDP

RFC 3037 LDP Applicability

RFC 3478 Graceful Restart Mechanism for LDP – GR helper

RFC 5036 LDP Specification

RFC 5283 LDP extension for Inter-Area LSP

RFC 5443 LDP IGP Synchronization

RFC 6388 LDP Extensions for Point-to-Multipoint and Multipoint-to-Multipoint LSP

RFC 6826 Multipoint LDP in-band signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths

draft-pdutta-mpls-tldp-hello-reduce-04, Targeted LDP Hello Reduction

MPLS/RSVP-TE

RFC 2702 Requirements for Traffic Engineering over MPLS

RFC2747 RSVP Cryptographic Authentication

RFC 2961 RSVP Refresh Overhead Reduction Extensions

RFC3097 RSVP Cryptographic Authentication - Updated Message Type Value

RFC 3209 Extensions to RSVP for Tunnels

RFC 3473 Generalized Multi-Protocol Label Switching (GMPLS) Signaling

Resource ReserVation Protocol-Traffic Engineering (RSVP-TE) Extensions – (support of IF_ID RSVP_HOP object with unnumbered interface and RSVP-TE Graceful Restart Helper Procedures)

RFC 3477 Signalling Unnumbered Links in Resource ReSerVation Protocol-Traffic Engineering (RSVP-TE)

RFC 3564 Requirements for Diff-Serv-aware TE

RFC 3906 Calculating Interior Gateway Protocol (IGP) Routes Over Traffic Engineering Tunnels

RFC 4090 Fast reroute Extensions to RSVP-TE for LSP Tunnels

RFC 4124 Protocol Extensions for Support of Diffserv-aware MPLS Traffic Engineering

RFC 4125 Maximum Allocation Bandwidth Constraints Model for Diffserv-aware MPLS Traffic Engineering

RFC 4127 Russian Dolls Bandwidth Constraints Model for Diffserv-aware MPLS Traffic Engineering

RFC 4561 Definition of a RRO Node-Id Sub-Object

RFC 4875 Extensions to Resource Reservation Protocol - Traffic Engineering (RSVP-TE) for Point-to-Multipoint TE Label Switched Paths (LSPs)

RFC 5151 Inter-domain MPLS and GMPLS Traffic Engineering – RSVP-TE Extensions

RFC 5712 MPLS Traffic Engineering Soft Preemption

RFC 5817 Graceful Shutdown in GMPLS Traffic Engineering Networks

draft-newton-mpls-te-dynamic-overbooking-00 A Diffserv-TE Implementation Model to dynamically change booking factors during failure events

MPLS — OAM

RFC 4379 Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures

RFC 6424 Mechanism for Performing Label Switched Path Ping (LSP Ping) over MPLS Tunnels

RFC 6425 Detecting Data Plane Failures in Point-to-Multipoint Multiprotocol Label Switching (MPLS) - Extensions to LSP Ping

MPLS-TP (7750/7450 only)

RFC 5586 MPLS Generic Associated Channel

RFC 5921 A Framework for MPLS in Transport Networks

RFC 5960 MPLS Transport Profile Data Plane Architecture

RFC 6370 MPLS-TP Identifiers

RFC 6378 MPLS-TP Linear Protection

RFC 6428 Proactive Connectivity Verification, Continuity Check and Remote Defect indication for MPLS Transport Profile

RFC 6426 MPLS On-Demand Connectivity and Route Tracing

RFC 6478 Pseudowire Status for Static Pseudowires

draft-ietf-mpls-tp-ethernet-addressing-02 MPLS-TP Next-Hop Ethernet Addressing

RIP

RFC 1058 RIP Version 1

RFC 2080 RIPng for IPv6

RFC 2082 RIP-2 MD5 Authentication

RFC 2453 RIP Version 2

TCP/IP

RFC 768 UDP

RFC 1350 The TFTP Protocol (Rev.

RFC 791 IP

RFC 792 ICMP

RFC 793 TCP

RFC 826 ARP

RFC 854 Telnet

RFC 951 BootP (rev)

RFC 1519 CIDR

RFC 1542 Clarifications and Extensions for the Bootstrap Protocol

RFC 1812 Requirements for IPv4 Routers

RFC 2347 TFTP option Extension

RFC 2328 TFTP Blocksize Option

RFC 2349 TFTP Timeout Interval and Transfer

Size option

RFC 2401 Security Architecture for Internet Protocol

RFC 2428 FTP Extensions for IPv6 and NATs

RFC 3596 DNS Extensions to Support IP version 6

RFC 5880 Bidirectional Forwarding Detection

RFC 5881 BFD IPv4 and IPv6 (Single Hop)

RFC 5883 BFD for Multihop Paths

RFC 5286 Basic Specification for IP Fast Reroute: Loop-Free Alternates

draft-litkowski-rtgwg-lfa-manageability-01 Operational management of Loop Free Alternates

VRRP

RFC 2787 Definitions of Managed Objects for the Virtual Router Redundancy Protocol

RFC 3768 Virtual Router Redundancy Protocol

draft-ietf-vrrp-unified-spec-02 Virtual Router Redundancy Protocol Version 3 for IPv4 and IPv6

PPP

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 1877 PPP Internet Protocol Control Protocol Extensions for Name Server Addresses

RFC 1989 PPP Link Quality Monitoring

RFC 1990 The PPP Multilink Protocol (MP)

RFC 1994 PPP Challenge Handshake

Authentication Protocol (CHAP)

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

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 — Signalling Specification For Frame Relay Bearer Service.

FRF2.2. PVC Network-to- Network Interface (NNI) Implementation Agreement.

FRF.12 Frame Relay Fragmentation Implementation Agreement

FRF.16.1 Multilink Frame Relay UNI/ NNI Implementation Agreement

ITU-T Q.933 Annex A Additional procedures for Permanent Virtual Connection (PVC) status management

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

ITU-T Recommendation I.432.1 BISDN user-network interface – Physical layer specification: General characteristics

GR-1248-CORE Generic Requirements for Operations of ATM Network Elements (NEs). Issue 3

GR-1113-CORE Bellcore, Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements, Issue 1

AF-ILMI-0065.000 Integrated Local Management Interface (ILMI) Version 4.0

AF-TM-0150.00 Addendum to Traffic Management v4.1 optional minimum desired cell rate indication for UBR

AF-PHY-0086.001 Inverse Multiplexing for ATM (IMA) Specification Version 1.1

DHCP

RFC 2131 Dynamic Host Configuration Protocol (REV)

RFC 3046 DHCP Relay Agent Information Option (Option 82)

RFC 1534 Interoperation between DHCP and BOOTP

Policy Management and Credit Control

3GPP TS 29.212 Policy and Charging Control (PCC) over Gx/Sd Reference Point (Release 11) - Gx support as it applies to wireline environment (BNG)

RFC 3588 Diameter Base Protocol

RFC 4006 Diameter Credit Control Application

NAT

RFC 6333 Dual-Stack Lite Broadband Deployments Following IPv4 Exhaustion

RFC 6334 Dynamic Host Configuration Protocol for IPv6 (DHCPv6) Option for Dual-Stack Lite

RFC 6888 Common Requirements For Carrier-Grade NATs (CGNs)

RFC 5508 NAT Behavioral Requirements for ICMP

RFC 5382 NAT Behavioral Requirements for TCP

RFC 6146 Statefull NAT64

VPLS

RFC 4761 Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling

RFC 4762 Virtual Private LAN Services Using LDP

RFC 5501 Requirements for Multicast Support in Virtual Private LAN Services

RFC 6074 Provisioning, Auto-Discovery, and Signaling in Layer 2 Virtual Private Networks (L2VPNs)

draft-ietf-l2vpn-vpls-mcast-13. Multicast in VPLS

RFC 7041 Extensions to the Virtual Private LAN Service (VPLS) Provider Edge (PE) Model for Provider Backbone Bridging

Pseudowire

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)

RFC 4717 Encapsulation Methods for Transport ATM over MPLS Networks

RFC 4816 PWE3 ATM Transparent Cell Transport Service

RFC 4448 Encapsulation Methods for Transport of Ethernet over MPLS Networks

RFC 4619 Encapsulation Methods for Transport of Frame Relay over MPLS Networks

RFC 4446 IANA Allocations for PWE3

RFC 4447 Pseudowire Setup and Maintenance Using LDP

RFC 5085 Pseudowire Virtual Circuit Connectivity Verification (VCCV): A Control Channel for Pseudowires

RFC 5659 An Architecture for Multi-Segment Pseudowire Emulation Edge-to-Edge

RFC 5885 Bidirectional Forwarding Detection (BFD) for the Pseudowire Virtual Circuit Connectivity Verification (VCCV)

RFC 6310 Pseudowire (PW) OAM Message Mapping

RFC6391 Flow Aware Transport of Pseudowires over an MPLS PSN

RFC 6575 ARP Mediation for IP Interworking of Layer 2 VPN

RFC 6718 Pseudowire Redundancy

RFC 6870 Pseudowire Preferential Forwarding Status bit

draft-ietf-l2vpn-vpws-iw-oam-03 OAM Procedures for VPWS Interworking

draft-ietf-pwe3-mpls-eth-oam-iwk-07 MPLS and Ethernet OAM Interworking

draft-ietf-pwe3-dynamic-ms-pw-16 Dynamic Placement of Multi Segment Pseudo Wires

MFA Forum 9.0.0 The Use of Virtual trunks for ATM/MPLS Control Plane Interworking

MFA Forum 12.0.0 Multiservice Interworking - Ethernet over MPLS

MFA Forum 13.0.0 Fault Management for Multiservice Interworking v1.0

MFA Forum 16.0.0 Multiservice Interworking - IP over MPLS

ANCP/L2CP

RFC 5851 ANCP framework

draft-ietf-ancp-protocol-02 ANCP Protocol

Voice /Video Performance:

ITU-T G.107 The E Model- A computational model for use in planning.

ETSI TS 101 329-5 Annex E extensions-QoS Measurement for VoIP - Method for determining an Equipment Impairment Factor using Passive Monitoring

ITU-T Rec. P.564 Conformance testing for voice over IP transmission quality assessment models

ITU-T G.1020 Appendix I Performance Parameter Definitions for Quality of Speech and other Voiceband Applications Utilizing IP Networks-Mean Absolute Packet Delay Variation.& Markov Models.

RFC 3550 Appendix A.8- RTP A Transport Protocol for Real-Time Applications- Estimating the Interarrival Jitter.

Circuit Emulation

RFC 4553 Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP)

RFC 5086 Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN)

MEF-8 Implementation Agreement for the Emulation of PDH Circuits over Metro Ethernet Networks, October 2004

RFC 5287 Control Protocol Extensions for the Setup of Time-Division Multiplexing (TDM) Pseudowires in MPLS Networks

SONET/SDH

ITU-G.841 Telecommunication Standardization Section of ITU, Types and Characteristics of SDH Networks Protection Architecture, issued in October 1998 and as augmented by Corrigendum1 issued in July 2002

AAA

RFC 2865 Remote Authentication Dial In User Service

RFC 2866 RADIUS Accounting

draft-grant-tacacs-02. The TACACS+ Protocol

SSH

RFC 4250 The Secure Shell (SSH) Protocol Assigned Numbers

RFC 4251 The Secure Shell (SSH) Protocol Architecture

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