



Alcatel-Lucent 7950

EXTENSIBLE ROUTING SYSTEM | RELEASE 13.0.R4
ROUTER CONFIGURATION GUIDE

Alcatel-Lucent – Proprietary & Confidential
Contains proprietary/trade secret information which is the property of Alcatel-Lucent. Not to be made available to, or copied or used by anyone who is not an employee of Alcatel-Lucent except when there is a valid non-disclosure agreement in place which covers such information and contains appropriate non-disclosure and limited use obligations.
Copyright 2015 © Alcatel-Lucent. All rights reserved.

All specifications, procedures, and information in this document are subject to change and revision at any time without notice. The information contained herein is believed to be accurate as of the date of publication. Alcatel-Lucent provides no warranty, express or implied, regarding its contents. Users are fully responsible for application or use of the documentation.

Alcatel, Lucent, Alcatel-Lucent and the Alcatel-Lucent logo are trademarks of Alcatel-Lucent. All other trademarks are the property of their respective owners.

Copyright 2015 Alcatel-Lucent.

All rights reserved.

Disclaimers

Alcatel-Lucent products are intended for commercial uses. Without the appropriate network design engineering, they must not be sold, licensed or otherwise distributed for use in any hazardous environments requiring fail-safe performance, such as in the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, direct life-support machines, or weapons systems, in which the failure of products could lead directly to death, personal injury, or severe physical or environmental damage. The customer hereby agrees that the use, sale, license or other distribution of the products for any such application without the prior written consent of Alcatel-Lucent, shall be at the customer's sole risk. The customer hereby agrees to defend and hold Alcatel-Lucent harmless from any claims for loss, cost, damage, expense or liability that may arise out of or in connection with the use, sale, license or other distribution of the products in such applications.

This document may contain information regarding the use and installation of non-Alcatel-Lucent products. Please note that this information is provided as a courtesy to assist you. While Alcatel-Lucent tries to ensure that this information accurately reflects information provided by the supplier, please refer to the materials provided with any non-Alcatel-Lucent product and contact the supplier for confirmation. Alcatel-Lucent assumes no responsibility or liability for incorrect or incomplete information provided about non-Alcatel-Lucent products.

However, this does not constitute a representation or warranty. The warranties provided for Alcatel-Lucent products, if any, are set forth in contractual documentation entered into by Alcatel-Lucent and its customers.

This document was originally written in English. If there is any conflict or inconsistency between the English version and any other version of a document, the English version shall prevail.

Table of Contents

Preface	13
About This Guide	13
Audience	13
List of Technical Publications	14
Searching for Information	15
To search for specific information in this guide	15
To search for specific information in multiple documents	15
Technical Support	17
Getting Started	
In This Chapter	19
Alcatel-Lucent 7950 SR-Series Router Configuration Process	19
IP Router Configuration	
In This Chapter	21
Configuring IP Router Parameters	22
Interfaces	22
Network Interface	22
Network Domains	23
System Interface	24
Unicast Reverse Path Forwarding Check (uRPF)	25
Creating an IP Address Range	26
QoS Policy Propagation Using BGP (QPPB)	27
QPPB	30
QPPB and GRT Lookup	35
Router ID	38
Autonomous Systems (AS)	39
Confederations	40
Proxy ARP	42
Exporting an Inactive BGP Route from a VPRN	43
Internet Protocol Versions	44
IPv6 Address Format	45
IPv6 Applications	47
DNS	49
Secure Neighbor Discovery (SeND)	49
SeND Persistent CGAs	50
IPv6 Provider Edge Router over MPLS (6PE)	56
Static Route Resolution Using Tunnels	58
Static Route ECMP Support	59
Weighted Load-Balancing over MPLS LSP	60
Weighted Load Balancing IGP, BGP, and Static Route Prefix Packets over IGP Shortcut	60
Feature Configuration	60
Feature Behavior	61
ECMP Considerations	63
Weighted Load Balancing Static Route Packets over MPLS LSP	64

Table of Contents

Bi-directional Forwarding Detection	66
BFD Control Packet	66
Control Packet Format	67
BFD for RSVP-TE	69
Echo Support	70
BFD Support for BGP	71
Centralized BFD	71
Aggregate Next Hop	74
Invalidate Next-Hop Based on ARP/Neighbor Cache State	74
LDP Shortcut for IGP Route Resolution	75
Process Overview	79
Configuration Notes	80
Configuring an IP Router with CLI	81
Router Configuration Overview	82
System Interface	82
Network Interface	82
Basic Configuration	83
Common Configuration Tasks	84
Configuring a System Name	84
Configuring Interfaces	85
Configuring a System Interface	85
Configuring a Network Interface	85
Configuring IPv6 Parameters	87
Router Advertisement	88
Configuring Proxy ARP	90
Creating an IP Address Range	92
Deriving the Router ID	93
Configuring a Confederation	94
Configuring an Autonomous System	95
Service Management Tasks	96
Changing the System Name	96
Modifying Interface Parameters	97
Deleting a Logical IP Interface	98
IP Router Command Reference	99
Command Hierarchies	99
Configuration Commands	113
Show Commands	209
Clear Commands	293
Debug Commands	298

VRRP

In This Chapter	303
VRRP Overview	304
VRRP Components	305
Virtual Router	305
IP Address Owner	305
Primary and Secondary IP Addresses	306
Virtual Router Master	306
Virtual Router Backup	307

Owner and Non-Owner VRRP	307
Configurable Parameters	308
Virtual Router ID (VRID)	308
Priority	308
IP Addresses	309
Message Interval and Master Inheritance	310
Skew Time	310
Master Down Interval	311
Preempt Mode	311
VRRP Message Authentication	312
Authentication Data	314
Virtual MAC Address	314
VRRP Advertisement Message IP Address List Verification	314
Inherit Master VRRP Router's Advertisement Interval Timer	315
IPv6 Virtual Router Instance Operationally Up	315
Policies	315
VRRP Priority Control Policies	316
VRRP Virtual Router Policy Constraints	316
VRRP Virtual Router Instance Base Priority	316
VRRP Priority Control Policy Delta In-Use Priority Limit	317
VRRP Priority Control Policy Priority Events	318
Priority Event Hold-Set Timers	318
LAG Degrade Priority Event	319
Host Unreachable Priority Event	321
Route Unknown Priority Event	321
VRRP Non-Owner Accessibility	322
Non-Owner Access Ping Reply	322
Non-Owner Access Telnet	322
Non-Owner Access SSH	323
VRRP Configuration Process Overview	324
Configuration Notes	325
General	325
Configuring VRRP with CLI	327
VRRP Configuration Overview	328
Preconfiguration Requirements	328
Basic VRRP Configurations	329
VRRP Policy	329
VRRP IES Service Parameters	330
Configure VRRP for IPv6	331
VRRP Router Interface Parameters	332
Common Configuration Tasks	333
Creating Interface Parameters	334
Configuring VRRP Policy Components	335
Configuring Service VRRP Parameters	336
Non-Owner VRRP Example	336
Owner Service VRRP	337
Configuring Router Interface VRRP Parameters	338
Router Interface VRRP Non-Owner	338
Router Interface VRRP Owner	339
VRRP Configuration Management Tasks	340

Table of Contents

Modifying a VRRP Policy	340
Deleting a VRRP Policy	341
Modifying Service and Interface VRRP Parameters	342
Modifying Non-Owner Parameters	342
Modifying Owner Parameters	342
Deleting VRRP on an Interface or Service	342
VRRP Command Reference	343
Command Hierarchies	343
Configuration Commands	349
Show Commands	389
Monitor Commands	402
Clear Commands	404
Debug Commands	406

Filter Policies

In This Chapter	407
ACL Filter Policy Overview	408
ACL Filter Policy Commands	409
Filter Policy Basics	411
Filter Policy Packet Match Criteria	411
IPv4/IPv6 Filter Policy Entry Match Criteria	411
MAC Filter Policy Entry Match Criteria	415
Filter Policy Actions	417
Filter Policy Statistics	420
Filter Policy Logging	421
Filter Policy cflowd Sampling	421
Filter Policy Management	422
Filter Policy Advanced Topics	423
Match-list for Filter Policies	423
Embedded Filters	427
System-level IPv4/IPv6 Line Card Filter Policy	429
Network-port VPRN Filter Policy	430
ISID MAC Filters	430
VID MAC filters	431
Redirect Policies	435
HTTP-redirect (Captive Portal)	438
Filter Policies and Dynamic, Policy-Driven Interfaces	440
Filter Policy-based ESM Service Chaining	440
Configuring Filter Policies with CLI	445
Basic Configuration	446
Common Configuration Tasks	447
Creating an IP Filter Policy	447
IP Filter Policy	448
IP Filter Entry	449
Creating an IPv6 Filter Policy	452
Creating a MAC Filter Policy	453
MAC Filter Policy	453
MAC ISID Filter Policy	454
MAC VID Filter Policy	455
MAC Filter Entry	456

Creating a Match List for Filter Policies	457
Apply IP (v4/v6) and MAC Filter Policies to a Service	458
Applying (IPv4/v6) Filter Policies to a Network Port	459
Creating a Redirect Policy	460
Configuring Policy-Based Forwarding for Deep Packet Inspection in VPLS	461
Filter Management Tasks	464
Renumbering Filter Policy Entries	464
Modifying a Filter Policy	466
Deleting a Filter Policy	468
Modifying a Redirect Policy	469
Deleting a Redirect Policy	470
Copying Filter Policies	471
Filter Command Reference	473
Command Hierarchies	473
Configuration Commands	483
Show Commands	533
Clear Commands	552
Monitor Commands	553
Debug Commands	553

Cflowd

In This Chapter	561
Cflowd Overview	562
Operation	563
Version 8	565
Version 9	565
Version 10	566
Cflowd Filter Matching	567
Cflowd Configuration Process Overview	568
Configuration Notes	569
Configuring Cflowd with CLI	571
Cflowd Configuration Overview	572
Traffic Sampling	572
Collectors	573
Aggregation	573
Basic Cflowd Configuration	575
Common Configuration Tasks	576
Global Cflowd Components	576
Configuring Cflowd	577
Enabling Cflowd	578
Configuring Global Cflowd Parameters	579
Configuring Cflowd Collectors	580
Version 9 and Version 10 Templates	581
Enabling Cflowd on Interfaces and Filters	592
Specifying Cflowd Options on an IP Interface	593
Interface Configurations	593
Service Interfaces	594
Specifying Sampling Options in Filter Entries	595
Filter Configurations	595
Dependencies	596

Table of Contents

Cflowd Configuration Management Tasks	598
Modifying Global Cflowd Components	598
Modifying Cflowd Collector Parameters	599
Common CLI Command Descriptions	
In This Chapter	601
Common Service Commands	602
Cflowd Command Reference	603
Command Hierarchies	603
Show Commands	605
Tools Commands	613
Clear Commands	618
Cflowd Configuration Commands	619
Standards and Protocol Support	627

List of Tables

Table 1: List of Technical Publications	14
---	----

Getting Started

Table 2: Configuration Process	19
--	----

IP Router Configuration

Table 3: QPPB Interactions with SAP Ingress QoS	36
Table 4: IPv6 Header Field Descriptions	45
Table 5: BFD Control Packet Field Descriptions	67
Table 6: Default Route Preferences	135

VRRP

Table 7: LAG Events	319
Table 8: Show VRRP Statistics Output	400

Filter Policies

Table 9: Display Filter Entry Action	410
Table 10: Display Filter Entry Action	420

Cflowd

Table 11: Template-Set	581
Table 12: Basic IPv4 Template	581
Table 13: MPLS-IPv4 Template	582
Table 14: Basic IPv6 Template	584
Table 15: MPLS-IPv6 Template	585
Table 16: Basic MPLS Template	587
Table 17: MPLS-IP Template	588
Table 18: Ethernet (L2-IP) Flow Template	590
Table 19: Cflowd Configuration Dependencies	597

Common CLI Command Descriptions

Table 20: Show Cflowd Collector Output Fields	605
Table 21: Show Cflowd Collector Detailed Output Fields	606
Table 22: Cflowd Status Output	610
Table 23: tools dump cflowd cache Output Fields	613
Table 24: Tools Dump Cflowd Top-flows Out put Fields	615
Table 25: Tools Dump Cflowd Top-protocols Output Fields	617

List of Figures

IP Router Configuration

Figure 1: Use of QPPB to Differentiate Traffic in an ISP Network	29
Figure 2: Confederation Configuration	41
Figure 3: IPv6 Header Format	44
Figure 4: IPv6 Internet Exchange	47
Figure 5: IPv6 Transit Services	47
Figure 6: IPv6 Services to Enterprise Customers and Home Users	48
Figure 7: IPv6 over IPv4 Tunnels	48
Figure 8: Neighbor discovery with and without SeND	50
Figure 9: Example of a 6PE Topology within One AS	56
Figure 10: Mandatory Frame Format	67
Figure 11: BFD for IES/VPDN over Spoke SDP	72
Figure 12: BFD over LAG	73

VRRP

Figure 13: VRRP Configuration	304
Figure 14: VRRP Configuration and Implementation Flow	324

Filter Policies

Figure 15: FP/CPM Filter Policy using Individual Address Prefixes	423
Figure 16: FP/CPM Filter Policy Using an Address Prefix Match List	424
Figure 17: Embedded Filter Policy	428
Figure 18: VID Filtering Examples	432
Figure 19: Port Groups	434
Figure 20: Web Redirect Traffic Flow	439
Figure 21: ACL filter modeling for ESM Service Chaining	441
Figure 22: Upstream ESM ACL-policy based service chaining	441
Figure 23: Downstream ESM ACL-policy based service chaining	442
Figure 24: Applying an IP Filter to an Ingress Interface	446
Figure 25: Policy-Based Forwarding for Deep Packet Inspection	461

Cflowd

Figure 26: Basic Cflowd Steps	563
Figure 27: V5, V8, V9, V10, and Flow Processing	564
Figure 28: Cflowd Configuration and Implementation Flow	568

Common CLI Command Descriptions

List of Figures

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 guide 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 guide is intended for network administrators who are responsible for configuring the 7950 XRS routers. It is assumed that the network administrators have an understanding of networking principles and configurations. Concepts described in this guide include the following:

- IP router configuration
- IP-based filters

List of Technical Publications

The 7950 XRS documentation set is composed of the following guides:

Table 1: List of Technical Publications

Guide	Description
7950 XRS Basic System Configuration Guide	This guide describes basic system configurations and operations.
7950 XRS System Management Guide	This guide describes system security and access configurations as well as event logging and accounting logs.
7950 XRS Interface Configuration Guide	This guide describes XMA Control Module (XCM), XRS Media Adaptor (XMA), port and Link Aggregation Group (LAG) provisioning.
7950 XRS 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.
7950 XRS Routing Protocols Guide	This guide provides an overview of routing concepts and provides configuration examples for RIP, OSPF, IS-IS, BGP, and route policies.
7950 XRS MPLS Guide	This guide describes how to configure Multiprotocol Label Switching (MPLS) and Label Distribution Protocol (LDP).
7950 XRS Services Guide	This guide describes how to configure service parameters such as service distribution points (SDPs), customer information, and user services.
7950 XRS Layer 2 Services and EVPN Guide: VLL, VPLS, PBB, and EVPN	This guide describes Virtual Leased Lines (VLL), Virtual Private LAN Service (VPLS), Provider Backbone Bridging (PBB), and Ethernet VPN (EVPN).
7950 XRS Layer 3 Services Guide: Internet Enhanced Services and Virtual Private Routed Network Services	This guide describes Internet Enhanced Services (IES) and Virtual Private Routed Network (VPRN) services.

Table 1: List of Technical Publications

Guide	Description
7950 XRS OAM and Diagnostics Guide	This guide describes how to configure features such as service mirroring and Operations, Administration and Management (OAM) tools.
7950 XRS Quality of Service Guide	This guide describes how to configure Quality of Service (QoS) policy management.

Searching for Information

You can use Adobe Reader, Release 6.0 or later, to search one or more PDF files for a term.

To search for specific information in this guide

1. From the Adobe Reader main menu, choose Edit > Search or Advanced Search. The Search panel opens.
2. Click on the In the current document radio button.
3. Enter the term to search for.
4. Select the following search criteria, if required:
 - Whole words only
 - Case-Sensitive
 - Include Bookmarks
 - Include Comments
5. Click on the Search button. Adobe Reader displays the search results.

You can expand the entries by clicking on the + symbol.

To search for specific information in multiple documents

Note: The PDF files that you search must be in the same folder.

1. From the Adobe Reader main menu, choose Edit > Search or Advanced Search. The Search panel opens.

2. Click on the All PDF Documents in radio button.
3. Choose the folder in which to search using the drop-down menu.
4. Enter the term to search for.
5. Select the following search criteria, if required:
 - Whole words only
 - Case-Sensitive
 - Include Bookmarks
 - Include Comments
6. Click on the Search button. Adobe Reader displays the search results.

You can expand the entries for each file by clicking on the + symbol.

Technical Support

If you purchased a service agreement for your 7950 SR-Series 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, follow this link to contact an Alcatel-Lucent support representative and to access product manuals and documentation updates:

<https://support2.alcatel-lucent.com/portal/olcsHome.do>

Getting Started

In This Chapter

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

Alcatel-Lucent 7950 SR-Series Router Configuration Process

[Table 2](#) lists the tasks necessary to configure logical IP routing interfaces, virtual routers, IP and MAC-based filtering.

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 2: Configuration Process

Area	Task	Chapter
Router configuration	Configure router parameters, including router interfaces and addresses router IDs.	IP Router Configuration on page 21
Protocol configuration	VRRP	VRRP on page 303
	IP and MAC filters	Filter Policies on page 407
Reference	List of IEEE, IETF, and other proprietary entities.	Standards and Protocol Support on page 629

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 on page 22](#)
 - [Interfaces on page 22](#)
 - [Autonomous Systems \(AS\) on page 39](#)
 - [Confederations on page 40](#)
 - [Proxy ARP on page 42](#)
 - [Exporting an Inactive BGP Route from a VPRN on page 43](#)
 - [Static Route Resolution Using Tunnels on page 58](#)
 - [Weighted Load-Balancing over MPLS LSP on page 60](#)
 - [Bi-directional Forwarding Detection on page 66](#)
- [Configuration Notes on page 80](#)

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 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 22](#)
 - [Creating an IP Address Range on page 26](#)
 - [Autonomous Systems \(AS\) on page 39](#)
 - [Confederations on page 40](#)
 - [Proxy ARP on page 42](#)
-

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

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.

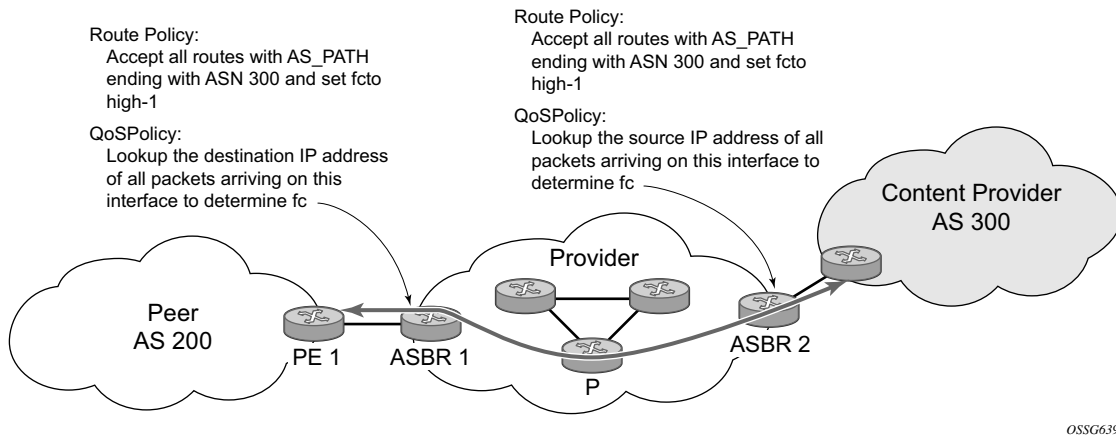


Figure 1: Use of QPPB to Differentiate Traffic in an ISP Network

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 hl 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>vpn>vrf-import

- BGP import policies:
 - `config>router>bgp>import`
 - `config>router>bgp>group>import`
 - `config>router>bgp>group>neighbor>import`
 - `config>service>vpn>bgp>import`
 - `config>service>vpn>bgp>group>import`
 - `config>service>vpn>bgp>group>neighbor>import`
- RIP import policies:
 - `config>router>rip>import`
 - `config>router>rip>group>import`
 - `config>router>rip>group>neighbor>import`
 - `config>service>vpn>rip>import`
 - `config>service>vpn>rip>group>import`
 - `config>service>vpn>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
      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 be 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.

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 30](#) 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 30](#) 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 3 summarizes these interactions.

Table 3: 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 3: 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 39](#)). 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.

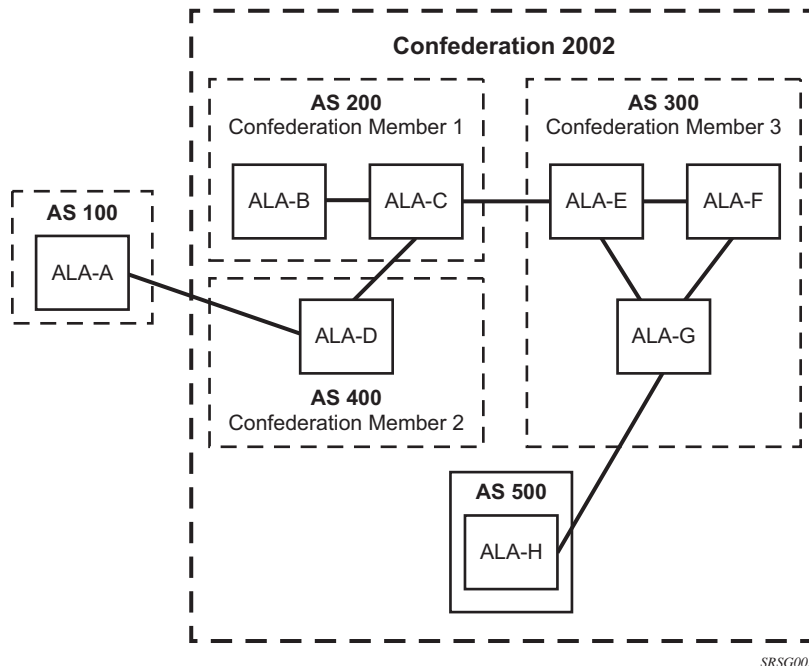


Figure 2: Confederation Configuration

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.

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.

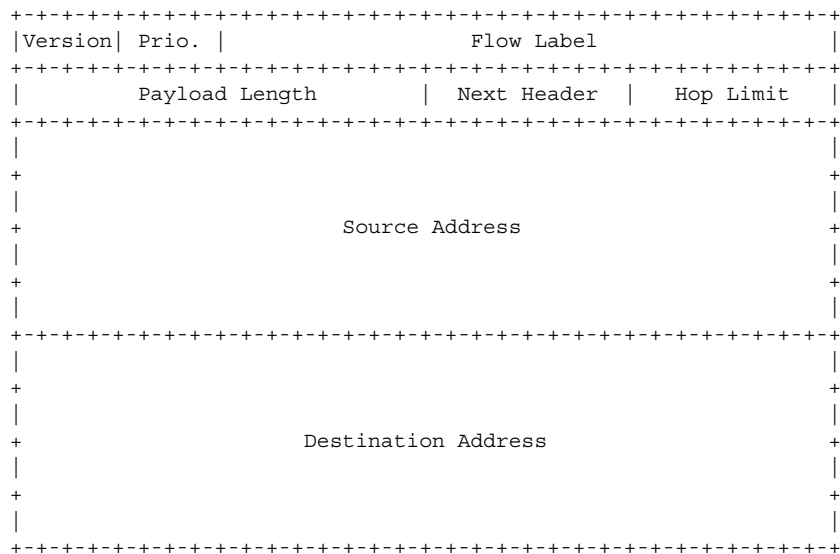


Figure 3: IPv6 Header Format

Table 4: 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. Decrement 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.

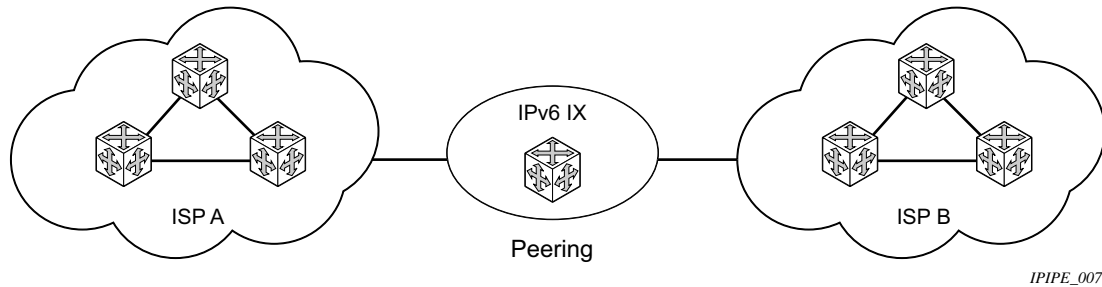


Figure 4: IPv6 Internet Exchange

- IPv6 transit services — [Figure 5](#) shows IPv6 transit provided by an ISP.

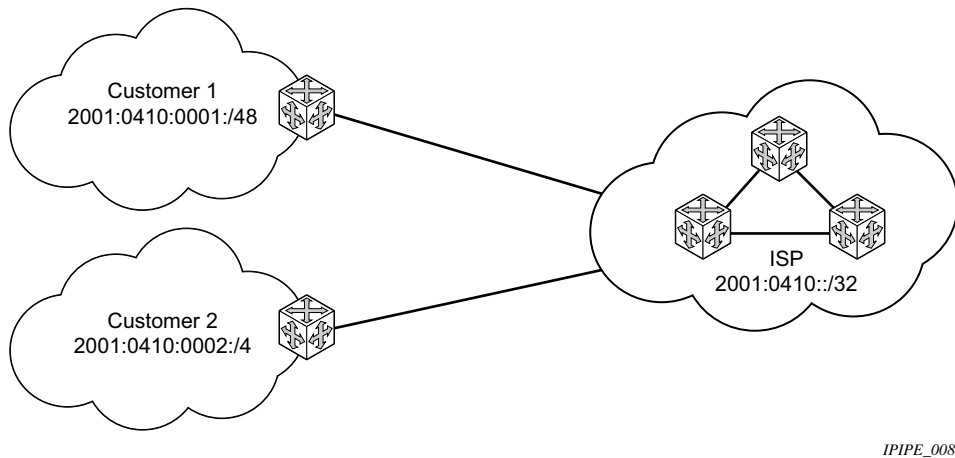


Figure 5: IPv6 Transit Services

- IPv6 services to enterprise customers and home users — [Figure 6](#) shows IPv6 connectivity to enterprise and home broadband users.

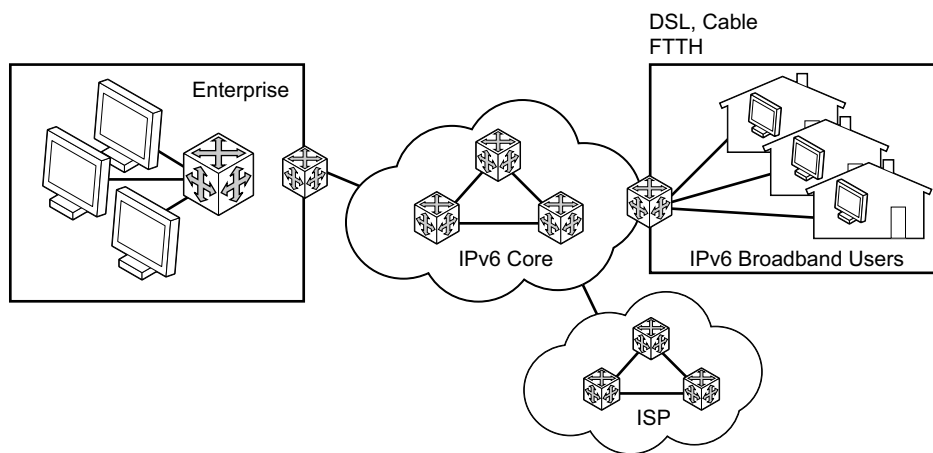


Figure 6: IPv6 Services to Enterprise Customers and Home Users

- 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.

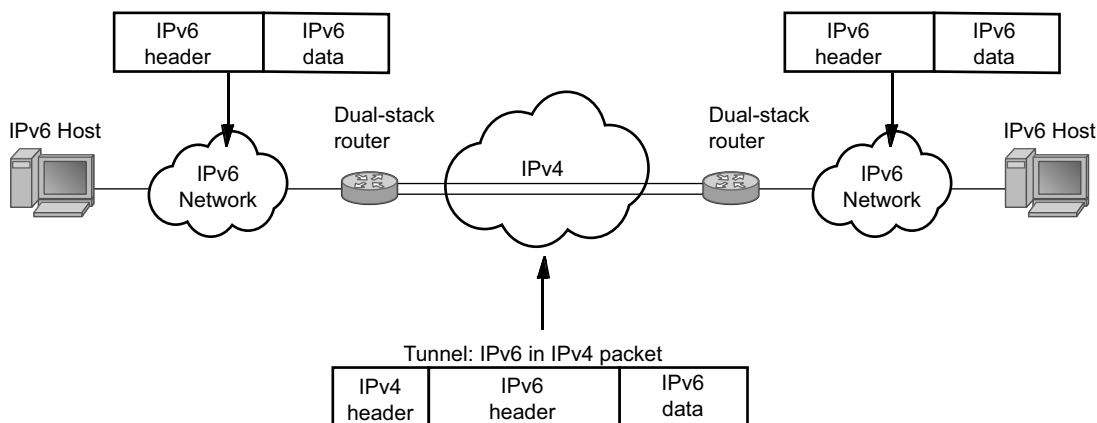


Figure 7: IPv6 over IPv4 Tunnels

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.

Secure Neighbor Discovery (SeND)

Secure Neighbor Discovery (SeND) in conjunction with Cryptographically Generated Addresses (CGAs) introduce a concept that allows operators to secure IPv6 neighbor discovery between nodes on a common Layer 2 network segment.

When SeND is enabled on an interface, CGAs must be enabled and static GUA/LLA IPv6 addressing is not supported. In this case, the router will generate a CGA from the configured prefix (GUA, LLA) and use that address for all communication. The router will validate NS/ND messages from other nodes on the network segment, and only install them in the neighbor cache if they pass validation.

A number of potential use-cases for SeND exist in order to secure the network from deliberate or accidental tampering during neighbor discovery; principally to prevent hijacking of in-use IPv6 addressing or man-in-the-middle attacks; but also to validate whether a node is permitted to participate in neighbor discovery at all; or to validate which routers are permitted to act as default gateways.

SeND impacts the following areas of neighbor discovery:

- Neighbor solicitation (solicited-node multicast address; target address)
- Neighbor advertisement (solicited; unsolicited)
- Router solicitation
- Router advertisement
- Redirect messages

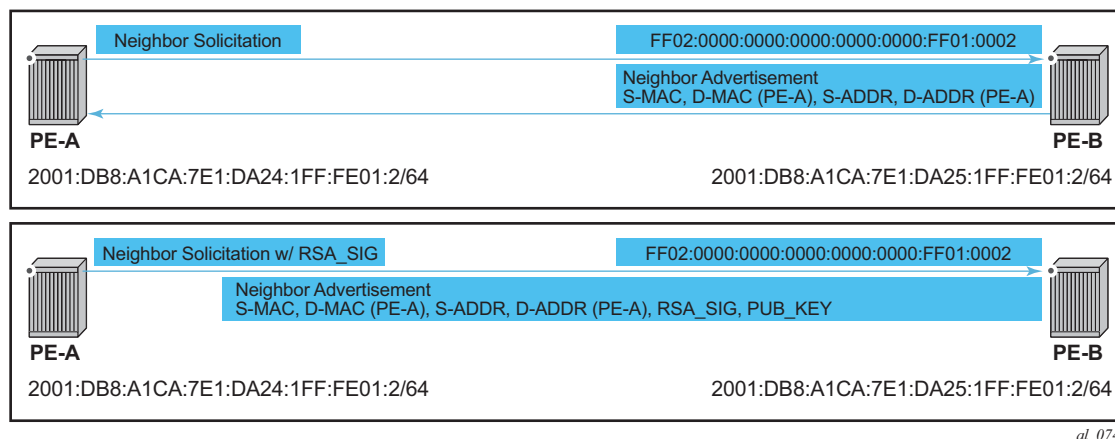


Figure 8: Neighbor discovery with and without SeND

When SeND is enabled on a node, basic neighbor discovery messaging is changed as illustrated in Figure 8. In the example, PE-A wants to find the MAC address of PE-B.

1. PE-A sends an NS message to the solicited node multicast address for PE-B's address with the CGA option, RSA signature option, timestamp option, and nonce option.
2. PE-B processes the NS message, and as it is configured for SeND operation, processes the NS. PE-B will validate the source address of the packet to ensure it is a valid CGA; then validate the cryptographic signature embedded in the NS message.
3. PE-B generates a NA message which is sent back to PE-A with the solicited bit, router bit set. The source address is that of PE-B, while the destination address is that of PE-A from the NS message. The timestamp is generated from PE-B, while the nonce is copied from PE-A's NS message
4. PE-A receives the NA and completes similar checks as PE-B did.

If all steps process correctly, then both nodes will install each other's addresses into their neighbor cache database.

SeND Persistent CGAs

Persistent CGAs is an enhancement of the SeND feature, introduced in release 12.

Previously, all generated CGAs on SeND-enabled interfaces remained unchanged after a CPM switchover, but after a reboot from a saved configuration file, all CGAs were regenerated.

To keep the same CGAs after a reboot from a saved configuration file:

1. Save the RSA key pair used for SeND.

2. Save the modifiers used during the CGA generation.

To make the CGAs persistent:

1. Import an online or offline generated RSA key pair for SeND.
2. Make sure that the CompactFlash (CF) file(s) containing an RSA key pair that is used for SeND, is (are) synchronized to the standby CPM by making use of the HA infrastructure used for certificates.
3. Make sure the configuration file is saved when one or more CGAs are generated.

Persistent RSA Key Pair

The RSA key pair is stored in a file on the CF.

Generate an RSA Key Pair

To generate an RSA key pair, use the **admin certificate gen-keypair** command:

admin certificate gen-keypair <local-url> [type rsa] size 1024

For example

```
admin certificate gen-keypair cf1:\myDir\myRsaKeyPair type rsa size 1024
```

This generates a der formatted file.

Import an online/offline generated RSA key pair

To import a generated RSA key pair, use the **admin certificate secure-nd-import** command:

admin certificate secure-nd-import <local-url> format der|pem|pkcs12 [password <[32 chars max]>] [key-rollover]

For example

```
admin certificate secure-nd-import cf1:\myDir\myRsaKeyPair format der
```

- Since SeND only uses RSA key pairs, the command is refused if the imported key type is not RSA.
- Since SeND only supports key size 1024, the command is refused if the imported key size is not 1024.
- The password has to be specified when an offline generated file in pkcs12 format has to be imported.
- **key-rollover** keyword: see the *RSA key pair rollover mechanism* section that follows.

- Creates the file cfx:\system-pki\secureNdKey (fixed directory and file name) and saves the imported key in that file in encrypted der format (same as the **admin certificate import** command).
- The RSA key pair is uploaded in the memory of SeND.

RSA key pair rollover mechanism

To trigger a key rollover, use the **admin certificate secure-nd-import** command described in the previous section “Import an online/offline generated RSA key pair”.

For example

```
admin certificate secure-nd-import cfl:\myDir\myOtherRsaKeyPair format
der key-rollover
```

- If CGAs exist that are generated based on an auto-generated or previously imported RSA key pair and the **key-rollover** keyword is not specified, the **secure-nd-import** command is refused.
- If a **secure-nd-import** with **key-rollover** is requested while a previous key rollover is still being handled, the new command is refused.
- If the **secure-nd-import** command is accepted, the imported RSA key pair is written to the file cfx:\system-pki\secureNdKey and loaded to SeND. Existing CGAs if any will be regenerated.
- While handling a key rollover, SeND keeps track of which interface uses which RSA key pair. Hence temporarily SeND can have two RSA key pairs in use. At all times only the latest RSA key pair is stored in the file cfx:\system-pki\secureNdKey. When the rollover is finished, the RSA key pair that is no longer referred to, is deleted from SeND’s memory.

Auto-generation of RSA key pair

The first time an interface becomes SeND enabled, SeND needs an RSA key pair to generate or check a modifier and to generate a CGA.

If the operator did not import an RSA key pair for SeND, an auto-generated RSA key pair will be used as a fallback.

The auto-generated RSA key pair is synced to the standby CPM as it is done in the previous release, but it will not be written to the CF. Therefore, all CGAs generated via an auto-generated RSA key pair, are not persistent. A warning will be given whenever a non-persistent CGA is generated.

The **admin certificate secure-nd-import** command without the **key-rollover** keyword will be refused if CGAs exist that made use of the auto-generated RSA key pair. Specifying the **key-rollover** keyword will result in regeneration of the CGAs.

See the section “Making non-persistent CGAs persistent” for more information on the procedure to make non-persistent CGAs persistent,

HA

For the synchronization of the RSA key pair file in `cfx:\system-pki\` used by SeND, the following commands for automatic and manual certificate synchronization are used:

- manual: **admin redundancy synchronize cert**
- automatic: **configure redundancy cert-sync**

SeND also synchronizes the RSA key pair to the standby CPM as it is done in the previous release.

Persistent CGA Modifier

The modifier used during the CGA generation will be saved in the configuration file. The CGA itself is not stored.

Based on the stored modifier and RSA key pair, the same CGA can be regenerated.

Note that the modifier is needed to be sent out in ND messages.

By storing the modifier in the configuration file, the operator can also configure an offline generated modifier (possibly with a security parameter > 1).

Example1: Configure a SeND interface without modifiers (as it is done in release 12.0).

```
configure router interface itf1
  address 10.10.10.1
  port 1/1/1
  ipv6
    secure-nd
    no shutdown
```

=> A modifier is generated based on the actual RSA key pair (that is, imported or auto-generated). The modifier is used to generate a link-local CGA.

=> The modifier is saved in the interface configuration file.

```
exit
address 2000:1::/64
```

=> A modifier is generated based on the actual RSA key pair. The modifier is used to generate the global CGA.

=> The modifier is stored in the interface configuration file.

Example 2: Configure a SeND interface with modifiers.

```
configure router interface itf2
  address 10.10.10.2
  port 1/1/2
  ipv6
    secure-nd
      link-local-modifier 0xABCD
```

=> The offline generated modifier is used to generate the link-local CGA.

```
    no shutdown
  exit
  address 3000:1::/64
```

=> A modifier is generated based on the actual RSA key pair. The modifier is used to generate the global CGA.

=> The modifier is stored in the interface configuration file.

```
    address 3000:2::/64 modifier 0xABCD
```

=> The same offline generated modifier as the link-local address above is used for the generation of a global address.

```
    address 3000:3::/64 modifier 0xABCD
```

=> Another offline generated modifier (*) is used for the generation of a global address.

=> For an offline generated modifier, a check is done to see if it is generated with the actual RSA key pair and the security parameter applicable for the interface. If this check fails, the command is refused, unless the command is triggered in the context of an exec of a config file: in this case, the modifier will be replaced by a new one that is generated based on the actual RSA key pair.

Making non-persistent CGAs persistent

CGAs can be non-persistent because:

- The operator forgot to configure an RSA key pair for SeND and hence the CGAs were generated based on an auto-generated RSA key pair.
- The operator forgot to synchronize an RSA key pair file to the stand-by CPM and a switch-over happens.
- The CGAs were generated by a software version not having persistent CGAs (such as, ISSU).
- The system was booted from a configuration file generated by a software version not having persistent CGAs.

Key rollover

You can import a new RSA key pair for SeND with the **key-rollover** keyword. This will result in the regeneration of all CGAs on all interfaces.

Exporting the SeND RSA key pair

Another method that does not result in the regeneration of the CGAs , is to export the RSA key pair that is currently in use by SeND to the system-pki directory via an admin command:

admin certificate secure-nd-export

This command will write the RSA key pair to the file cfx:\system-pki\secureNdKey in encrypted der format.

Booting from a saved configuration file

Configuration saved by a software version with persistent CGAs

The file cfx:\system-pki\secureNdKey should exist. This file will be automatically uploaded by SeND during initialization.

The configuration file should contain a modifier for each address on a SeND enabled interface.

Modifiers in the configuration file are checked against the current RSA key pair. If the check fails, a new modifier and CGA is generated and a warning is given to the operator that a new CGA is generated.

If a modifier is missing in the configuration file for an IPv6 /64 prefix on a SeND enabled interface, a new modifier and CGA will be generated based on the active RSA key pair.

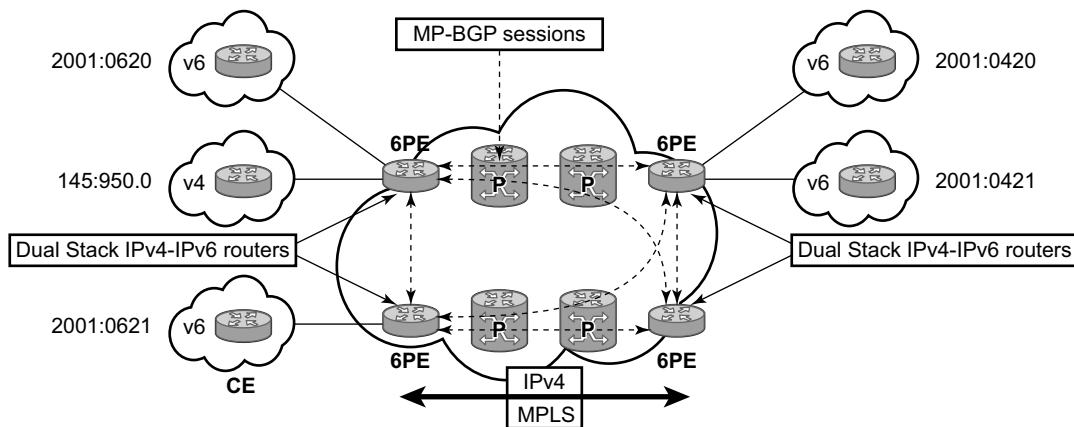
Configuration saved by a software version having non-persistent CGAs

The file cfx:\system-pki\secureNdKey does not exist nor does the configuration file contain a modifier for any of the IPv6 /64 prefixes on secure-nd enabled interfaces.

New CGAs have to be generated (from the CLI context). Follow one of the procedures described in section “Making non-persistent CGAs persistent” to make the non-persistent CGA's persistent.

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.



Fig_30

Figure 9: 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.

Static Route Resolution Using Tunnels

The user can forward packets of a static route to an indirect next-hop over a tunnel programmed in TTM by configuring the following static route tunnel binding command:

```
config>router>static-route-entry {ip-prefix/prefix-length} [mcast] indirect {ip-address}
tunnel-next-hop
    resolution {any|disabled|filter}
    resolution-filter
        [no] ldp
        [no] rsvp-te
            [no] [lsp <name1>]
            [no] [lsp <name2>]
            .
            .
            [no] [lsp <namen>]
        exit
    [no] disallow-igp
    exit
exit
```

The **static-route-entry** command is only supported with the **indirect** next-hop option and the **tunnel-next-hop** option configured together. The existing **static-route** command is still supported with all other options, including the **indirect** option which can be used to resolve the indirect next-hops in RTM.

The new command is an add-on to configure the resolution to tunnel next-hops in TTM. As such, the user must first configure the prefix with the existing command and the **indirect** option and then enter the new **static-route-entry** command with the **indirect** option. For example:

```
/configure router static-route 5.5.5.5/32 indirect 1.0.0.2
/configure router static-route-entry 5.5.5.5/32 indirect 1.0.0.2
    tunnel-next-hop
        rsvp-te
            lsp to-1.0.0.2-1
            lsp to-1.0.0.2-2
        exit
    no shutdown
exit
```

If **tunnel-next-hop** context is configured and **resolution** is set to **disabled**, the binding to tunnel is removed and resolution resumes in RTM to IP next-hops.

If **resolution** is set to **any**, any supported tunnel type in static route context will be selected following TTM preference.

The following tunnel types are supported in a static route context: RSVP and LDP.

- The **ldp** value instructs the code to search for an LDP LSP with a FEC prefix corresponding to the address of the indirect next-hop.

- The **rsvp** value instructs the code to search for the best metric RSVP LSP to the address of the indirect next-hop. This address can correspond to the system interface or to another loopback used on the remote node. The LSP metric is provided by MPLS in the tunnel table. In the case of multiple RSVP LSPs with the same lowest metric, the code selects the LSP with the lowest tunnel-id.

If one or more explicit tunnel types are specified using the **resolution-filter** option, then only these tunnel types will be selected again following the TTM preference. In the case of RSVP-TE tunnel type, the user can further restrict the selection by providing a list of LSP names.

The user must set **resolution** to **filter** to activate the list of tunnel-types configured under resolution-filter.

If **disallow-igp** is enabled, the static-route will not be activated using IP next-hops in RTM if no tunnel next-hops are found in TTM.

Static Route ECMP Support

The following is the ECMP behavior of a static route:

- ECMP is supported when resolving in RTM multiple static routes of the same prefix with multiple user-entered indirect IP next-hops. The system picks as many direct next-hops as available in RTM beginning from the first indirect next-hop and up to the value of the **ecmp** option in the system.
- ECMP is also supported when resolving in TTM a static route to a single indirect next-hop using a LDP tunnel when LDP has multiple direct next-hops.
- ECMP is supported when resolving in TTM a static route to a single indirect next-hop using a RSVP-TE tunnel type when there is more than one RSVP LSP with the same lowest metric to the indirect next-hop.
- ECMP is supported when resolving in TTM a static route to a single indirect next-hop using a list of user configured RSVP-TE LSP names when these LSPs have the same metric to the indirect next-hop.
- ECMP is supported when resolving in TTM multiple static routes of the same prefix with multiple user-entered indirect next-hops each binding to a tunnel type. The system picks as many tunnel next-hops as available in TTM beginning from the first indirect next-hop and up to the value of the **ecmp** option in the system.
- ECMP is supported when resolving concurrently in RTM and TTM multiple static routes of the same prefix with multiple user entered indirect tunnel next-hops. There is no support for mixing IP and tunnel next-hops for the same prefix using different indirect next-hops. Tunnel next-hops preferred over IP next-hops.

Weighted Load-Balancing over MPLS LSP

The weighted load-balanced, or weighted-ecmp, feature sprays packets of IGP, BGP, and static route prefixes resolved to a set of ECMP tunnel next-hops proportionally to the weights configured for each MPLS LSP in the ECMP set.

Weighted load-balancing is supported in the following forwarding contexts:

- IGP prefix resolved to IGP shortcuts in RTM (**rsvp-shortcut** or **advertise-tunnel-link** enabled in the IGP instance).
- BGP prefix with the BGP next-hop resolved to IGP shortcuts in RTM (**rsvp-shortcut** enabled in the IGP instance).
- Static route prefix resolved to an indirect next-hop which itself is resolved to a set of equal-metric MPLS LSPs in TTM. The user can allow automatic selection or specify the names of the equal-metric MPLS LSPs in TTM to be used in the ECMP set.
- Static route prefix resolved to an indirect next-hop which itself is resolved to IGP shortcuts in RTM.
- BGP prefix with a BGP next-hop resolved to a static route which itself resolves to set of tunnel next-hops towards an indirect next-hop in RTM or TTM.
- BGP prefix resolving to another BGP prefix which next-hop is resolved to set of ECMP tunnel next-hops with a static route in RTM or TTM or to IGP shortcuts in RTM.

Note that this feature does not modify the route calculation, thus the same set of ECMP next-hops is computed for a prefix. It also does not change the hash routine, but only the spraying of the flows over the tunnel next-hops is modified to reflect the normalized weight of each tunnel next-hop.

As part of this feature, static route implementation has been enhanced to support ECMP over a set of equal-cost MPLS LSPs. The user can allow automatic selection or specify the names of the equal-metric MPLS LSPs in TTM to be used in the ECMP set. For more information see [Static Route Resolution Using Tunnels on page 58](#).

Weighted Load Balancing IGP, BGP, and Static Route Prefix Packets over IGP Shortcut

Feature Configuration

The user must have IGP shortcut or forwarding adjacency feature enabled in one or more IGP instances:

```
configure>router>ospf(isis)>rsvp-shortcut
```

```
configure>router>ospf(isis)>advertise-tunnel-link
```

The user can also disable specific MPLS LSPs from being used in IGP shortcut or forwarding adjacency by configuring the following:

```
configure>router>mpls>lsp>no igp-shortcut
```

The user enables the weighted load balancing feature using the following new router level command:

```
configure>router>weighted-ecmp
```

When this command is enabled, packets of IGP, BGP, and static route prefixes resolved to a set of ECMP tunnel next-hops are sprayed proportionally to the weights configured for each MPLS LSP in the ECMP set.

The user can configure a weight for each LSP using the following command:

```
configure>router>mpls>lsp>load-balancing-weight <32-bit-integer>
```

For an auto-LSP signaled via an LSP template, the weight is configured using the following command:

```
configure>router>mpls>lsp-template>load-balancing-weight <32-bit-integer>
```

There is no default weight value for an LSP. If one or more LSP in the ECMP set of a prefix does not have a weight configured, the regular ECMP spraying for the prefix will be performed. The user entered weight is normalized to the closest integer value which represents the number of entries in the ingress prefix hash table assigned to the LSP for the purpose of spraying packets of all prefixes resolved to this LSP. The higher the normalized weight, the more entries will be assigned to the LSP, the more packets will be sent to this LSP.

Feature Behavior

This section describes the details of the behavior of the weighted load-balancing feature for IGP, BGP, and static route prefixes resolved in RTM to IGP shortcuts.

When an IGP, BGP, or a static route prefix is resolved in RTM to a set of ECMP tunnel next-hops of type RSVP-TE and the router level **weighted-ecmp** option is enabled, the ingress hash table for the next-hop selection is populated with a number of tunnel next-hop entries for each LSP equal to the normalized LSP weight value. All prefixes resolving to the same set of ECMP tunnel next-hops use the same table.

This feature follows the following procedures:

1. MPLS populates the user configured LSP weight in TTM. When the global command **weighted-ecmp** is enabled, and if one or more LSPs in the ECMP set of a prefix does not have a weight configured, the regular ECMP spraying for the prefix will be performed.
 2. IGP computes the normalized weight for each prefix tunnel next-hop. The minimum value of the normalized weight is 1 and the maximum is 64. IGP updates the route in RTM with the set of tunnel next-hops and normalized weights. RTM downloads the information to IOM for inclusion in the FIB.
 3. The normalized weights of route tunnel next-hops are updated in the following cases:
 - When the main SPF is run following a trigger, e.g., network failure, and updates a given route with a modified set of tunnel next-hops. This will trigger a route re-download to the IOM and all users of RTM are notified.
 - The user adds or changes the weight of one or more LSPs. In this case, RTM will perform a route download to IOM but other users of RTM should not be notified since the route resolution did not change.
 4. The weighted load balancing feature is only applied to a prefix when all the tunnel next-hops in the ECMP set have the same endpoint. If an IGP prefix resolves in RTM to a set of ECMP tunnel next-hops which do not terminate on the same endpoint, the regular ECMP spraying is performed. If BGP performs BGP ECMP to a set of BGP ECMP next-hops for a prefix [weighted-bgp-ecmp-prd], regular ECMP spraying is performed towards a given BGP next-hop if the subset of its tunnel next-hops does not terminate on the same endpoint.
 5. Regular ECMP spraying is also applied if a prefix is resolved in RTM to an ECMP set which consists of a mix of IP and tunnel next-hops.
 6. This feature is not supported in the following contexts:
 - Packets of BGP prefix with the BGP next-hop resolved in TTM to RSVP LSP (BGP shortcut).
 - CPM generated packets, including OAM packets, which are looked-up in RTM and which are forwarded over tunnel next-hops. These will continue to be forwarded using either regular ECMP or by selecting one next-hop from the set as in existing implementation.
-

ECMP Considerations

The weight assigned to an LSP impacts only the forwarding decision, not the routing decision. In other words, it does not change the selection of the set of ECMP tunnel next-hops of a prefix when more next-hops exist than the value of the router **ecmp** option. This selection continues to follow the algorithm used in the IGP shortcut feature.

Once the set of tunnel next-hops is selected, the LSP weight is used to modulate the amount of packets forwarded over each next-hop.

Weighted Load Balancing Static Route Packets over MPLS LSP

Feature Configuration

The user enables the resolution of a static route to a one or more MPLS P2P LSPs in TTM using the following new static route configuration command:

```
config>router>static-route-entry {ip-prefix/prefix-length} [mcast] indirect {ip-address} tunnel-next-hop
  — resolution {any|disabled|filter}
  — resolution-filter
    — [no] ldp
    — [no] rsvp-te
      — [no] [lsp <name1>]
      — [no] [lsp <name2>]
      — .
      — .
      — [no] [lsp <namen>]
    — exit
  — [no] disallow-igp
  — exit
exit
```

The user can either provide a list of LSP names or let the automatic selection of the LSP tunnel next-hops from the TTM by configuring **resolution** to the **any** value. These are mutually exclusive. A maximum of 128 LSP names can be entered within a static route prefix configuration.

Note that a P2P auto-lsp instantiated via an LSP template can be selected in TTM when **resolution** is set to **any**. It is however not recommended to configure an auto-lsp name explicitly under the **rsvp-te** node as the auto-generated name can change if the node reboots which will black-hole traffic of the static route.

The above command is covered in much more details in [Static Route Resolution Using Tunnels on page 58](#) which also provides the selection rules among multiple LSP types: RSVP and LDP. A given static route of a prefix can only be resolved to a set of tunnel next-hops of the same type though for each indirect next-hop.

The existing **static-route** command is still supported with all other options, including the **indirect** one which can be used to resolve the indirect next-hops in RTM. The new command is an add-on to configure the resolution to tunnel next-hops in TTM. As such, the user must first configure the prefix with the existing command and the **indirect** option and then enter the new command with the indirect option and with the new **static-route-entry** command. Here is an example:

```
/configure router static-route 5.5.5.5/32 indirect 1.0.0.2
/configure router static-route-entry 5.5.5.5/32 indirect 1.0.0.2
  tunnel-next-hop
    rsvp-te
      lsp to-1.0.0.2-1
```



```

        lsp to-1.0.0.2-2
    exit
    no shutdown
exit

```

In order to perform ECMP over a set of configured MPLS LSPs the user must enter two or more LSP names to be used as tunnel next-hops. If automatic selection is performed, ECMP is performed if two or more MPLS LSPs are found in TTM to the indirect next-hop of the static route. All LSPs however must have the same LSP metric otherwise only the tunnel next-hops with the same lowest metric will be activated for the static route.

The user can force the metric of an LSP to a constant value using the following command:

```
configure>router>mpls>lsp>metric
```

If the user enters for the same static route more LSP names with the same LSP metric than the value of the router level **ecmp** option, only the first configured LSPs which number equals the **ecmp** value will be selected. The remaining tunnel next-hops for the route will not be activated. When automatic MPLS LSP selection is performed in TTM, the lower tunnel-id is used as a tie-breaker among the same lowest metric LSPs.

In order to perform weighted load-balancing over the set of MPLS LSPs, either when the LSP names are provided or when auto-selection in TTM is performed, the user must also enable the weighted ECMP globally like for a static, IGP and BGP prefixes resolving to IGP shortcuts:

```
configure>router>weighted-ecmp
```

Feature Behavior

The behavior of this feature in terms of RTM and IOM is exactly the same as in the case of BGP, IGP, and static route prefixes resolving to IGP shortcuts. See [Feature Behavior on page 61](#) for the details. In this case, the static route module computes the normalized weight for each prefix tunnel next-hop of the static route indirect next-hop. The minimum value of the normalized weight is 1 and the maximum is 64. The static route module updates the route in RTM with the set of tunnel next-hops and normalized weights. RTM downloads the information to IOM for inclusion in the FIB.

If one or more LSP in the ECMP set of a prefix static route does not have a weight configured, the regular ECMP spraying for the prefix will be performed.

ECMP is also supported when resolving in TTM the same static route with multiple user-entered indirect next-hops each binding to the same or different tunnel types. The system picks as many tunnel next-hops as available in RTM beginning from the first indirect next-hop and up to the value of the **ecmp** option in the system. In this case, the weighted load-balancing will be applied directly using the weights of the selected set of tunnel next-hops. If one or more LSP in the ECMP set of a prefix static route does not have a weight configured, or if one or more of the indirect next-hops binds to an LDP LSP, the regular ECMP spraying for the prefix will be performed.

If the same prefix is resolved via both a static route and an IGP shortcut route, then the RTM default protocol preference will install the static route only. As a result, the set of ECMP tunnel next-hops and the weighted load balancing behavior will be determined by the static route configuration and not of the IGP shortcut configuration.

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 demand 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.

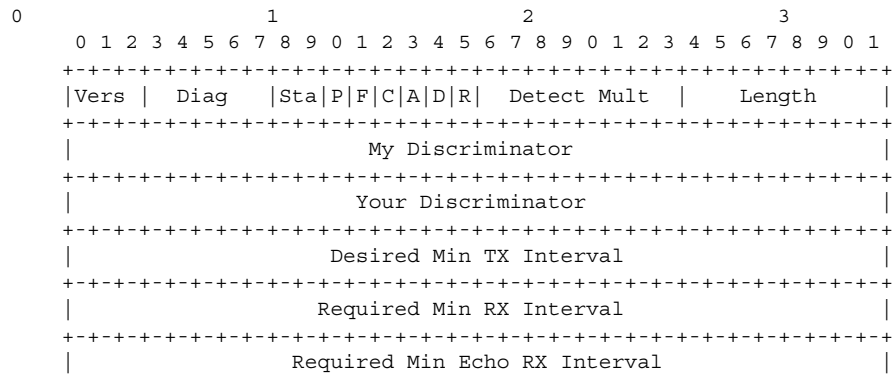


Figure 10: Mandatory Frame Format

Table 5: 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 5: 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.

BFD is supported on the following interfaces:

- Ethernet (Null, Dot1Q & QinQ)
- Spoke SDPs
- LAG 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

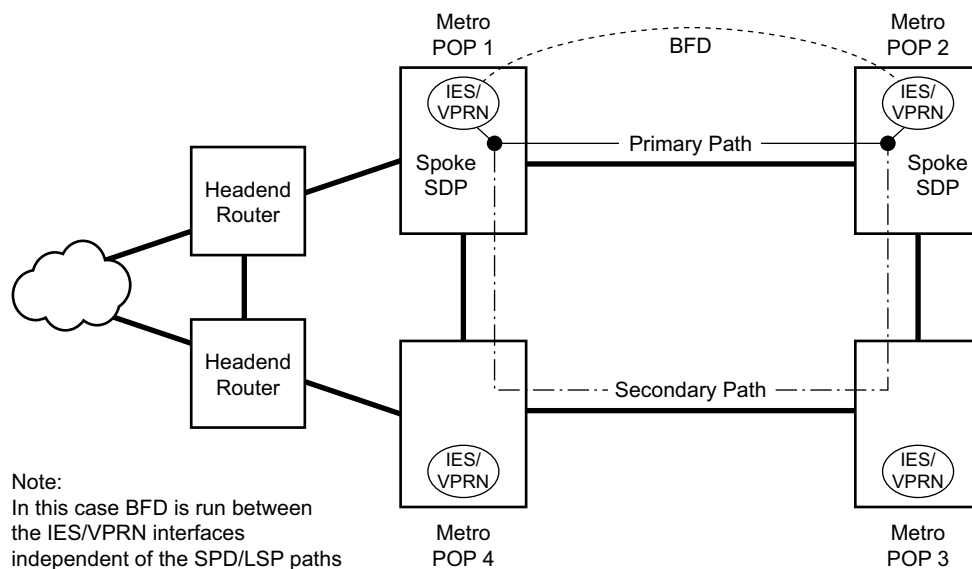
The following applications of centralized BFD require BFD to run on the CPM.

- 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 XCM itself.

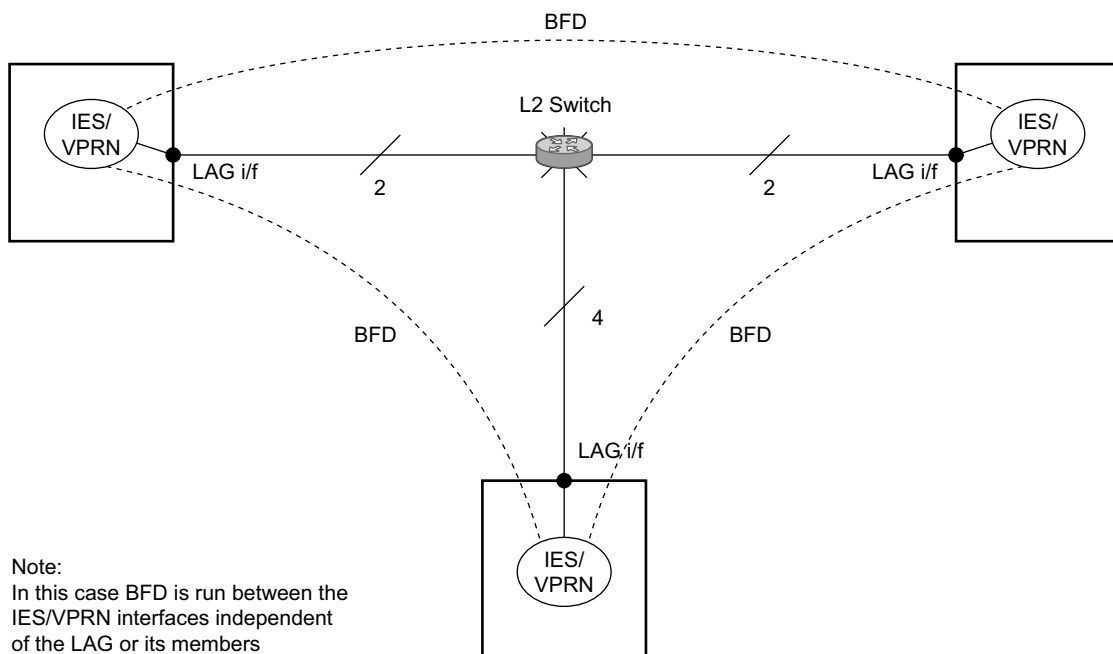


Fig_31

Figure 11: BFD for IES/VP RN 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.



Fig_32

Figure 12: 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.

LDP Shortcut for IGP Route Resolution

This feature 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.

```
config>router>ldp-shortcut [ipv4][ipv6]
```

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 77](#).

This feature is not restricted to /32 IPv4 prefixes or /128 IPv6 FEC prefixes. However only /32 IPv4 and /128 IPv6 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 on linecards with the LDP tunnel information.

When an IPv4 packet is received on an ingress network interface, or a regular IES interface, the lookup of the packet by the ingress linecard 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 linecards 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 linecard 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 BGP Route Resolution to an LDP FEC

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 following option in BGP:

```
config>router>bgp>next-hop-resolution>shortcut-tunnel
      family ipv4
      resolution-filter ldp
```

Interaction with Static Route Resolution to an LDP FEC

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. The most specific route for a prefix will be selected and if both a static and IGP routes exist, the RTM route type preference will be used to select one.

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 statically configured or dynamically learned over IES interfaces.

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

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.

Configuring an IP Router with CLI

This section provides information to configure an IP router.

Topics in this section include:

- [Router Configuration Overview on page 82](#)
- [Basic Configuration on page 83](#)
- [Common Configuration Tasks on page 84](#)
 - [Configuring a System Name on page 84](#)
 - [Configuring Interfaces on page 85](#)
 - [Configuring a System Interface on page 85](#)
 - [Configuring a Network Interface on page 85](#)
 - [Configuring Proxy ARP on page 90](#)
 - [Creating an IP Address Range on page 92](#)
 - [Configuring an Autonomous System on page 95](#)
 - [Service Management Tasks on page 96](#)
- [Service Management Tasks on page 96](#)
 - [Changing the System Name on page 96](#)
 - [Modifying Interface Parameters on page 97](#)
 - [Deleting a Logical IP Interface on page 98](#)

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 either a physical port or Ethernet LAG interface.

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
    ...
        exit
        isis
        exit
    ...
#-----
A:ALA-A> config#
```

Common Configuration Tasks

The following sections describe basic system tasks.

- [Configuring a System Name on page 84](#)
 - [Configuring Interfaces on page 85](#)
 - [Configuring a System Interface on page 85](#)
 - [Configuring a Network Interface on page 85](#)
 - [Configuring Proxy ARP on page 90](#)
 - [Creating an IP Address Range on page 92](#)
 - [Configuring an Autonomous System on page 95](#)
-

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}]
        egress
          filter ip ip-filter-id
        ingress
          filter ip ip-filter-id
        port port-name
```

Configuring Interfaces

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

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
    unreachablees 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*]
 unreachablees [*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#
```

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.

Router advertisement can be configured under the `config>router>router-advertisement` context or under the `config>service>vprn>router-advertisement` context. Use the following example CLI syntax to enable router advertisement and configure router advertisement parameters:

CLI Syntax:

```
config>router# router-advertisement
  dns-options
    dns-servers ipv6-address
    rdns-lifetime seconds
  interface ip-int-name
    current-hop-limit number
    dns-options
      dns-servers ipv6-address
      rdns-lifetime {seconds / infinite}
    include-dns
    managed-configuration
    max-advertisement-interval seconds
    min-advertisement-interval seconds
    mtu mtu-bytes
    other-stateful-configuration
      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 2001:db8:3::/64
    exit
    use-virtual-mac
    no shutdown
  exit
-----
*A:sim131>config>router>router-advert# interface n1
*A:sim131>config>router>router-advert>if# prefix 2001:db8:3::/64
```



```
-----  
        autonomous  
        on-link  
        preferred-lifetime 604800  
        valid-lifetime 2592000  
-----  
*A:tahi>config>router>router-advert>if>prefix#
```

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 "ProxyARPolicy"
    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 "ProxyARPolicy"
    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]`

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} [broadcast 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 41](#).

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#
```

Service Management Tasks

This section discusses the following service management tasks:

- [Changing the System Name on page 96](#)
 - [Modifying Interface Parameters on page 97](#)
 - [Deleting a Logical IP Interface on page 98](#)
-

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
      . . .
-----
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 on page 100](#)
- [Router BFD commands on page 102](#)
- [Router Interface Commands on page 103](#)
- [Router Interface IPv6 Commands on page 106](#)
- [Router Advertisement Commands on page 107](#)
- [Show Commands on page 108](#)
- [Clear Commands on page 110](#)
- [Debug Commands on page 111](#)

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
— [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-range static-range
— no static-label-range
— sr-labels start-value end end-value
— no sr-labels
— multicast-info policy-name
— no multicast-info
— multicast-info
— description description-string
— no description
— origin-validation
— [no] rpki-session ip-address
— [no] connect-retry seconds
— [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-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**] [**cpe-check** *cpe-ip-address* [**interval** *seconds*] [**drop-count** *count*] [**padding-size** *padding-size*] [**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**]
- **static-route-entry** {*ip-prefix/prefix-length*} [**mcast**] **indirect** {*ip-address*}
 - **[no] tunnel-next-hop**
 - **[no] disallow-igp**
 - **resolution** {*any* | **disabled** | **filter**}
 - **resolution-filter** [**ldp**] [**rsvp-te** [**lsp** *lsp name*]...[**lsp** *lsp name*]]
- **[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*]
- **weighted-ecmp**

config

- **router** management
 - **origin-validation**
 - **[no] rpki-session** *ip-address*
 - **[no] connect-retry** *seconds*
 - **[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 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 [penalty-weight penalty-weight]
      — no srlg-group group-name
    — [no] interface ip-int-name gmpls-loopback
    — [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-limit limit [log-only] [threshold percent]
      — no arp-limit
      — arp-timeout seconds
      — no arp-timeout
      — bfd transmit-interval [receive receive-interval] [multiplier multiplier] [echo-
        receive echo-interval]
      — no bfd
      — cflowd-parameters
      — no cflowd-parameters
        — sampling {unicast | multicast} type {acl | interface} [direction
          {ingress-only | egress-only|both}]
        — no sampling {unicast | multicast}
      — cpu-protection policy-id
      — no cpu-protection
      — delayed-enable seconds
      — no delayed-enable
      — description description-string
      — no description
      — dhcp
        — description description-string
        — no description
        — gi-address ip-address [src-ip-addr]
        — no gi-address
        — [no] option
          — action {replace | drop | keep}
          — no action
          — circuit-id [ascii-tuple | ifindex | sap-id | vlan-ascii-tuple]
          — no circuit-id
          — remote-id [mac | string string]
          — [no] vendor-specific-option
            — [no] client-mac-address
            — [no] pool-name
            — [no] port-id
            — [no] service-id
            — string text
            — no string
            — [no] system-id
          — python-policy <[256 chars max]>
          — no python-policy
          — [no] relay-plain-bootp

```

- **server** *server1* [*server2...*(up to 8 max)]
- **no server**
- **[no]**
- **[no] trusted**
- **dist-cpu-protection** *policy-name*
- **no dist-cpu-protection**
- **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-mtu** *octets*
- **no ip-mtu**
- **lag-link-map-profile** *lnk-map-profile-id*
- **no lag-link-map-profile**
- **ldp-sync-timer** *seconds*
- **no ldp-sync-timer**
- **load-balancing**
 - **egr-ip-load-balancing** {**source** | **destination** | **inner-ip**}
 - **no egr-ip-load-balancing**
 - **lsr-load-balancing** *hashing-algorithm*
 - **no lsr-load-balancing**
 - **[no] spi-load-balancing**
 - **[no] teid-load-balancing**
- **[no] local-proxy-arp**
- **[no] loopback**
- **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
— 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
— vas-if-type {to-from-access | to-from-network | to-from-both}
— no vas-if-type
— [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 343](#).

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
          — unreachablees [number seconds]
          — no unreachablees
        — link-local-address ipv6-address [preferred]
        — [no] local-proxy-nd
        — neighbor ipv6-address [mac-address]
        — no neighbor ipv6-address
        — neighbor-limit limit [log-only] [threshold percent]
        — no neighbor-limit
        — proxy-nd-policy policy-name [policy-name...(up to 5 max)]
        — no proxy-nd-policy
        —
        — [no] secure-nd
          — [no] allow-unsecured-msgs
          — link-local-modifier modifier
          — no link-local-modifier
          — public-key-min-bits bits
          — no public-key-min-bits
          — security-parameter sec
          — no security-parameter
          — [no] shutdown
        — stale-time seconds
        — no stale-time
        — tcp-mss mss-value
        — no tcp-mss
        — [no] urpf-check
          — mode {strict | loose | strict-no-ecmp}
          — no mode
      — [no] urpf-check
        — mode {strict | loose}
        — no mode

```

Router Advertisement Commands

```

config
  — router
    — [no] router-advertisement
      — [no] dns-options
        — dns-servers ipv6-address
        — no dns-servers
        — rdnss-lifetime seconds
        — no rdnss-lifetime
      — [no] interface ip-int-name
        — current-hop-limit number
        — no current-hop-limit
        — [no] dns-options
          — dns-servers ipv6-address
          — no dns-servers
          — rdnss-lifetime {seconds | infinite}
          — no rdnss-lifetime
          — [no] include-dns
        — [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
  — if-attribute
    — srlg-group [name]
  — 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]]
  — 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]
    — icmp-redirect-route {all | ip-address}
    — icmp6 all
    — icmp6 global
    — icmp6 interface interface-name
    — interface [ip-int-name | ip-addr] [icmp] [urpf-stats] [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]

```

Configuration Commands

Generic Commands

shutdown

Syntax	[no] shutdown
Context	config>router>interface
Description	<p>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.</p> <p>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.</p> <p>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.</p> <p>The no form of the command puts an entity into the administratively enabled state.</p>
Default	no shutdown

description

Syntax	description <i>description-string</i> no description
Context	config>router>if config>router>if>dhcp config>router>if>vrrp
Description	<p>This command creates a text description stored in the configuration file for a configuration context.</p> <p>The no form of the command removes the description string from the context.</p>
Default	No description is associated with the configuration context.
Parameters	<i>description-string</i> — 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 <i>router-name</i>
Context	config
Description	This command enables the context to configure router parameters, and interfaces, route policies, and protocols.
Parameters	<i>router-name</i> — Specify the router-name.
Values	router-name: Base, management
Default	Base

aggregate

Syntax	aggregate <i>ip-prefix/ip-prefix-length</i> [summary-only] [as-set] [aggregator <i>as-number:ip-address</i>] [black-hole] [community <i>comm-id</i>] [description <i>description</i>] aggregate <i>ip-prefix/ip-prefix-length</i> [summary-only] [as-set] [aggregator <i>as-number:ip-address</i>] [community <i>comm-id</i>] [indirect <i>ip-address</i>] [description <i>description</i>] no aggregate <i>ip-prefix/ip-prefix-length</i>
Context	config>router
Description	<p>This command creates an aggregate route.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>A standard 4-byte BGP community may be associated with an aggregate route in order to facilitate route policy matching.</p> <p>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.</p> <p>The no form of the command removes the aggregate.</p>

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 (eight 16-bit pieces)

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::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 <i>autonomous-system</i> no autonomous-system
Context	config>router
Description	<p>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.</p> <p>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.</p>
Default	No autonomous system number is defined.
Parameters	<i>autonomous-system</i> — The autonomous system number expressed as a decimal integer.
Values	1 — 4294967295

confederation

Syntax	confederation <i>confed-as-num</i> members <i>as-number</i> [<i>as-number...up to 15 max</i>] no confederation [<i>confed-as-num</i> members <i>as-number...up to 15 max</i>]
Context	config>router
Description	<p>This command creates confederation autonomous systems within an AS.</p> <p>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.</p> <p>The no form of the command deletes the specified member AS from the confederation.</p> <p>When no members are specified in the no statement, the entire list is removed and confederation is disabled.</p> <p>When the last member of the list is removed, confederation is disabled.</p>
Default	no confederation - no confederations are defined.
Parameters	<i>confed-as-num</i> — The confederation AS number expressed as a decimal integer.
Values	1 — 65535
	members <i>member-as-num</i> — The AS number(s) of members that are part of the confederation, expressed as a decimal integer. Up to 15 members per <i>confed-as-num</i> can be configured.
Values	1 — 65535

ecmp

Syntax	ecmp <i>max-ecmp-routes</i> no ecmp
Context	config>router
Description	<p>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.</p> <p>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.</p> <p>When more ECMP routes are available at the best preference than configured in <i>max-ecmp-routes</i>, then the lowest next-hop IP address algorithm is used to select the number of routes configured in <i>max-ecmp-routes</i>.</p> <p>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.</p>
Default	no ecmp
Parameters	<p><i>max-ecmp-routes</i> — The maximum number of equal cost routes allowed on this routing table instance, expressed as a decimal integer. Setting ECMP <i>max-ecmp-routes</i> to 1 yields the same result as entering no ecmp.</p> <p>Values 0 — 32</p>

weighted-ecmp

Syntax	weighted-ecmp no ecmp
Context	config>router
Description	<p>This command enables the weighted load-balancing, or weighted ECMP, over MPLS LSP.</p> <p>When this command is enabled, packets of IGP, BGP, and static route prefixes resolved to a set of ECMP tunnel next-hops are sprayed proportionally to the weights configured for each MPLS LSP in the ECMP set.</p> <p>Weighted load-balancing over MPLS LSP is supported in the following forwarding contexts:</p> <ul style="list-style-type: none"> • IGP prefix resolved to IGP shortcuts in RTM (rsvp-shortcut or advertise-tunnel-link enabled in the IGP instance). • BGP prefix with the BGP next-hop resolved to IGP shortcuts in RTM (rsvp-shortcut or advertise-tunnel-link enabled in the IGP instance). • Static route prefix resolved to an indirect next-hop which itself is resolved to a set of equal-metric MPLS LSPs in TTM. The user can allow automatic selection or specify the names of the equal-metric MPLS LSPs in TTM to be used in the ECMP set. • Static route prefix resolved to an indirect next-hop which itself is resolved to IGP shortcuts in RTM.

- BGP prefix with a BGP next-hop resolved to a static route which itself resolves to set of tunnel next-hops towards an indirect next-hop in RTM or TTM.
- BGP prefix resolving to another BGP prefix which next-hop is resolved to set of ECMP tunnel next-hops with a static route in RTM or TTM or to IGP shortcuts in RTM.

IGP computes the normalized weight for each prefix tunnel next-hop. IGP updates the route in RTM with the set of tunnel next-hops and normalized weights. RTM downloads the information to IOM for inclusion in the FIB.

If one or more LSPs in the ECMP set of a prefix do not have a weight configured, the regular ECMP spraying for the prefix will be performed.

The weight assigned to an LSP impacts only the forwarding decision, not the routing decision. In other words, it does not change the selection of the set of ECMP tunnel next-hops of a prefix when more next-hops exist than the value of the router **ecmp** option. Once the set of tunnel next-hops is selected, the LSP weight is used to modulate the amount of packets forwarded over each next-hop. It also does not change the hash routine, but only the spraying of the flows over the tunnel next-hops is modified to reflect the normalized weight of each tunnel next-hop.

The no version of the command resumes regular ECMP spraying of packets of IGP, BGP, and static route prefixes over MPLS LSP.

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	<p>This command enables IP Fast-Reroute (FRR) feature on the system.</p> <p>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.</p> <p>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.</p> <p>When any of the following events occurs, IGP instructs in the fast path on the XMAs to enable the LFA backup next-hop:</p> <ul style="list-style-type: none"> 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 <p>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.</p> <p>The no form of this command disables the IP FRR feature on the system</p>
Default	no ip-fast-reroute

mc-maximum-routes

Syntax	mc-maximum-routes <i>number</i> [log-only] [threshold <i>threshold</i>] no mc-maximum-routes
Context	config>router
Description	<p>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.</p> <p>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.</p>
Default	no mc-maximum-routes
Parameters	<p><i>number</i> — Specifies the maximum number of routes to be held in a VRF context.</p> <p>Values 1 — 2147483647</p> <p>log-only — Specifies that if the maximum limit is reached, only log the event. log-only does not disable the learning of new routes.</p> <p>threshold <i>threshold</i> — The percentage at which a warning log message and SNMP trap should be sent.</p> <p>Values 0 — 100</p>

Default 10

mpls-labels

Syntax	mpls-labels
Context	config>router
Description	This command creates a context for the configuration of global parameters related to MPLS labels.

static-label-range

Syntax	static-label-range <i>static-range</i> no static-label-range
Context	config>router>mpls-labels
Description	This command configures the range of MPLS static label values shared among static LSP, MPLS-TP LSP, and static service VC label. Once this range is configured, it is reserved and cannot be used by other protocols such as RSVP, LDP, BGP, or Segment Routing to assign a label dynamically.
Parameters	<i>static-range</i> — Size of the static label range in number of labels. The minimum label value in the range is 32. The maximum label value is thus computed as {32+ static-range-1}.
Values	0 — 131040 for chassis mode C
Values	0 — 262112 for chassis mode D
Default	18400

sr-labels

Syntax	sr-labels <i>start start-value end end-value</i> no sr-labels
Context	config>router>mpls-labels
Description	This command configures the range of the Segment Routing Global Block (SRGB). It is a label block which is used for assigning labels to segment routing prefix SIDs originated by this router. This range is carved from the system dynamic label range and is not instantiated by default. This is a reserved label and once configured it cannot be used by other protocols such as RSVP, LDP, and BGP to assign a label dynamically.
Parameters	start <i>start-value</i> — start label value in the SRGB
Values	18432 — 524287
Default	none

end *end-value* — end label value in the SRGB

Values 18432 — 524287

Default none

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	<i>network-domain-name</i> — Network domain name character string.

rpki-session

Syntax	rpki-session <i>ip-address</i> no rpki-session <i>ip-address</i>
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	<i>ip-address</i> — 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 <i>seconds</i> 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	<i>seconds</i> — Specifies time in seconds. Values 1-65535

description

Syntax	description <i>description-string</i> no description
Context	config>router>origin-validation>rpki-session
Description	This command configures a description for an RPKI-Router session.

Default	no description
Parameters	<i>description-string</i> — Specifies a text string up to 80 characters in length.

local-address

Syntax	local-address <i>ip-address</i> 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	<i>ip-address</i> — Specifies an IPv4 address or an IPv6 address.

port

Syntax	port <i>port-id</i> 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	<i>port-id</i> — Specifies a port-id. Values 0-65535

refresh-time

Syntax	refresh-time <i>seconds1</i> hold-time <i>seconds2</i> 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	<i>seconds1</i> — Specifies a time in seconds.
	Values 30-32767
	<i>seconds2</i> — 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 <i>seconds</i> 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	<i>seconds</i> — Specifies a time in seconds.
	Values 60-3600

static-entry

Syntax	static-entry <i>ip-prefix/ip-prefix-length upto prefix-length2 origin-as as-number</i> [valid invalid] no static-entry <i>ip-prefix/ip-prefix-length upto prefix-length2 origin-as as-number</i>
Context	config>router>origin-validation

Description	<p>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-validation command configured.</p> <p>Note that static entries can only be configured under the config>router>origin-validation context of the base router.</p>
Default	no static entries
Parameters	<p><i>ip-prefix/ip-prefix-length</i> — Specifies an IPv4 or IPv6 address with a minimum prefix length value.</p> <p>Values 60-3600</p> <p><i>prefix-length2</i> — Specifies the maximum prefix length.</p> <p><i>as-number</i> — Specifies as-number.</p> <p>Values 0-4294967295</p> <p>valid — Specifies a keyword meaning the static entry expresses a valid combination of origin AS and prefix range.</p> <p>invalid — Specifies a keyword meaning the static entry expresses an invalid combination of origin AS and prefix range.</p>

router-id

Syntax	<p>router-id <i>ip-address</i></p> <p>no router-id</p>
Context	config>router
Description	<p>This command configures the router ID for the router instance.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The no form of the command reverts to the default value.</p>
Default	<p>The system uses the system interface address (which is also the loopback address).</p> <p>If a system interface address is not configured, use the last 32 bits of the chassis MAC address.</p>

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

service-prefix

Syntax	service-prefix <i>ip-prefix/mask</i> <i>ip-prefix netmask</i> [exclusive] no service-prefix <i>ip-prefix/mask</i> <i>ip-prefix netmask</i>				
Context	config>router				
Description	<p>This command creates an IP address range reserved for IES or VPLS services.</p> <p>The purpose of reserving IP addresses using service-prefix is to provide a mechanism to reserve one or more address ranges for services.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>				
Default	no service-prefix - no IP addresses are reserved for services.				
Parameters	<p><i>ip-prefix/mask</i> — The IP address prefix to include in the service prefix allocation in dotted decimal notation.</p> <table> <tr> <td>Values</td><td> <i>ipv4-prefix:</i> a.b.c.d (host bits must be 0) <i>ipv4-prefix-length:</i> 0 — 32 <i>ipv6-prefix:</i> x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D <i>ipv6-prefix-length:</i> 0 — 128 </td></tr> <tr> <td>Values</td><td>exclusive</td></tr> </table> <p>When this option is specified, the addresses configured are exclusively used for services and cannot be assigned to network ports.</p>	Values	<i>ipv4-prefix:</i> a.b.c.d (host bits must be 0) <i>ipv4-prefix-length:</i> 0 — 32 <i>ipv6-prefix:</i> x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D <i>ipv6-prefix-length:</i> 0 — 128	Values	exclusive
Values	<i>ipv4-prefix:</i> a.b.c.d (host bits must be 0) <i>ipv4-prefix-length:</i> 0 — 32 <i>ipv6-prefix:</i> x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D <i>ipv6-prefix-length:</i> 0 — 128				
Values	exclusive				

sgt-qos

Syntax	sgt-qos
Context	config>router
Description	This command configures DSCP/Dot1p re-marking for self-generated traffic.

application

Syntax	application <i>dscp-app-name</i> dscp { <i>dscp-value</i> <i>dscp-name</i> } application <i>dot1p-app-name</i> dot1p <i>dot1p-priority</i> no application { <i>dscp-app-name</i> <i>dot1p-app-name</i> }
Context	config>router>sgt-qos
Description	This command configures DSCP/Dot1p re-marking for applications.
Parameters	<i>dscp-app-name</i> — Specifies the DSCP application name. <div style="margin-left: 40px;">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</div> <i>dscp-value</i> — Specifies the DSCP value <div style="margin-left: 40px;">Values 0 — 63</div> <i>dscp-name</i> — Specifies the DSCP name. <div style="margin-left: 40px;">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</div> <i>dot1p-priority</i> — Specifies the Dot1p priority. <div style="margin-left: 40px;">Values none, 0 — 7</div> <i>dot1p-app-name</i> — Specifies the Dot1p application name. <div style="margin-left: 40px;">Values arp, isis, pppoe</div>

dscp

Syntax	dscp <i>dscp-name</i> fc <i>fc-name</i> no dscp <i>dscp-name</i>
Context	config>router>sgt-qos
Description	This command configures DSCP name to FC mapping.

Parameters	<i>dscp-name</i> — 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
	<i>fc-name</i> — Specifies the forward class name.
Values	be, l2, af, l1, h2, ef, h1, nc

bfd-template

Syntax	bfd-template <i>name</i> [create] no bfd-template <i>name</i>
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 the BFD session terminates in the CPM network processor.
Default	no bfd-template
Parameters	<i>name</i> — 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 <i>transmit-interval</i> 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	<i>transmit-interval</i> — 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 <i>receive-interval</i> 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	<i>receive-interval</i> — 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 <i>transmit-interval</i> 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	<i>transmit-interval</i> — 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 <i>echo-interval</i> 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	<i>echo-interval</i> — Specifies the echo receive interval.
Values	100 ms — 100,000 ms in 1 ms increments

Default 100

multiplier

Syntax	multiplier <i>multiplier</i> 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 <i>multiplier</i> x <i>receive-interval</i> , then the session is declared down.
Default	3
Parameters	<i>multiplier</i> — 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 <i>holdoff-time</i>] no single-sfm-overload
Context	config>router
Description	<p>This command configures OSPF, OSPFv3 and IS-IS to set overload when the router has fewer than the full set of SFMs functioning, which reduces forwarding capacity. Setting overload enables a router to still participate in exchanging routing information, but routes all traffic away from it.</p> <p>The conditions to set overload are as follows:</p> <ul style="list-style-type: none"> • 7750 SR-12/SR-7/SR-c12 and 7450 ESS-12/ESS-7/ESS-6 platforms: protocol sets overload if one of the SF/CPMs fails • 7950 XRS and 7750 SR-12e platforms: protocol sets overload if two SFMs fail <p>The no form of this command configures the router to not set overload if an SFM fails.</p>
Default	no single-sfm-overload
Parameters	<p><i>holdoff-time</i> — This parameter specifies the delay between detecting SFM failures and setting overload.</p> <p>Values 1— 600 seconds</p> <p>Default 0 seconds</p>

static-route

Syntax	<p>[no] static-route {<i>ip-prefix/prefix-length</i> <i>ip-prefix netmask</i>} [preference <i>preference</i>] [metric <i>metric</i>] [tag <i>tag</i>] [community <i>comm-id</i>] [enable disable] next-hop <i>ip-int-name</i> <i>ip-address</i> [<i>mcast-family</i>] [bfd-enable {<i>cpe-check cpe-ip-address</i> [<i>interval seconds</i>] [drop-count <i>count</i>] [padding-size <i>padding-size</i>] [log] {<i>prefix-list prefix-list-name</i> [all none] } {<i>fc fc-name</i> [priority {low high}] [ldp-sync] [validate-next-hop]</p> <p>[no] static-route {<i>ip-prefix/prefix-length</i> <i>ip-prefix netmask</i>} [preference <i>preference</i>] [metric <i>metric</i>] [tag <i>tag</i>] [community <i>comm-id</i>] [enable disable] indirect <i>ip-address</i> [<i>cpe-check cpe-ip-address</i> [<i>interval seconds</i>] [drop-count <i>count</i>] [padding-size <i>padding-size</i>] [log] {<i>prefix-list prefix-list-name</i> [all none] } {<i>fc fc-name</i> [priority {low high}] }</p> <p>[no] static-route {<i>ip-prefix/prefix-length</i> <i>ip-prefix netmask</i>} [preference <i>preference</i>] [metric <i>metric</i>] [tag <i>tag</i>] [community <i>comm-id</i>] [enable disable] black-hole [<i>mcast-family</i>] {<i>prefix-list prefix-list-name</i> [all none] }</p>
Context	config>router
Description	<p>This command creates static route entries for both the network and access routes.</p> <p>When configuring a static route, either next-hop, indirect or black-hole must be configured.</p> <p>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.</p>

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 (eight 16-bit pieces)
		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[-interface]
		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 modifying 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 6 on page 135.

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[-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 be resolved from a 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.

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 6: 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**

cpe-check *target-ip-address* — This parameter specifies the IP address of the target CPE device. This option initiates a background ICMP ping test to the configured target IP address. This address can either be an IPv4 address for IPv4 static routes or an IPv6 address for IPv6 static routes. 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

padding-size *padding-size* — This optional parameter specifies the amount of padding to add to the ICMP packet in bytes. The parameter is only applicable when the **cpe-check** parameter is used with the **static-route** command.

Values 0 — 16384 bytes

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#
```

static-route-entry

Syntax	static-route-entry { <i>ip-prefix/prefix-length</i> } [mcast] indirect { <i>ip-address</i> }	
Context	config>router	
Description	This command enables the resolution of a static route prefix to an indirect tunnel next-hop.	
Default	No static routes are defined.	
Parameters	<i>ip-prefix/prefix-length</i> — 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 (eight 16-bit pieces)
		x:x:x:x:x:d.d.d.d
		x [0 — FFFF]H
		d [0 — 255]D
	ipv6-prefix-length	0 — 128
	indirect <i>ip-address</i> — Specifies that the route is indirect and specifies the next hop IP address used to reach the destination.	
	The configured <i>ip-addr</i> 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 <i>ip-addr</i> configured can be either on the network or the access side and is normally at least one hop away from this node.	

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[-interface]
		x:x:x:x:x:x.d.d.d[-interface]
		x: [0..FFFF]H
		d: [0..255]D
		interface: 32 characters maximum, mandatory for link local addresses

tunnel-next-hop

Syntax	tunnel-next-hop
Context	config>router>static-route-entry
Description	<p>This command enables the context to configure the resolution of a static route prefix to an indirect tunnel next-hop.</p> <p>The existing static-route command is still supported with all other options, including the indirect option which can be used to resolve the indirect next-hops in RTM.</p> <p>The new command is an add-on to configure the resolution to tunnel next-hops in TTM. As such, the user must first configure the prefix with the existing command and the indirect option and then enter the new command with the indirect option and with the new static-route-entry command.</p> <p>If tunnel-next-hop context is configured and resolution is set to disabled, the binding to tunnel is removed and resolution resumes in RTM to IP next-hops.</p> <p>If resolution is set to any, any supported tunnel type in static route context will be selected following TTM preference.</p> <p>The following tunnel types are supported in a static route context: RSVP and LDP.</p> <p>The ldp value instructs the code to search for an LDP LSP with a FEC prefix corresponding to the address of the indirect next-hop.</p> <p>The rsvp value instructs the code to search for the best metric RSVP LSP to the address of the indirect next-hop. This address can correspond to the system interface or to another loopback used on the remote node. The LSP metric is provided by MPLS in the tunnel table. In the case of multiple RSVP LSPs with the same lowest metric, the code selects the LSP with the lowest tunnel-id.</p> <p>If one or more explicit tunnel types are specified using the resolution-filter option, then only these tunnel types will be selected again following the TTM preference. In the case of RSVP-TE tunnel type, the user can further restrict the selection by providing a list of LSP names.</p> <p>The user must set resolution to filter to activate the list of tunnel-types configured under resolution-filter.</p> <p>If disallow-igp is enabled, the static-route will not be activated using IGP next-hops in RTM if no tunnel next-hops are found in TTM.</p>

disallow-igp

Syntax	disallow-igp no disallow-igp
Context	config>router>static-route-entry>tunnel-next-hop
Description	This command is for indirect static routes using tunnel next-hops. When enabled, the static route will not be activated using IGP next-hops in RTM if no tunnel next-hops are found in TTM.

resolution

Syntax	resolution {any filter disabled}
Context	config>router>static-route-entry>tunnel-next-hop
Description	This command configures the resolution mode in the resolution of a static route using tunnels to an indirect next-hop.
Parameters	<p>any — enables the binding to any supported tunnel type in a static route context following TTM preference.</p> <p>filter — enables the binding to the subset of tunnel types configured under resolution-filter.</p> <p>disabled — disables the resolution of a static route using tunnels to an indirect next-hop.</p>

resolution-filter

Syntax	resolution-filter [ldp] [rsvp-te [lsp lsp name]...[lsp lsp name]]
Context	config>router>static-route-entry>tunnel-next-hop
Description	<p>This command configures the subset of tunnel types which can be used in the resolution of a static route using tunnels to an indirect next-hop.</p> <p>The following tunnel types are supported in a static route context: RSVP and LDP. In the case of RSVP-TE tunnel type, the user can further restrict the selection by providing a list of LSP names.</p>
Parameters	<p>ldp — selects the LDP tunnel type.</p> <p>rsvp-te [lsp lsp-name]...[lsp lsp-name] — selects the RSVP-TE tunnel type or a set of specific RSVP LSP names.</p>

triggered-policy

Syntax	triggered-policy no triggered-policy
Context	config>router

Description	<p>This command triggers route policy re-evaluation.</p> <p>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.</p> <p>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 <i>soft</i> or <i>soft inbound</i> 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.</p>
--------------------	---

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>ttd-propagate
Description	<p>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.</p> <p>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.</p> <p>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.</p> <p>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:</p> <p>RSVP LSP shortcut:</p> <ul style="list-style-type: none"> • configure router mpls shortcut-local-ttl-propagate <p>LDP LSP shortcut:</p> <ul style="list-style-type: none"> • 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>tll-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.

lsp-label-route

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

Context	config>router>ttl-propagate
Description	<p>This command configures the TTL propagation for transit packets at a router acting as an LSR for a BGP label route.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
Default	none
Parameters	<p>none — The TTL of the swapped label is not propagated into the transport label stack.</p> <p>all — The TTL of the swapped label is propagated into all labels of the transport label stack.</p>

vpn-local

Syntax	vpn-local [all vc-only none]
Context	config>router>ttl-propagate
Description	<p>This command configures the TTL propagation for locally generated packets which are forwarded over a MPLS LSPs in all VPRN service contexts.</p> <p>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:</p> <p>The user can enable the TTL propagation behavior separately for locally generated packets by CPM (vpn-local) and for user and control packets in transit at the node (vpn-transit).</p> <p>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.</p> <p>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.</p>

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	<p>none — The TTL of the IP packet is not propagated into the VC label or labels in the transport label stack</p> <p>vc-only — The TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack.</p> <p>all — The TTL of the IP packet is propagated into the VC label and all labels in the transport label stack.</p>

vprn-transit

Syntax	vprn-transit [all vc-only none]
Context	config>router>ttl-propagate
Description	<p>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:</p> <p>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).</p> <p>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.</p> <p>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.</p> <p>The user can override the global configuration within each VPRN service instance using the following commands:</p>

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

Note 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	<p>none — The TTL of the IP packet is not propagated into the VC label or labels in the transport label stack</p> <p>vc-only — The TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack.</p> <p>all — The TTL of the IP packet is propagated into the VC label and all labels in the transport label stack.</p>

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	<p>always — Specifies that the LAC will send all L2TP packets with the DF bit set to 1.</p> <p>never — Specifies that the LAC will send all L2TP packets with the DF bit set to 0.</p>

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.

Router Interface Commands

interface

Syntax	[no] interface <i>ip-int-name</i> [unnumbered-mpls-tp] [no] interface <i>ip-int-name</i> gmpls-loopback
Context	config>router
Description	<p>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.</p> <p>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.</p> <p>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.</p> <p>Although not a keyword, the ip-int-name “system” is associated with the network entity (such as a specific 7950 SR), not a specific interface. The system interface is also referred to as the loopback address.</p> <p>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.</p> <p>A GMPLS loopback interface is a special type of loopback interface that is used as the IP interface for a GMPLS IP Control Channel (IPCC). RSVP and LMP packets associated with GMPLS are associated with this loopback interface. All other IP protocols are blocked on this interface. One gmpls-loopback interface is required for each GMPLS peer node.</p> <p>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.</p>
Default	No interfaces or names are defined within the system.
Parameters	<p><i>ip-int-name</i> — 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.</p> <p>Values 1 — 32 alphanumeric characters.</p> <p>If the <i>ip-int-name</i> already exists, the context is changed to maintain that IP interface. If <i>ip-int-name</i> 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</p>

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.

gmpls-loopback — Specifies that the interface is a loopback interface for GMPLS control plane packets.

address

Syntax	address { <i>ip-address/mask</i> <i>ip-address netmask</i> } [broadcast <i>all-ones</i> host-ones] [track-srrp <i>srrp-instance</i>] no address
Context	config>router>interface
Description	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>By default, no IP address or subnet association exists on an IP interface until it is explicitly created.</p> <p>The no form of the command removes the IP address assignment from the IP interface. Interface specific configurations 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.</p>
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 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* 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 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.

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	<p>This command enables the forwarding of directed broadcasts out of the IP interface.</p> <p>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.</p> <p>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.</p> <p>By default, directed broadcasts are not allowed and are discarded at this egress IP interface.</p> <p>The no form of the command disables directed broadcasts forwarding out of the IP interface.</p>
Default	no allow-directed-broadcasts — Directed broadcasts are dropped.

arp-limit

Syntax	arp-limit <i>limit</i> [log-only] [threshold percent] no arp-limit
Context	config>router>interface
Description	<p>This command configures the maximum amount of dynamic IPv4 ARP entries that can be learned on an IP interface.</p> <p>When the number of dynamic ARP entries reaches the configured percentage of this limit, an SNMP trap is sent. When the limit is exceeded, no new entries are learned until an entry expires and traffic to these destinations will be dropped. Entries that have already been learned will be refreshed.</p> <p>The no form of the command removes the arp-limit.</p>
Default	90 percent
Parameters	log-only — Enables the warning message to be sent at the specified threshold percentage, and also when the limit is exceeded. However, entries above the limit will be learned.

percent — The threshold value (as a percentage) that triggers a warning message to be sent.

Values 0 — 100

limit — The number of entries that can be learned on an IP interface expressed as a decimal integer. If the limit is set to 0, dynamic ARP learning is disabled and no dynamic ARP entries are learned.

Values 0 — 524288

arp-timeout

Syntax	arp-timeout <i>seconds</i> no arp-timeout
Context	config>router>interface
Description	<p>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.</p> <p>The no form of the command reverts to the default value.</p>
Default	14400 seconds (4 hours)
Parameters	<p><i>seconds</i> — 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.</p> <p>Values 0 — 65535</p>

bfd

Syntax	bfd <i>transmit-interval</i> [receive <i>receive-interval</i>] [multiplier <i>multiplier</i>] [echo-receive <i>echo-interval</i>] [type cpm-np] no bfd
Context	config>router>interface config>router>interface>ipv6
Description	<p>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.</p> <p>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.</p> <p>The no form of the command removes BFD from the router interface regardless of the IGP/RSVP.</p> <p>Important notes: On the 7950 SR OS, the <i>transmit-interval</i> and receive <i>receive-interval</i> values can only be modified to a value less than 100 ms when:</p> <ol style="list-style-type: none"> 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	<p><i>transmit-interval</i> — Sets the transmit interval, in milliseconds, for the BFD session.</p> <p>Values 10 — 100000 10 — 100000 (see Important Notes above)The minimum value is 300 msec for central BFD sessions</p> <p>Default 100</p> <p><i>receive receive-interval</i> — Sets the receive interval, in milliseconds, for the BFD session.</p> <p>Values 10 — 100000 10 — 100000 (see Important Notes above)</p> <p>Default 100</p> <p><i>multiplier multiplier</i> — Set the multiplier for the BFD session.</p> <p>Values 3— 20</p> <p>Default 3</p> <p><i>echo-receive echo-interval</i> — Sets the minimum echo receive interval, in milliseconds, for the session.</p> <p>Values 100 — 100000</p> <p>Default 0</p> <p>type cpm-np — Selects the CPM network processor as the local termination point for the BFD session. See Important Notes, above.</p>

cflowd-parameters

Syntax	cflowd-parameters no cflowd-parameters
Context	config>router>interface
Description	<p>This command creates the configuration context to configure cflowd parameters for the associated IP interfaces.</p> <p>cflowd is used for network planning and traffic engineering, capacity planning, security, application and user profiling, performance monitoring, usage-based billing, and SLA measurement.</p> <p>At a minimum, the sampling command must be configured within this context in order to enable cflowd sampling, otherwise traffic sampling will not occur.</p>
Default	no cflowd-parameters

sampling

Syntax	sampling {unicast multicast} type {acl interface} [direction {ingress-only egress-only both}] no sampling {unicast multicast}
Context	config>router>interface>cflowd-parameters
Description	<p>This command enables and configures the cflowd sampling behavior to collect traffic flow samples through a router for analysis.</p> <p>This command can be used to configure the sampling parameters for unicast and multicast traffic separately. If sampling is not configured for either unicast or multicast traffic, then that type of traffic will not be sampled.</p> <p>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.</p> <p>The no form of the command disables the associated type of traffic sampling on the associated interface.</p>
Default	no sampling
Parameters	<p>unicast — Specifies that the sampling command will control the sampling of unicast traffic on the associated interface/SAP.</p> <p>multicast — Specifies that the sampling command will control the sampling of multicast traffic on the associated interface/SAP.</p> <p>type —</p> <p>Values</p> <p>acl — Specifies that the sampled traffic is controlled via an IP traffic filter entry with the action “filter-sample” configured.</p> <p>interface — Specifies that all traffic entering or exiting the interface is subject to sampling.</p> <p>direction — Specifies the direction to collect traffic flow samples.</p> <p>Values</p> <p>ingress-only — Enables ingress sampling only on the associated interface.</p> <p>egress-only — Enables egress sampling only on the associated interface.</p> <p>both — Enables both ingress and egress cflowd sampling.</p>

cpu-protection

Syntax	cpu-protection <i>policy-id</i> 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 <i>cpu-protection-policy-id</i> context.
Parameters	<p><i>policy-id</i> — Specifies an existing CPU protection policy.</p> <p>Values</p> <p>1 — 255</p>

delayed-enable

Syntax	delayed-enable <i>seconds</i> no delayed-enable
Context	config>router>if
Description	This command will cause a delay in the activation of an IP interface by the specified number of seconds. The delay is invoked whenever the system attempts to bring the associated IP interface up. The no form of the command removes the command from the active configuration and removes the delay in activating the associated IP interface. If the configuration is removed during a delay period, the currently running delay will continue until it expires.
Parameters	<i>seconds</i> — Specifies a delay, in seconds, to make the interface operational. Values 1 — 1200

dist-cpu-protection

Syntax	dist-cpu-protection <i>policy-name</i> no dist-cpu-protection
Context	config>router>if
Description	This command assigns a Distributed CPU protection policy for the interface.

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 applicable to IP statistics, and not to uRPF statistics. If enabled, then the following statistics are collected: <ul style="list-style-type: none"> • 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 <i>group-name</i> [<i>group-name...</i> (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 <i>group-name</i> [<i>group-name...</i> (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-mtu

Syntax	ip-mtu <i>octets</i> no ip-mtu
---------------	---

Context	config>router>if
Description	<p>This command configures the IP maximum transmit unit (packet) for the associated router IP interface.</p> <p>The configured IP-MTU cannot be larger then the calculated IP MTU based on the port MTU configuration.</p> <p>The MTU that will be used is:</p> <p>MINIMUM((Port_MTU - EtherHeaderSize), (Configured ip-mtu))</p> <p>The no form of the command returns the associated IP interfaces MTU to its default value, which is calculated, based on the port MTU setting. (For Ethernet ports this will typically be 1554.)</p>
Default	no ip-mtu
Parameters	<p><i>octets</i> — 5</p> <p>Values 12 – 9000</p>

lag-link-map-profile

Syntax	lag-link-map-profile <i>link-map-profile-id</i> no lag-link-map-profile
Context	config>router>if
Description	<p>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.</p> <p>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.</p>
Default	no lag-link-map-profile
Parameters	<i>link-map-profile-id</i> — 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	<p>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.</p> <p>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</p>

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, or a regular IES interface, the lookup of the packet by the ingress forwarding engine 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 forwarding engine 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 <i>seconds</i> no ldp-sync-timer
Context	config>router>interface
Description	<p>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.</p> <p>Note that if an interface belongs to both IS-IS and OSPF, a physical failure will cause both IGP's 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.</p> <p>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.</p> <p>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.</p> <p>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:</p>

- `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

load-balancing

Syntax **load-balancing**

Context config>router>if

Description This command enables the load-balancing context to configure interface per-flow load balancing options that will apply to traffic entering this interface and egressing over a LAG/ECMP on system-egress. This is a per interface setting. For load-balancing options that can also be enabled on the system level, the options enabled on the interface level overwrite system level configurations.

Default not applicable

egr-ip-load-balancing

Syntax **egr-ip-load-balancing {source | destination | inner-ip}**
no egr-ip-load-balancing

Context config>router>interface>load-balancing

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	<p>source — Specifies using source address and (if l4-load balancing is enabled) source port in the hash, ignore destination address/port.</p> <p>destination — Specifies using destination address and (if l4-load balancing is enabled) destination port in the hash, ignore source address/port.</p> <p>inner-ip — Specifies use of the inner IP header parameters instead of outer IP header parameters in LAG/ECMP hash for IPv4 encapsulated traffic.</p>

lsr-load-balancing

Syntax	lsr-load-balancing <i>hashing-algorithm</i> no lsr-load-balancing
Context	config>router>if>load-balancing
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	<p>lbl-only — Only the label is used in the hashing algorithm.</p> <p>lbl-ip — The IP header is included in the hashing algorithm.</p> <p>ip-only — the IP header is used exclusively in the hashing algorithm</p> <p>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 or 0x86DD). 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.</p>

spi-load-balancing

Syntax	[no] spi-load-balancing
Context	config>router>if>load-balancing
Description	<p>This command enables use of the SPI in hashing for ESP/AH encrypted IPv4/v6 traffic. This is a per interface setting.</p> <p>The no form disables the SPI function.</p>
Default	disabled

teid-load-balancing

Syntax	[no] teid-load-balancing
Context	config>router>interface>load-balancing
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

loopback

Syntax	[no] loopback
Context	config>router>interface
Description	This command configures the interface as a loopback interface.
Default	Not enabled

mac

Syntax	mac <i>ieee-mac-addr</i> 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	<i>ieee-mac-addr</i> — Specifies the 48-bit MAC address for the IP interface in the form <i>aa:bb:cc:dd:ee:ff</i> or <i>aa-bb-cc-dd-ee-ff</i> , where <i>aa</i> , <i>bb</i> , <i>cc</i> , <i>dd</i> , <i>ee</i> and <i>ff</i> 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 <i>holdover-time</i>]
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	<i>holdover-time</i> — 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 <i>network-domain-name</i> no network-domain
Context	config>router>interface
Description	<p>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.</p> <p>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..</p> <p>Single interfaces can be associated with multiple network-domains.</p>
Default	per default “default” network domain is assigned

ntp-broadcast

Syntax	[no] ntp-broadcast
Context	config>router>interface
Description	<p>This command enables SNTP broadcasts received on the IP interface. This parameter is only valid when the SNTP broadcast-client global parameter is configured.</p> <p>The no form of the command disables SNTP broadcast received on the IP interface.</p>
Default	no ntp-broadcast

port

Syntax	port <i>port-name</i> no port
Context	config>router>interface
Description	<p>This command creates an association with a logical IP interface and a physical port.</p> <p>An interface can also be associated with the system (loopback address).</p> <p>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 <i>port-id</i> for Ethernet ports takes the following form:</p> <ul style="list-style-type: none"> • Ethernet interfaces <p>If the card in the slot has XMAs, <i>port-id</i> is in the slot_number/XMA_number/port_number format; for example, 1/1/3 specifies port 3 of the XMA installed in XMA slot 1 on the card installed in chassis slot 1.</p> <p>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.</p>
Default	No port is associated with the IP interface.
Parameters	<i>port-name</i> — The physical port identifier to associate with the IP interface.

proxy-arp-policy

Syntax	[no] proxy-arp-policy <i>policy-name</i> [<i>policy-name...</i> (up to 5 max)]
Context	config>router>interface
Description	<p>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.</p> <p>Use proxy ARP so the router responds to ARP requests on behalf of another device. Static ARP is used when a 7950 SR needs to know about a device on an interface that cannot or does not respond to ARP requests. Thus, the 7950 SR configuration can state that if it has a packet that has a certain IP address to send it to the corresponding ARP address.</p>
Default	no proxy-arp-policy
Parameters	<i>policy-name</i> — 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	<p>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:</p> <ul style="list-style-type: none"> • 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. <p>Note: The port will validate the destination IP address on received 1588 messages. If the 1588 messages are sent to a loopback address within the node rather than the address of the interface, then the loopback address must be configured in the configure>system>security>source-address application ptp context.</p>
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	<p>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.</p> <p>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.</p> <p>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.</p> <p>If neither the optional source or destination parameter is present, then the default is destination address matching.</p> <p>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).</p>

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 {[<i>ip-address/mask</i> <i>ip-address netmask</i>]} [broadcast { all-ones host-ones }] [igp-inhibit] no secondary <i>ip-addr</i>
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. <i>ip-address</i> — The IP address of the IP interface. The <i>ip-address</i> 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 <i>ip-address</i> portion of the IP address from the mask that defines the scope of the local subnet. No spaces are allowed between the <i>ip-addr</i> , the “/” and the <i>mask-length</i> parameter. If a forward slash does not ediatly follow the <i>ip-addr</i> , a dotted decimal mask must follow the prefix. <i>mask-length</i> — 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 <i>ip-address</i> from the <i>mask-length</i> 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	<p>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.</p> <p>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.</p> <p>The number of static-arp entries that can be configured on a single node is limited to 1000.</p> <p>Static ARP is used when a 7950 SR needs to know about a device on an interface that cannot or does not respond to ARP requests. Thus, the 7950 SR 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 7950 SR responds to ARP requests on behalf of another device.</p> <p>The no form of the command removes a static ARP entry.</p>
Default	No static ARPs are defined.
Parameters	<p><i>unnumbered</i> — Specifies the static ARP MAC for an unnumbered interface. Unnumbered interfaces support dynamic ARP. Once this command is configured, it overrides any dynamic ARP.</p> <p><i>ieee-mac-addr</i> — Specifies the 48-bit MAC address for the static ARP in the form <i>aa:bb:cc:dd:ee:ff</i> or <i>aa-bb-cc-dd-ee-ff</i>, where <i>aa</i>, <i>bb</i>, <i>cc</i>, <i>dd</i>, <i>ee</i> and <i>ff</i> are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC and non-IEEE reserved MAC addresses.</p>

strip-label

Syntax	[no] strip-label
Context	config>router>interface
Description	<p>This command forces packets to be stripped of all (max 5) MPLS labels before the packets are handed over for possible filter (PBR) processing.</p> <p>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.</p> <p>This command is only supported on:</p> <ul style="list-style-type: none"> • Null/Dot1q encaps • Network ports • IPv4 <p>The no form of the command removes the strip-label command.</p> <p>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.</p>
Default	no strip-label

tos-marking-state

Syntax	tos-marking-state {trusted untrusted} no tos-marking-state
---------------	---

Context	config>router>interface
Description	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
Default	trusted
Parameters	<p>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</p> <p>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.</p>

unnumbered

Syntax	unnumbered [<i>ip-address</i> <i>ip-int-name</i>] no unnumbered
Context	config>router>interface
Description	<p>This command sets an IP interface as an unnumbered interface and specifies the IP address to be used for the interface.</p> <p>To conserve IP addresses, unnumbered interfaces can be configured. The address used when generating packets on this interface is the <i>ip-addr</i> parameter configured.</p> <p>An error message will be generated if an unnumbered interface is configured, and an IP address already exists on this interface.</p> <p>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.</p>
Parameters	<i>ip-addr</i> <i>ip-int-name</i> — 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	<p>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.</p> <p>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.</p> <p>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.</p> <p>If neither the optional source or destination parameter is present, then the default is destination address matching.</p> <p>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.</p> <p>The no form of the command reverts to the default.</p>
Default	destination
Parameters	<p>source — Enables QoS classification of incoming IP packets based on the source address matching a route with QoS information.</p> <p>destination — Enables QoS classification of incoming IP packets based on the destination address matching a route with QoS information.</p>

secure-nd

Syntax [no] secure-nd

Context	config>router>if>ipv6
Description	This command enables Secure Neighbor Discovery (SeND) on the IPv6 interface. The no form of the command reverts to the default and disabled SeND.

allow-unsecured-msgs

Syntax	[no] allow-unsecured-msgs
Context	config>router>if>ipv6>secure-nd
Description	This command specifies whether unsecured messages are accepted. When Secure Neighbor Discovery (SeND) is enabled, only secure messages are accepted by default. The no form of the command disables accepting unsecured messages.

link-local-modifier

Syntax	link-local-modifier <i>modifier</i> [no] link-local-modifier
Context	config>router>if>ipv6>secure-nd
Description	This command configures the Cryptographically Generated Address (CGA) modifier for link-local addresses.
Parameters	<i>modifier</i> — Specifies the modifier in 32 hexadecimal nibbles. Values 0x0–0xFFFFFFFF

public-key-min-bits

Syntax	public-key-min-bits <i>bits</i> [no] public-key-min-bits
Context	config>router>if>ipv6>secure-nd
Description	This command configures the minimum acceptable key length for public keys used in the generation of a Cryptographically Generated Address (CGA).
Parameters	<i>bits</i> — Specifies the number of bits. Values 512–1024

security-parameter

Syntax	security-parameter <i>sec</i>
---------------	--------------------------------------

[no] security-parameter

Context	config>router>if>ipv6>secure-nd
Description	This command configures the security parameter used in the generation of a Cryptographically Generated Address (CGA).
Parameters	<i>sec</i> — Specifies the security parameter.
Values	0–1

shutdown

Syntax	[no] shutdown
Context	config>router>if>ipv6>secure-nd
Description	This command enables or disables Secure Neighbor Discovery (SeND) on the interface.

stale-time

Syntax	stale-time <i>seconds</i> no stale-time
Context	config>router>ipv6 config>router>if>ipv6
Description	This command configures the time a neighbor discovery cache entry can remain stale before being removed. The no form of the command removes the stale-time value.
Default	no stale-time
Parameters	<i>seconds</i> — The allowed stale time (in seconds) before a neighbor discovery cache entry is removed.
Values	60–65535

tcp-mss

Syntax	tcp-mss <i>mss-value</i> no tcp-mss
Context	config>router>if config>router>if>ipv6
Description	This command statically sets the TCP maximum segment size (MSS) for TCP connections originated from the associated IP interface to the specified value. The no form of the command removes the static value and allows the TCP MSS value to be calculated based on the IP MTU value by subtracting the base IP and TCP header lengths from the IP MTU value ($\text{tcp_mss} = \text{ip_mtu} - 40$).

Default	no tcp-mss
Parameters	<p><i>mss-value</i> — The TCP MSS value that should be used in the TCP SYN packet during the three-way handshake negotiation of a TCP connection.</p> <p>Note: 9158 = max-IP_MTU (9198)-40</p> <p>Values 536 - 9158 (IPv4) 1220 - 9138 (IPv6)</p>

urpf-check

Syntax	[no] urpf-check
Context	<pre>config>router>if config>router>if>ipv6</pre>
Description	<p>This command enables unicast RPF (uRPF) Check on this interface.</p> <p>The no form of the command disables unicast RPF (uRPF) Check on this interface.</p>
Default	disabled

vas-if-type

Syntax	vas-if-type {to-from-access to-from-network to-from-both} no vas-if-type
Context	config>router>interface
Description	<p>This command configures the type of a Value Added Service (VAS) facing interface.</p> <p>The no form of the command removes VAS interface type configuration.</p>
Default	no vas-if-type
Parameters	<p>to-from-access — Used when two separate (to-from-access and to-from-network) interfaces are used for Value Added Service (VAS) connectivity. For service chaining, traffic arriving from access interfaces (upstream) is redirected to a PBR target reachable over this interface for upstream VAS processing. Downstream traffic after VAS processing must arrive on this interface, so the traffic is subject to regular routing but is not subject to AA divert, nor egress subscriber PBR.</p> <p>to-from-network — Used when two separate (to-from-access and to-from-network) interfaces are used for Value Added Service (VAS) connectivity. For service chaining, traffic arriving from network interfaces (downstream) is redirected to a PBR target reachable over this interface for downstream VAS processing. Upstream traffic after VAS processing must arrive on this interface, so regular routing can be applied.</p> <p>to-from-both — Used when a single interface is used for Value Added Service (VAS) connectivity (no local-to-local traffic). For service chaining, both traffic arriving from access and from network is redirected to a PBR target reachable over this interface for upstream/downstream</p>

VAS processing. Traffic after VAS processing must arrive on this interface, so the traffic is subject to regular routing but is not subject to AA divert, nor egress subscriber PBR.

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 IGP 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	<pre>config>router>mh-primary-interface config>router>mh-secondary-interface</pre>
Description	<p>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.</p> <p>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 <code>config>router>service-prefix</code> 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.</p> <p>By default, no IP address or subnet association exists on an IP interface until it is explicitly created.</p> <p>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.</p> <p>If a new address is entered while another address is still active, the new address will be rejected.</p>
Parameters	<p><i>ip-address</i> — 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.</p> <p>Values 1.0.0.0 - 223.255.255.255</p> <p>/ — 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 immediately follow the ip-addr, a dotted decimal mask must follow the prefix.</p> <p><i>mask-length</i> — 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.</p> <p>Values 1-32</p> <p><i>mask</i> — 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 in a logical 'AND' function to derive</p>

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).

description

Syntax	description <i>description-string</i> 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	<i>description-string</i> — 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 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 — 31

admin-group

Syntax	admin-group <i>group-name</i> [<i>group-name...</i> (up to 5 max)] no admin-group <i>group-name</i> [<i>group-name...</i> (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	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
Parameters	<i>group-name</i> — 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 <i>group-name</i> value <i>group-value</i> [penalty-weight <i>penalty-weight</i>] no srlg-group <i>group-name</i>
Context	config>router>if-attribute
Description	<p>This command defines a Shared Risk Link Group (SRLG) which can be associated with an IP or MPLS interface.</p> <p>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.</p> <p>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.</p> <p>The user then configures the SRLG membership of an interface. The user can apply SRLGs to an IES, VPRN, network IP, or MPLS interface. A maximum of 64 SRLGs can be applied to a given interface.</p> <p>When SRLGs are applied to MPLS interfaces, CSPF at an LER will exclude the SRLGs of interfaces used by the LSP primary path when computing the path of the secondary path. CSPF at an LER or</p>

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 instance, 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.

A user may specify a penalty weight (**penalty-weight**) associated with an SRLG. This controls the likelihood of paths with links sharing SRLG values with a primary path being used by a bypass or detour LSP. The higher the penalty weight, the less desirable it is to use the link with a given SRLG.

Parameters	<i>group-name</i> — 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 <i>group-value</i> — 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
	penalty-weight <i>penalty-weight</i> — Specifies the integer value of the penalty weight that is assigned to the SRLG group.
	Values 0 — 65535
	Default 0

srlg-group

Syntax	srlg-group <i>group-name</i> [<i>group-name...</i> (up to 5 max)] no srlg-group <i>group-name</i> [<i>group-name...</i> (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. In 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 <i>group-name</i> no exclude-group <i>group-name</i>
Context	config>router>route-next-hop-policy>template
Description	<p>This command configures the admin group constraint into the route next-hop policy template.</p> <p>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.</p> <p>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).</p> <p>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.</p> <p>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.</p> <p>If the same group name is part of both include and exclude statements, the exclude statement will win. In other words, the exclude statement can be viewed as having an implicit preference value of zero (0).</p> <p>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.</p>
Parameters	<i>group-name</i> — 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	<p>This command configures the SRLG constraint into the route next-hop policy template.</p> <p>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 SRLGs of the outgoing interface used by the primary next-hop.</p> <p>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.</p>

protection-type

Syntax	protection-type {link node} no protection-type
Context	config>router>route-next-hop-policy>template
Description	<p>This command configures the protection type constraint into the route next-hop policy template.</p> <p>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.</p> <p>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.</p> <p>The no form deletes the protection type constraint from the route next-hop policy template.</p>
Parameters	<p>{link node} — Specifies the two possible values for the protection type.</p> <p>Default node</p>

nh-type

Syntax	nh-type {ip tunnel} no nh-type
Context	config>router>route-next-hop-policy>template
Description	<p>This command configures the next-hop type constraint into the route next-hop policy template.</p> <p>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.</p> <p>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.</p> <p>The no form deletes the next-hop type constraint from the route next-hop policy template.</p>
Parameters	<p>{ip tunnel} — Specifies the two possible values for the next-hop type.</p> <p>Default ip</p>

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 IGP 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 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 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	<p>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:</p> <ol style="list-style-type: none">1.user-defined IPv4 filter entries2.flowspec-derived filter entries3.user-defined IPv4 filter default-action <p>The no form of the command removes IPv4 flowspec filtering from the network IP interface.</p>
Default	No network interfaces have IPv4 flowspec enabled.

flowspec-ipv6

Syntax	[no] flowspec
Context	config>router>interface>ingress

Description	<p>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:</p> <ol style="list-style-type: none"> 1.user-defined IPv6 filter entries 2.flowspec-derived filter entries 3.user-defined IPv6 filter default-action <p>The no form of the command removes IPv6 flowspec filtering from the network IP interface.</p>
Default	No network interfaces have IPv6 flowspec enabled.

filter

Syntax	<p>filter ip <i>ip-filter-id</i> filter ipv6 <i>ipv6-filter-id</i> no filter [ip <i>ip-filter-ip</i>] [ipv6 <i>ipv6-filter-id</i>]</p>
Context	<p>config>router>if>ingress config>router>if>egress</p>
Description	<p>This command associates an IP filter policy with an IP interface.</p> <p>Filter policies control packet forwarding and dropping based on IP match criteria.</p> <p>The <i>ip-filter-id</i> must have been pre-configured before this filter command is executed. If the filter ID does not exist, an error occurs.</p> <p>Only one filter ID can be specified.</p> <p>The no form of the command removes the filter policy association with the IP interface.</p>
Default	No filter is specified.
Parameters	<p>ip <i>ip-filter-id</i> — 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.</p> <p>Values 1 — 16384</p> <p>ipv6 <i>ipv6-filter-id</i> — 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.</p> <p>Values 1 — 65535</p>

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	<p>This command enables responses to ICMP mask requests on the router interface.</p> <p>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.</p> <p>The no form of the command disables replies to ICMP mask requests on the router interface.</p>
Default	mask-reply — Replies to ICMP mask requests.

redirects

Syntax	redirects [<i>number seconds</i>] no redirects
Context	config>router>if>icmp
Description	<p>This command enables and configures the rate for ICMP redirect messages issued on the router interface.</p> <p>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.</p> <p>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 <i>number</i> and <i>time</i> parameters by indicating the maximum number of redirect messages that can be issued on the interface for a given time interval.</p> <p>By default, generation of ICMP redirect messages is enabled at a maximum rate of 100 per 10 second time interval.</p> <p>The no form of the command disables the generation of ICMP redirects on the router interface.</p>

Default	redirects 100 10 — Maximum of 100 redirect messages in 10 seconds.
Parameters	<p><i>number</i> — The maximum number of ICMP redirect messages to send, expressed as a decimal integer. This parameter must be specified with the <i>time</i> parameter.</p> <p>Values 10 — 1000</p> <p><i>seconds</i> — The time frame, in seconds, used to limit the <i>number</i> of ICMP redirect messages that can be issued, expressed as a decimal integer.</p> <p>Values 1 — 60</p>

tll-expired

Syntax	tll-expired [<i>number seconds</i>] no tll-expired
Context	config>router>if>icmp
Description	<p>This command configures the rate that Internet Control Message Protocol (ICMP) Time To Live (TTL) expired messages are issued by the IP interface.</p> <p>By default, generation of ICMP TTL expired messages is enabled at a maximum rate of 100 per 10 second time interval.</p> <p>The no form of the command disables the generation of TTL expired messages.</p>
Default	tll-expired 100 10 — Maximum of 100 TTL expired message in 10 seconds.
Parameters	<p><i>number</i> — The maximum number of ICMP TTL expired messages to send, expressed as a decimal integer. The <i>seconds</i> parameter must also be specified.</p> <p>Values 10 — 1000</p> <p><i>seconds</i> — The time frame, in seconds, used to limit the <i>number</i> of ICMP TTL expired messages that can be issued, expressed as a decimal integer.</p> <p>Values 1 — 60</p>

unreachables

Syntax	unreachables [<i>number seconds</i>] no unreachables
Context	config>router>if>icmp
Description	<p>This command enables and configures the rate for ICMP host and network destination unreachable messages issued on the router interface.</p> <p>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 <i>number</i> and <i>seconds</i> parameters by indicating the maximum number of destination unreachable messages that can be issued on the interface for a given time interval.</p>

By default, generation of ICMP destination unreachable 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 unreachable on the router interface.

Default unreachable 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 { <i>ipv6-address/prefix-length</i> } [eui-64] no address { <i>ipv6-address/prefix-length</i> }		
Context	config>router>if>ipv6		
Description	This command assigns an IPv6 address to the interface.		
Default	none		
Parameters	<i>ipv6-address/prefix-length</i> — Specify the IPv6 address on the interface.		
	Values	ipv6-address/prefix:	ipv6-address x:x:x:x:x:x:x (eight 16-bit pieces) 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 specified 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 specified 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 [<i>number seconds</i>] 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	<i>number</i> — Limits the number of redirects issued per the time frame specified in <i>seconds</i> parameter. Values 10 — 1000 <i>seconds</i> — 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 [<i>number seconds</i>] no time-exceeded
Context	config>router>if>ipv6>icmp6
Description	This command configures rate for ICMPv6 time-exceeded messages.
Parameters	<i>number</i> — Limits the number of time-exceeded messages issued per the time frame specified in <i>seconds</i> parameter. Values 10 — 1000 <i>seconds</i> — 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 [<i>number seconds</i>] 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**]

Context config>router>if>ipv6
config>service>ies>if>ipv6
config>service>vprn>if>ipv6

Description This command configures the IPv6 link local address.

The **no** form of the command removes the configured link local address, and the router automatically generates a default link local address.

Note that removing a manually configured link local address may impact routing protocols or static routes that have a dependency on that address. It is not recommended to remove a link local address when there are active IPv6 subscriber hosts on an IES or VPRN interface.

Parameters **preferred** — Disables duplicated address detection and sets the address to preferred, even if there is a duplicate 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.

neighbor

Syntax **neighbor** [*ipv6-address*] [*mac-address*]
no neighbor [*ipv6-address*]

Context	config>router>if>ipv6
Description	This command configure a proxy neighbor discovery policy for the interface.
Parameters	<i>policy-name</i> — 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.

Router Interface DHCP Commands

dhcp

Syntax	dhcp
Context	config>router>if
Description	This command enables the context to configure DHCP parameters.

gi-address

Syntax	gi-address <i>ip-address</i> [<i>src-ip-addr</i>] no gi-address
Context	config>router>if>dhcp
Description	This command configures the gateway interface address for the DHCP relay. The GI address is needed, when the router functions as a DHCP relay, to distinguish between the different subscriber interfaces and potentially between the group interfaces defined.
Default	no gi-address
Parameters	<i>ip-address</i> — Specifies the host IP address to be used for DHCP relay packets. <i>src-ip-address</i> — Specifies the source IP address to be used for DHCP relay packets.

option

Syntax	[no] option
Context	config>router>if>dhcp
Description	This command enables DHCP Option 82 (Relay Agent Information Option) parameters processing and enters the context for configuring Option 82 sub-options. The no form of this command returns the system to the default.
Default	no option

action

Syntax	action {replace drop keep} no action
Context	config>router>if>dhcp>option

Description	<p>This command configures the processing required when the SR-Series router receives a DHCP request that already has a Relay Agent Information Option (Option 82) field in the packet.</p> <p>The no form of this command returns the system to the default value.</p>
Default	<p>Per RFC 3046, <i>DHCP Relay Agent Information Option</i>, section 2.1.1, <i>Reforwarded DHCP requests</i>, the default is to keep the existing information intact. The exception to this is if the giaddr of the received packet is the same as the ingress address on the router. In that case the packet is dropped and an error is logged.</p>
Parameters	<p>replace — In the upstream direction (from the user), the existing Option 82 field is replaced with the Option 82 field from the router. In the downstream direction (towards the user) the Option 82 field is stripped (in accordance with RFC 3046).</p> <p>drop — The packet is dropped, and an error is logged.</p> <p>keep — The existing information is kept in the packet and the router does not add any additional information. In the downstream direction the Option 82 field is not stripped and is sent on towards the client.</p> <p>The behavior is slightly different in case of Vendor Specific Options (VSOs). When the keep parameter is specified, the router will insert his own VSO into the Option 82 field. This will only be done when the incoming message has already an Option 82 field.</p> <p>If no Option 82 field is present, the router will not create the Option 82 field. In this in that case, no VSO will be added to the message.</p>

circuit-id

Syntax	<p>circuit-id [ascii-tuple ifindex sap-id vlan-ascii-tuple] no circuit-id</p>
Context	<p>config>router>if>dhcp>option</p>
Description	<p>When enabled, the router sends the interface index (If Index) in the circuit-id suboption of the DHCP packet. The If Index of a router interface can be displayed using the command show>router>interface>detail. This option specifies data that must be unique to the router that is relaying the circuit.</p> <p>If disabled, the circuit-id suboption of the DHCP packet will be left empty.</p> <p>The no form of this command returns the system to the default.</p>
Default	<p>circuit-id</p>
Parameters	<p>ascii-tuple — Specifies that the ASCII-encoded concatenated tuple will be used which consists of the access-node-identifier, service-id, and interface-name, separated by “ ”.</p> <p>ifindex — Specifies that the interface index will be used. The If Index of a router interface can be displayed using the command show>router>interface>detail.</p> <p>sap-id — Specifies that the SAP ID will be used.</p> <p>vlan-ascii-tuple — Specifies that the format will include VLAN-id and dot1p bits in addition to what is included in ascii-tuple already. The format is supported on dot1q and qinq ports only. Thus,</p>

when the Option 82 bits are stripped, dot1p bits will be copied to the Ethernet header of an outgoing packet.

remote-id

Syntax	remote-id [mac string <i>string</i>] no remote-id
Context	config>router>if>dhcp>option
Description	When enabled, the router sends the MAC address of the remote end (typically the DHCP client) in the remote-id suboption of the DHCP packet. This command identifies the host at the other end of the circuit. If disabled, the remote-id suboption of the DHCP packet will be left empty. The no form of this command returns the system to the default.
Default	remote-id
Parameters	mac — This keyword specifies the MAC address of the remote end is encoded in the suboption. string <i>string</i> — Specifies the remote-id.

vendor-specific-option

Syntax	[no] vendor-specific-option
Context	config>router>if>dhcp>option
Description	This command configures the Alcatel-Lucent vendor specific suboption of the DHCP relay packet.

client-mac-address

Syntax	[no] client-mac-address
Context	config>router>if>dhcp>option
Description	This command enables the sending of the MAC address in the Alcatel-Lucent vendor specific suboption of the DHCP relay packet. The no form of the command disables the sending of the MAC address in the Alcatel-Lucent vendor specific suboption of the DHCP relay packet.

pool-name

Syntax	[no] pool-name
Context	config>router>if>dhcp>option>vendor-specific-option

Description This command enables the sending of the pool name in the Alcatel vendor-specific suboption of the DHCP relay packet.
The **no** form of the command disables the feature.

port-id

Syntax **[no] port-id**

Context config>router>if>dhcp>option>vendor-specific-option

Description This command enables sending of the port-id in the Alcatel vendor specific suboption of the DHCP relay packet
The **no** form of the command disables the sending.

service-id

Syntax **[no] service-id**

Context config>router>if>dhcp>option>vendor-specific-option

Description This command enables the sending of the service ID in the Alcatel-Lucent vendor specific suboption of the DHCP relay packet.
The **no** form of the command disables the sending of the service ID in the Alcatel-Lucent vendor specific suboption of the DHCP relay packet.

string

Syntax **[no] string *text***

Context config>router>if>dhcp>option>vendor-specific-option

Description This command specifies the vendor specific suboption string of the DHCP relay packet.
The **no** form of the command returns the default value.

Parameters *text* — The string can be any combination of ASCII characters up to 32 characters in length. If spaces are used in the string, enclose the entire string in quotation marks (“ ”).

system-id

Syntax **[no] system-id**

Context config>router>if>dhcp>option>vendor-specific-option

Description	This command specifies whether the system-id is encoded in the Alcatel-Lucent vendor specific sub-option of Option 82.
Default	None

relay-plain-bootp

Syntax	[no] relay-plain-bootp
Context	config>router>if>dhcp
Description	This command enables the relaying of plain BOOTP packets. The no form of the command disables the relaying of plain BOOTP packets.

server

Syntax	server server1 [server2...(up to 8 max)]
Context	config>router>if>dhcp
Description	This command specifies a list of servers where requests will be forwarded. The list of servers can entered as either IP addresses or fully qualified domain names. There must be at least one server specified for DHCP relay to work. If there are multiple servers then the request is forwarded to all of the servers in the list. There can be a maximum of 8 DHCP servers configured. The flood command is applicable only in the VPLS case. There is a scenario with VPLS where the VPLS node only wants to add Option 82 information to the DHCP request to provider per-subscriber information, but it does not do full DHCP relay. In this case, the server is set to "flood". This means the DHCP request is still a broadcast and is sent through the VPLS domain. A node running at L3 further upstream then can perform the full L3 DHCP relay function.
Default	no server
Parameters	<i>server</i> — Specifies the DHCP server IP address.

trusted

Syntax	[no] trusted
Context	config>router>if>dhcp
Description	According to RFC 3046, <i>DHCP Relay Agent Information Option</i> , a DHCP request where the giaddr is 0.0.0.0 and which contains a Option 82 field in the packet, should be discarded, unless it arrives on a "trusted" circuit. If trusted mode is enabled on an IP interface, the relay agent (the SR-Series) will modify the request's giaddr to be equal to the ingress interface and forward the request. Note that this behavior only applies when the action in the Relay Agent Information Option is "keep". In the case where the Option 82 field is being replaced by the relay agent (action = "replace"), the

original Option 82 information is lost anyway, and there is thus no reason for enabling the trusted option.

The **no** form of this command returns the system to the default.

Default not enabled

python-policy

Syntax **python-policy** *name*
no python-policy

Context config>router>if>dhcp

Description This command specifies a python policy. Python policies are configured in the **config>python>python-policy** *name* context.

Parameters *name* — Specifies the name of an existing python script up to 32 characters in length.

Router Advertisement Commands

router-advertisement

Syntax	[no] router-advertisement
Context	config>router
Description	<p>This command configures router advertisement properties. By default, it is disabled for all IPv6 enabled interfaces.</p> <p>The no form of the command disables all IPv6 interface. However, the no interface <i>interface-name</i> command disables a specific interface.</p>
Default	disabled

dns-options

Syntax	[no] dns-options
Context	config>router>router-advertisement config>router>router-advertisement>interface
Description	<p>This command enables the context for configuration of DNS information for Stateless Address Auto-Configuration (SLAAC) hosts.</p> <p>When specified at the router-advertisement level in the routing context, this command allows configuration of service-wide parameters. These can then be inherited at the interface level by specifying the config>router>router-advertisement>interface>dns-options>include-dns command.</p> <p>The no form of the command disables configuration of DNS information for Stateless Address Auto-Configuration (SLAAC) hosts.</p>
Default	disabled

dns-servers

Syntax	server <i>ipv6-address</i> no server
Context	config>router>router-advertisement>dns-options config>router>router-advertisement>interface>dns-options
Description	<p>This command specifies the IPv6 DNS servers to include in the RDNSS option in Router Advertisements. When specified at the router advertisement level this applies to all interfaces that have include-dns enabled, unless the interfaces have more specific dns-options configured.</p>
Default	none

Parameters *ipv6-address* — Specify the IPv6 address of the DNS server(s), up to 4 max. Specified as eight 16-bit hexadecimal pieces.

include-dns

Syntax **[no] include-dns**

Context config>router>router-advertisement>interface>dns-options

Description This command enables the Recursive DNS Server (RDNSS) Option in router advertisements. This must be enabled for each interface on which the RDNSS option is required in router advertisement messages.

 The **no** form of the command disables the RDNSS option in router advertisements.

Default disabled

rdnss-lifetime

Syntax **rdnss-lifetime {seconds | infinite}**
no rdnss-lifetime

Context config>router>router-advertisement>dns-options
 config>router>router-advertisement>interface>dns-options

Description This command specifies the maximum time that the RDNSS address may be used for name resolution by the client. The RDNSS Lifetime must be no more than twice MaxRtrAdvLifetime with a maximum of 3600 seconds.

Default infinite

Parameters **infinite** — specifies an infinite RDNSS lifetime.
 seconds — Specifies the time in seconds.

Values 4— 3600

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 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. .

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	<i>seconds</i> — 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	<i>mtu-bytes</i> — 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, <i>Stateless Dynamic Host Configuration Protocol (DHCP) for IPv6</i> .
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 (eight 16-bit pieces)
		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.

Router Advertisement Commands

Default	604800
Parameters	<i>seconds</i> — 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 { <i>seconds</i> 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	<i>seconds</i> — 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 <i>milli-seconds</i> 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	<i>milli-seconds</i> — Specifies the length of time the router should be considered reachable. Values 0 — 3600000

retransmit-time

Syntax	retransmit-timer <i>milli-seconds</i> 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	<i>milli-seconds</i> — Specifies how often the retransmission should occur.
Values	0 — 1800000

router-lifetime

Syntax	router-lifetime <i>seconds</i> no router-lifetime
Context	config>router>router-advert>if
Description	This command sets the router lifetime.
Default	1800
Parameters	<i>seconds</i> — 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	<p>This command enables sending router advertisement messages using the VRRP virtual MAC address, provided that the virtual router is currently the master.</p> <p>If the virtual router is not the master, no router advertisement messages are sent.</p> <p>The no form of the command disables sending router advertisement messages.</p>
Default	no use-virtual-mac

Show Commands

aggregate

Syntax	aggregate [<i>family</i>] [active]
Context	show>router
Description	This command displays aggregate routes.
Parameters	<i>family</i> — 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 [<i>ip-int-name</i> <i>ip-address/mask</i> mac <i>ieee-mac-address</i> 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	<i>ip-address/mask</i> — Only displays ARP entries associated with the specified IP address and mask. <i>ip-int-name</i> — Only displays ARP entries associated with the specified IP interface name. mac <i>ieee-mac-addr</i> — 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-3-121.1.1.3.3      Up (3)
    121.1.3.2          ospf2             N/A       N/A       cpm-np
ies-3-122.1.4.3      Up (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
Protocols      : static
Rx Interval    : 10
Multiplier     : 3
Up Time        : 1d 19:03:28
Down Time      : None
Oper State     : Up (3)
Tx Interval    : 10
Echo Interval  : 0
Up Transitions : 2
Down Transitions : 1
Version Mismatch : 0

Forwarding Information
Local Discr    : 19269
Local Diag     : 0 (None)
Local Min Tx   : 10
Last Sent (ms) : 6
Type           : cpm-np
Remote Discr   : 5101
Remote Diag    : 0 (None)
Remote Min Tx  : 1000
Last Recv (ms) : 367
Local State    : Up (3)
Local Mode     : Async
Local Mult     : 3
Local Min Rx   : 10
Remote State   : Up (3)
Remote Mode    : Async
Remote Mult    : 3
Remote Min Rx  : 10
=====
*A:Dut-C#
```

bfd-template

Syntax	bfd-template <i>template-name</i>
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

```

Show Commands

```
=====
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

```

Show Commands

```
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 [<i>ip-int-name</i> <i>ip-address</i>]
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
```

Show Commands

```
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#
*A:Dut-C# show router ecmp

=====
Router ECMP
=====
Instance      Router Name      ECMP      Max-ECMP-      Weight ECMP
              Rtes
-----
1             Base             True      32             True
=====
```

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 linecard.

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 (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)
```

Show Commands

```
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
  vprnl:mda-1-1
20.12.0.44/32                                STATIC
  vprnl:mda-2-1
20.12.0.45/32                                STATIC
  vprnl:mda-2-2
20.12.0.46/32                                STATIC
  vprnl:mda-3-1
100.0.0.1/32                                TMS
  vprnl:mda-1-1
  vprnl:mda-3-1
138.203.71.202/32                            STATIC
  10.12.0.2 (itfToArborCP_02)
```

```
-----
Total Entries : 15
-----
=====
```



```
*A:Dut-C>config>router>mpls>lsp# show router fib 1 5.3.0.1/32 extensive
```

```
=====
FIB Display (Router: Base)
=====
```

```
Dest Prefix      : 5.3.0.1/32
Protocol         : BGP
Indirect Next-Hop : 10.0.0.1
  QoS            : Priority=n/c, FC=n/c
  Source-Class   : 0
  Dest-Class     : 0
  ECMP-Weight    : 1
Resolving Next-Hop : 1.0.0.2 (RSVP tunnel:115)
  ECMP-Weight    : 1
Resolving Next-Hop : 1.0.0.2 (RSVP tunnel:61443)
  ECMP-Weight    : 1
Indirect Next-Hop : 10.0.0.2
  QoS            : Priority=n/c, FC=n/c
  Source-Class   : 0
  Dest-Class     : 0
  ECMP-Weight    : 30
Resolving Next-Hop : 1.0.0.3 (RSVP tunnel:94)
  ECMP-Weight    : 20
Resolving Next-Hop : 1.0.0.3 (RSVP tunnel:61442)
  ECMP-Weight    : 1
```

```
=====
Total Entries : 1
=====
```

```
*A:Dut-C> show router fib 1 10.0.0.2/32 extensive
```

```
=====
FIB Display (Router: Base)
=====
```

```
Dest Prefix      : 10.0.0.2/32
Protocol         : OSPF
Next-Hop         : 1.0.0.3 (RSVP tunnel:94)
  QoS            : Priority=n/c, FC=n/c
  Source-Class   : 0
  Dest-Class     : 0
  ECMP-Weight    : 20
Next-Hop         : 1.0.0.3 (RSVP tunnel:61442)
  QoS            : Priority=n/c, FC=n/c
  Source-Class   : 0
  Dest-Class     : 0
  ECMP-Weight    : 1
```

```
=====
Total Entries : 1
=====
```

```
*A:Dut-C> show router route-table 10.1.0.5/32 extensive
```

```
=====
Route Table (Router: Base)
=====
```

```
Dest Prefix      : 10.1.0.5/32
Protocol         : STATIC
Age              : 00h01m37s
Preference       : 5
Next-Hop         : 1.0.0.2 (RSVP tunnel:128)
  QoS            : Priority=n/c, FC=n/c
```

Show Commands

```
Source-Class      : 0
Dest-Class        : 0
Metric            : 1
ECMP-Weight       : 10
Next-Hop          : 1.0.0.2 (RSVP tunnel:132)
QoS               : Priority=n/c, FC=n/c
Source-Class      : 0
Dest-Class        : 0
Metric            : 1
ECMP-Weight       : 1
-----
No. of Destinations: 1
=====

*A:Dut-C> show router fib 1 10.1.0.5/32 extensive

=====
FIB Display (Router: Base)
=====
Dest Prefix      : 10.1.0.5/32
Protocol         : STATIC
Next-Hop         : 1.0.0.2 (RSVP tunnel:128)
QoS              : Priority=n/c, FC=n/c
Source-Class     : 0
Dest-Class       : 0
ECMP-Weight      : 10
Next-Hop         : 1.0.0.2 (RSVP tunnel:132)
QoS              : Priority=n/c, FC=n/c
Source-Class     : 0
Dest-Class       : 0
ECMP-Weight      : 1
=====
Total Entries : 1
=====

*A:Dut-B# show router fib 1 10.15.1.0/24

=====
FIB Display
=====
Prefix [Flags]                                Protocol
NextHop
-----
10.15.1.0/24                                BGP
  10.20.1.3 (Transport:SR)
-----
Total Entries : 1
-----
=====

*A:Dut-B# show router fib 1 10.15.1.0/24 extensive

=====
FIB Display (Router: Base)
=====
Dest Prefix      : 10.15.1.0/24
Protocol         : BGP
```

```
Installed          : Y
Indirect Next-Hop  : 10.20.1.3
Label              : 262123
QoS                : Priority=n/c, FC=n/c
Source-Class       : 0
Dest-Class         : 0
ECMP-Weight        : 1
Resolving Next-Hop : 10.20.1.3 (SR tunnel)
ECMP-Weight        : 1
=====
Total Entries : 1
=====
```

fp-tunnel-table

Syntax	fp-tunnel-table <i>slot-number</i> [<i>ip-prefix/prefix-length</i>]														
Context	show>router														
Description	<p>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:</p> <ul style="list-style-type: none">• BGP shortcut (configure>router>bgp>next-hop-resolution>shortcut-tunnel)• IGP shortcut (config>router>isis[ospf]>rsvp-shortcut)• IGP prefix resolved to an LDP LSP (config>router>ldp-shortcut)• Static route resolved to a LDP or RSVP LSP• VPRN auto-bind• 6PE/6VPE.														
Parameters	<p><i>slot-number</i> — Displays information for the specified slot.</p> <p>Values 1 — 10</p> <p><i>ip-prefix[/prefix-length]</i> — Displays routes only matching the specified ip-address and length.</p> <p>Values</p> <table><tr><td>ipv4-prefix:</td><td>a.b.c.d (host bits must be set to 0)</td></tr><tr><td>ipv4-prefix-length:</td><td>0 — 32</td></tr><tr><td>ipv6 ipv6-prefix[/pref*]:</td><td>x:x:x:x:x:x:x (eight 16-bit pieces)</td></tr><tr><td></td><td>x:x:x:x:x:d.d.d.d</td></tr><tr><td></td><td>x: [0 — FFFF]H</td></tr><tr><td></td><td>d: [0 — 255]D</td></tr><tr><td>prefix-length:</td><td>1 — 128ipv6</td></tr></table>	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 (eight 16-bit pieces)		x:x:x:x:x:d.d.d.d		x: [0 — FFFF]H		d: [0 — 255]D	prefix-length:	1 — 128ipv6
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 (eight 16-bit pieces)														
	x:x:x:x:x:d.d.d.d														
	x: [0 — FFFF]H														
	d: [0 — 255]D														
prefix-length:	1 — 128ipv6														

Sample Output

```
*A:Dut-B# show router fp-tunnel-table 1 10.20.1.3/32

=====
Tunnel Table Display

Legend:
B - FRR Backup
=====
Destination                                Protocol  Tunnel-ID
  Lbl                NextHop          Intf/Tunnel
-----
10.20.1.3/32
    262137            10.2.1.3          1/1/3:1          LDP          -
10.20.1.3/32
    262133            10.2.1.3          1/1/3:1          RSVP          1
10.20.1.3/32
    18602             10.2.1.3          1/1/3:1          SR-ISIS-0     -
10.20.1.3/32
                                SR-OSPF-0     -
```

```

19102          10.2.1.3          1/1/3:1
-----
Total Entries : 4
-----
=====
*A:Dut-B#

*A:Dut-C# show router fp-tunnel-table 1

=====
Tunnel Table Display

Legend:
B - FRR Backup
=====
Destination          NextHop          Intf/Tunnel      Protocol  Tunnel-ID
-----
4.0.0.1/32
    20001             1.3.4.4          2/1/3:1          SR-ISIS-0  -
    20001/21005        1.2.3.2 (B)      1/1/2            SR-ISIS-0  -
10.20.1.2/32
    21002             1.2.3.2          1/1/2            SR-ISIS-0  -
    21002/21005        1.3.4.4 (B)      2/1/3:1          SR-ISIS-0  -
10.20.1.4/32
    21004             1.3.4.4          2/1/3:1          SR-ISIS-0  -
    21004/21005        1.2.3.2 (B)      1/1/2            SR-ISIS-0  -
10.20.1.5/32
    21005             1.2.3.2          1/1/2            SR-ISIS-0  -
    21005             1.3.4.4 (B)      2/1/3:1          SR-ISIS-0  -
-----
Total Entries : 4
-----
=====
*A:Dut-C#

```

```

*A:Dut-C# show router fp-tunnel-table 1

=====
Tunnel Table Display

Legend:
B - FRR Backup
=====
Destination          NextHop          Intf/Tunnel      Protocol  Tunnel-ID
-----
1.1.3.1/32
    3                 1.1.3.1          1/1/1            SR         -
1.2.3.2/32
    3                 1.2.3.2          1/1/2:1          SR         -
1.3.5.5/32
    3                 1.3.5.5          2/1/1            SR         -
2.2.3.2/32
    3                 2.2.3.2          1/1/2:2          SR         -
10.20.1.1/32
    21011             1.1.3.1          1/1/1            SR-OSPF-0  -

```

```

      22011          1.2.3.2(B)          1/1/2:1
10.20.1.2/32          SR-OSPF-0      -
      22022          2.2.3.2            1/1/2:2
      24022/25044     1.3.5.5(B)        2/1/1
10.20.1.4/32          SR-OSPF-0      -
      25044          1.3.5.5            2/1/1
      22044          2.2.3.2            1/1/2:2
10.20.1.5/32          SR-OSPF-0      -
      25055          1.3.5.5            2/1/1
      24055/22044     2.2.3.2(B)        1/1/2:2
10.20.1.6/32          SR-OSPF-0      -
      25066          1.3.5.5            2/1/1
      24066/22044     2.2.3.2(B)        1/1/2:2
-----
Total Entries : 9
-----
=====
*A:Dut-C#
```

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.
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.

Label	Description (Continued)
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#
```

if-attribute

Syntax	if-attribute
Context	show>router
Description	This command enables the context to display interface attribute related information.

srlg-group

Syntax	srlg-group [<i>name</i>]
Context	show>router>if-attribute>srlg-group
Description	This command displays SRLG statistics.
Parameters	<i>name</i> — Only displays entries associated with the specified SRLG name.

Output **SRLG Output** — The following table describes the show router if-attribute srlg-group output fields:

Label	Description
Group Name	The name of the SRLG.
Group Value	The integer value of the SRLG.
Penalty Weight	The penalty weight that is assigned to the SRLG.
No. of Groups	The total number of displayed SRLGs.

Sample Output

```

B:CORE2# show router if-attribute srlg-group
=====
Interface Srlg Groups
=====
Group Name           Group Value  Penalty Weight
-----
1                     1            100
2                     2            200
3                     3            300
-----
No. of Groups: 3
=====
B:CORE2#

```

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.

Label	Description (Continued)
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 Advertise- ments	The number of times the router advertised its location.
Neighbor Adver- tisements	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.

Note: The **show router interface statistics** command also shows the MPLS statistics that are shown in using the **show router mpls interface statistics** command. This allows the operator to see MPLS statistics from interfaces that are not added to MPLS, such as a carrier's network interfaces. See "Sample Output" on page 243 for an example of the MPLS fields that are displayed. These fields are displayed regardless of the state of MPLS.

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.

Label	Description (Continued)
	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	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
```

Show Commands

```
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
                                           ICMP Mask Reply   : True

IP Oper MTU      : 1500
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
  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

```

Show Commands

```

    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.
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.

Label	Description (Continued)
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:bksiml619# show router interface "to-siml621" detail
=====
Interface Table (Router: Base)
=====
-----
Interface
-----
If Name           : to-siml621
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.

Show Commands

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
Mpls Rx Pkts      : 0                               Mpls Rx Bytes     : 0
Mpls Tx Pkts      : 0                               Mpls Tx Bytes     : 0

```

```

=====
* indicates that the corresponding row element may have been truncated.

*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
HoldUp-Time       : 0
Track Srrp Inst   : 0
IPv6 Addr         : FE80::200:FF:FE00:3/64
-----
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
ICMP Mask Reply   : True
IP Oper MTU       : 1500
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
Rx Pkts           : N/A
Rx V4 Pkts        : N/A
Rx V6 Pkts        : N/A
Tx Pkts           : 0
Tx V4 Pkts        : 0
Oper (v4/v6)      : Up/Up
Rx Bytes          : N/A
Rx V4 Bytes       : N/A
Rx V6 Bytes       : N/A
Tx Bytes          : 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.

Label	Description (Continued)
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
=====
```

Detailed IPv6 Interface Output — The following is an example of the IPv6 interface detailed output.

Sample Output

```
*A:ALA-A# show router interface ipv6 detail
=====
Interface Table (Router: Base)
=====
-----
Interface
-----
If Name       : gig-1/1/1
Admin State   : Up                               Oper (v4/v6)   : Up/Up
Protocols     : None
IPv6 Addr     : fe80::da24:ffff:fe00:0/64          PREFERRED
-----
Details
-----
Description    : (Not Specified)
If Index       : 2                               Virt. If Index  : 2
Last Oper Chg  : 05/12/2014 15:22:37             Global If Index : 1
Lag Link Map Prof: none
Port Id       : 1/1/1:0
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                          Network QoS Policy: 1
MAC Address    : d8:5d:01:01:00:01               Mac Accounting  : Disabled
Ingress stats  : Disabled                       IPv6 DAD        : Enabled
TCP MSS V4     : 0                             TCP MSS V6      : 0
ARP Timeout    : 14400s                        IPv6 Nbr ReachTime: 30s
ARP Retry Timer : 5000ms                       IPv6 stale time  : 14400s
ARP Limit      : Disabled                      IPv6 Nbr Limit   : Disabled
ARP Threshold  : Disabled                      IPv6 Nbr Threshold: Disabled
ARP Limit Log On*: Disabled                   IPv6 Nbr Log Only : Disabled
IP MTU         : (default)
```

```
IP Oper MTU      : 1500          ICMP Mask Reply  : True
ARP Populate     : Disabled
<trimmed for brevity>
```

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: U - Label In Use,  N - Label Not In Use, W - Label Withdrawn
        WP - Label Withdraw Pending, BU - Alternate For Fast Re-Route
        (S) - Static           (M) - Multi-homed Secondary Support
        (B) - BGP Next Hop (BU) - Alternate Next-hop for Fast Re-Route
=====
LDP IPv4 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 IPv4 Prefix Active Bindings: 10
=====
=====
```

```

LDP IPv6 Prefix Bindings (Active)
=====
Prefix                               Op           IngLbl      EgrLbl
EgrNextHop                          EgrIf/LspId
-----
No Matching Entries Found
=====

LDP Generic IPv4 P2MP Bindings (Active)
=====
P2MP-Id                             Interface
RootAddr                           Op           IngLbl      EgrLbl
EgrNH                              EgrIf/LspId
-----
No Matching Entries Found
=====

LDP Generic IPv6 P2MP Bindings (Active)
=====
P2MP-Id                             Interface
RootAddr                           Op           IngLbl      EgrLbl
EgrNH                              EgrIf/LspId
-----
No Matching Entries Found
=====

LDP In-Band-SSM IPv4 P2MP Bindings (Active)
=====
Source
Group                               Interface
RootAddr                           Op           IngLbl      EgrLbl
EgrNH                              EgrIf/LspId
-----
No Matching Entries Found
=====

LDP In-Band-SSM IPv6 P2MP Bindings (Active)
=====
Source
Group                               Interface
RootAddr                           Op           IngLbl      EgrLbl
EgrNH                              EgrIf/LspId
-----
No Matching Entries Found
=====

LDP In-Band-VPN-SSM IPv4 P2MP Bindings (Active)
=====
Source
Group                               RD           Op
RootAddr                           Interface    IngLbl      EgrLbl
EgrNH                              EgrIf/LspId
-----
No Matching Entries Found

```

```

=====
LDP In-Band-VPN-SSM IPv6 P2MP Bindings (Active)
=====
Source
Group                                RD                Op
RootAddr                            Interface          IngLbl    EgrLbl
EgrNH                               EgrIf/LspId
-----
No Matching Entries Found
=====

```

*A:Dut-A# show router ldp bindings

```

=====
LDP Bindings (IPv4 LSR ID 1.1.1.1:0)
(IPv6 LSR ID ::[0])
=====
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 For Fast Re-Route, TLV - (Type, Length: Value)
=====
LDP IPv4 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 IPv4 Prefix Bindings: 12
=====

```

```

=====
LDP IPv6 Prefix Bindings
=====
Prefix                IngLbl                EgrLbl
Peer                  EgrIntf/LspId
EgrNextHop
-----
No Matching Entries Found
=====

```

LDP Generic IPv4 P2MP Bindings

=====			
P2MP-Id	Interface	IngLbl	EgrLbl
RootAddr	EgrIf/LspId		
EgrNH			
Peer			

100			
1.1.1.1	Unknw	--	131051
90.90.90.2	1/1/6		
2.2.2.2:0			
104			
1.1.1.1	Unknw	--	131050
90.90.90.2	1/1/6		
2.2.2.2:0			
600			
1.1.1.1	Unknw	--	131049
90.90.90.2	1/1/6		
2.2.2.2:0			
700			
1.1.1.1	Unknw	--	131048
90.90.90.2	1/1/6		
2.2.2.2:0			
800			
1.1.1.1	Unknw	--	131047
90.90.90.2	1/1/6		
2.2.2.2:0			
900			
1.1.1.1	Unknw	--	131046
90.90.90.2	1/1/6		
2.2.2.2:0			
1500			
1.1.1.1	Unknw	--	131045
90.90.90.2	1/1/6		
2.2.2.2:0			
100			
6.6.6.6	Unknw	--	131044
90.90.90.2	1/1/6		
2.2.2.2:0			
900			
6.6.6.6	Unknw	--	131043
90.90.90.2	1/1/6		
2.2.2.2:0			

 No. of Generic IPv4 P2MP Bindings: 9
 =====

LDP Generic IPv6 P2MP Bindings

```
P2MP-Id
RootAddr          Interface      IngLbl   EgrLbl
EgrNH             EgrIf/LspId
Peer
-----
No Matching Entries Found
=====

=====
LDP In-Band-SSM IPv4 P2MP Bindings
=====
Source
Group
RootAddr          Interface      IngLbl   EgrLbl
EgrNH             EgrIf/LspId
Peer
-----
No Matching Entries Found
=====

=====
LDP In-Band-SSM IPv6 P2MP Bindings
=====
Source
Group
RootAddr          Interface      IngLbl   EgrLbl
EgrNH             EgrIf/LspId
Peer
-----
No Matching Entries Found
=====

=====
LDP In-Band-VPN-SSM IPv4 P2MP Bindings
=====
Source
Group              RD
RootAddr          Interface      IngLbl   EgrLbl
EgrNH             EgrIf/LspId
Peer
-----
1.1.1.1
225.0.0.1          1.1.1.1:100
3.3.3.3            Unknwn        --        100
60.60.60.1         1/1/1
2.2.2.2:100

1.1.1.1
225.0.0.1          1.1.1.1:100
3.3.3.3            Unknwn        --        100
60.60.60.1         1/1/1
2.2.2.2:100

1.1.1.1
225.0.0.1          1.1.1.1:100
3.3.3.3            Unknwn        --        100
60.60.60.1         1/1/1
2.2.2.2:100
```

```
-----
No. of In-Band-VPN-SSM IPv4 P2MP Bindings: 3
=====
```

```
=====
LDP In-Band-VPN-SSM IPv6 P2MP Bindings
=====
```

Source Group RootAddr EgrNH Peer	RD Interface EgrIf/LspId	IngLbl	EgrLbl
1.1.1.1 225.0.0.1 2000::3000 60.60.60.1 2.2.2.2:100	1.1.1.1:100 Unknwn 1/1/1	--	100
1.1.1.1 225.0.0.1 2000::3000 60.60.60.1 2.2.2.2:100	1.1.1.1:100 Unknwn 1/1/1	--	100
1.1.1.1 225.0.0.1 2000::3000 60.60.60.1 2.2.2.2:100	1.1.1.1:100 Unknwn 1/1/1	--	100

```
-----
No. of In-Band-VPN-SSM IPv6 P2MP Bindings: 3
=====
```

```
=====
LDP Service FEC 128 Bindings
=====
```

Type Peer	VCId SvcId	SDPId	IngLbl EgrLbl	LMTU RMTU
?-Eth 2.2.2.2:0	100 Ukwn	R. Src	-- 131023D	None 986
?-Eth 2.2.2.2:0	500 Ukwn	R. Src	-- 131022D	None 1386
?-Eth 2.2.2.2:0	2001 Ukwn	R. Src	-- 131019D	None 986
?-Eth 2.2.2.2:0	2003 Ukwn	R. Src	-- 131017D	None 986
?-Ipipe 2.2.2.2:0	1800 Ukwn	R. Src	-- 131014D	None 1486

```
-----
No. of VC Labels: 5
=====
```

```
=====
LDP Service FEC 129 Bindings
=====
SAII                               AGII       IngLbl     LMTU
TAII                               Type       EgrLbl     RMTU
Peer                               SvcId      SDPIId
-----
No Matching Entries Found
=====
```

mvpn

Syntax	mvpn
Context	show>router <i>router-instance</i>
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 [<i>ip-int-name</i> <i>ip-address</i> <i>mac ieee-mac-address</i> 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] [<i>network-domain-name</i>]
Context	show>router
Description	This command displays network-domains information.
Parameters	detail — Displays detailed network-domains information. <i>network-domain-name</i> — 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 [<i>family</i>] [<i>ip-prefix[/prefix-length]</i>] [longer exact protocol <i>protocol-name</i>] [all] [next-hop-type <i>type</i>][qos][alternative][accounting-class] route-table [<i>family</i>] summary route-table <i>tunnel-endpoints</i> [ip-prefix[/prefix-length]] [longer exact] [detail] route-table [<family>] [<ip-prefix[/prefix-length]>] [longer exact protocol <protocol-name>] extensive [all]		
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. <i>ip-prefix[/prefix-length]</i> — 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 (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 <i>ip-prefix/mask</i> and routes with longer masks. exact — Displays the exact route matching the <i>ip-prefix/mask</i> 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.

next-hop-type tunneled — Displays only the tunneled next-hops. For each route entry, the tunnel owner and tunnel ID is shown.

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

```

Show Commands

```
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

```

Show Commands

```

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#

*A:Dut-C>config>router>mpls>lsp# show router route-table 10.0.0.2/32 extensive

```

=====
Route Table (Router: Base)
=====
Dest Prefix          : 10.0.0.2/32
  Protocol            : OSPF (1)
  Age                  : 00h02m40s
  Preference          : 150
  Next-Hop             : 1.0.0.3 (RSVP tunnel:94)
    QoS                : Priority=n/c, FC=n/c
    Source-Class       : 0
    Dest-Class         : 0
    Metric              : 10
    ECMP-Weight        : 20
  Next-Hop             : 1.0.0.3 (RSVP tunnel:61442)
    QoS                : Priority=n/c, FC=n/c
    Source-Class       : 0
    Dest-Class         : 0
    Metric              : 10
    ECMP-Weight        : 1
-----

```

No. of Destinations: 1

*A:Dut-C>config>router>static-route-entry>indirect>tunnel-next-hop# show router route-table 10.1.0.5/32 extensive

```

=====
Route Table (Router: Base)
=====
Dest Prefix          : 10.1.0.5/32
  Protocol            : STATIC
  Age                  : 00h00m11s
  Preference          : 5
  Next-Hop             : 1.0.0.2 (RSVP tunnel:128)
    QoS                : Priority=n/c, FC=n/c
    Source-Class       : 0
    Dest-Class         : 0
    Metric              : 1
    ECMP-Weight        : 18
  Next-Hop             : 1.0.0.2 (RSVP tunnel:132)
    QoS                : Priority=n/c, FC=n/c
    Source-Class       : 0
    Dest-Class         : 0
    Metric              : 1

```

```

ECMP-Weight      : 2
Next-Hop         : 1.0.0.3 (RSVP tunnel:94)
  QoS            : Priority=n/c, FC=n/c
  Source-Class   : 0
  Dest-Class     : 0
  Metric         : 1
  ECMP-Weight    : 7
Next-Hop         : 1.0.0.3 (RSVP tunnel:61442)
  QoS            : Priority=n/c, FC=n/c
  Source-Class   : 0
  Dest-Class     : 0
  Metric         : 1
  ECMP-Weight    : 2
-----
No. of Destinations: 1
=====

```

rtr-advertisement

Syntax	rtr-advertisement [<i>interface-name</i>] [prefix <i>ipv6-prefix[/prefix-length]</i>] 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	<i>interface-name</i> — Maximum 32 characters. <i>ipv6-prefix[/prefix-length]</i> — Displays routes only matching the specified ip-address and length.						
Values	<table><tr><td>ipv6</td><td>ipv6-prefix[/pref*:</td><td>x:x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D</td></tr><tr><td></td><td>prefix-length:</td><td>1 — 128</td></tr></table>	ipv6	ipv6-prefix[/pref*:	x:x:x:x:x:x:x:x (eight 16-bit pieces) x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D		prefix-length:	1 — 128
ipv6	ipv6-prefix[/pref*:	x:x:x:x:x:x:x:x (eight 16-bit pieces) 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.

Label	Description (Continued)
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 Inter-val	The maximum interval between sending router advertisement messages.
Managed Config	True — Indicates that DHCPv6 has been configured. 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 Inter-val	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

```

Show Commands

```
-----
Server1          : 2001:db8::1
Server2          : N/A
Server3          : N/A
Server4          : N/A
Rdnss-lifetime   : 1200                Include-dns      : yes
-----

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] <i>[[ip-prefix lmask] [preference preference] [next-hop ip-address] tag tag]</i>
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 (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 (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	<p>BH — The static route is a black hole route. The <i>Nexthop</i> for this type of route is <i>black-hole</i>.</p> <p>ID — The static route is an indirect route, where the <i>nexthop</i> for this type of route is the non-directly connected next hop.</p> <p>NH — The route is a static route with a directly connected next hop. The <i>Nexthop</i> for this type of route is either the next hop IP address or an egress IP interface name.</p>
Next Hop	The next hop for the static route destination.
Protocol	The protocol through which the route was learned.

Label	Description (Continued)
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                                Preference : 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
Interface       : n/a
Prefix List     : n/a
Metric          : 1
Admin State     : Up
BFD             : disabled
CPE-check       : disabled
Nexthop Type    : IP
Active          : Y
Prefix List Type : n/a
Preference      : 5
Tag             : 0
Community       : 100:33
-----
No. of Static Routes: 1
=====

*A:Dut-C> show router static-route 10.1.0.5/32 detail
=====
Static Route Table (Router: Base)  Family: IPv4
=====
Prefix          : 10.1.0.5/32
Nexthop         : 1.0.0.2
Indirect        : Type
Interface       : n/a
Prefix List     : n/a
Metric          : 1
Source Class    : 0
Active          : Y
Prefix List Type : n/a
Preference      : 5
Dest Class      : 0

```

```

Admin State      : Up                               Tag                : 0
Creation Origin  : manual
BFD              : disabled
Community        :
CPE-check        : disabled
Tunnel Resolution: filter                           Disallow-IGP        : disabled
RSVP-TE Tunnels  : enabled                           LDP Tunnels         : 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	<p>false — Addresses in the range are not exclusively for use for service IP addresses.</p> <p>true — Addresses in the range are exclusively for use for service IP addresses and cannot be assigned to network IP interfaces.</p>

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 [<i>app-name</i>] [dscp dot1p]
Context	show>router>sgt-qos
Description	This command displays application QoS settings.
Parameters	<i>app-name</i> — 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 [<i>dscp-name</i>]
Context	show>router>sgt-qos
Description	This command displays DSCP to FC mappings.
Parameters	<i>dscp-name</i> — 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.
<i>service-id</i>	<p><i>state</i> — Current single SFM state</p> <p><i>start</i> — Last time this vRtr went into overload, after having respected the hold-off time</p> <p><i>interval</i> — How long the vRtr remained or is in overload</p>
ICMP Tunneling	<p>No — ICMP tunneling is disabled.</p> <p>Yes — TICMP tunneling is enabled.</p>
VPRN Local TTL Propagate	<p><i>inherit</i> — VPRN instance is to inherit the global configuration</p> <p><i>none</i> — TTL of IP packet is not propagated into the VC or transport label stack</p> <p><i>vc-only</i> — TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack</p> <p><i>al</i> — TTL of the IP packet is propagated into the VC label and all labels in the transport label stack</p>

Label	Description (Continued)
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
```

Show Commands

```
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 following 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 following 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 [<i>ip-address[/mask]</i>] [protocol <i>protocol</i> sdp <i>sdp-id</i>] [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 referring 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	<p><i>ip-address[/mask]</i> — Displays the specified tunnel table's destination IP address and mask.</p> <p>protocol <i>protocol</i> — Displays LDP protocol information.</p> <p>sdp <i>sdp-id</i> — Displays information pertaining to the specified SDP.</p> <p>summary — Displays summary tunnel table information.</p>
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.
CBF Classes	The forwarding classes and/or default-lsp option assigned to this tunnel

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

```

Show Commands

```
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 Number          : 0
Port Path Cost       : 10
Admin Edge           : Disabled
Link Type            : Pt-pt
Root Guard           : Disabled
Last BPDUs from      : N/A
Designated Bridge    : N/A

Port State           : Forwarding
Port Priority         : 128
Auto Edge            : Enabled
Oper Edge            : N/A
BPDUs Encap          : Dot1d
Active Protocol       : N/A
Designated Port Id   : N/A

Fwd Transitions      : 0
Cfg BPDUs rcvd       : 0
TCN BPDUs rcvd       : 0
TC bit BPDUs rcvd    : 0

Bad BPDUs rcvd       : 0
Cfg BPDUs tx          : 0
TCN BPDUs tx         : 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#
```

```
A:Dut-C# show router tunnel-table
```

```
=====
Tunnel Table (Router: Base)
=====
Destination          Owner      Encap TunnelId Pref   Nexthop      Metric
-----
4.0.0.1/32           isis (0)  MPLS  524309    11      1.3.4.4      10
10.20.1.2/32         isis (0)  MPLS  524312    11      1.2.3.2      10
10.20.1.4/32         isis (0)  MPLS  524310    11      1.3.4.4      10
10.20.1.5/32         isis (0)  MPLS  524311    11      1.2.3.2      20
-----
Flags: B = BGP backup route available

```

```

E = inactive best-external BGP route
=====
A:Dut-C#

A:Dut-C# show router tunnel-table detail

=====
Tunnel Table (Router: Base)
=====
Destination      : 7.1.126.2/32
NextHop          : 110.20.1.5
Tunnel Flags     : is-over-tunnel
Age              : 01h27m59s
CBF Classes      : (Not Specified)
Owner            : ldp
Tunnel ID        : 66389
Tunnel Label     : 243909
Tunnel MTU       : 9186
Encap            : MPLS
Preference       : 9
Tunnel Metric    : 1
-----

Destination      : 10.20.1.22/32
NextHop          : 120.1.17.7
Tunnel Flags     : (Not Specified)
Age              : 01h29m15s
CBF Classes      : (Not Specified)
Owner            : rsvp
Tunnel ID        : 13
Tunnel Label     : 249809
Tunnel MTU       : 9190
LSP ID           : 44032
LSP Bandwidth    : 0
Encap            : MPLS
Preference       : 7
Tunnel Metric    : 2000
Bypass Label     : 0
LSP Weight       : 0
-----

Destination      : 10.20.1.22/32
NextHop          : 120.1.18.7
Tunnel Flags     : exclude-for-lfa
Age              : 00h01m47s
CBF Classes      : default-lsp
Owner            : rsvp
Tunnel ID        : 243
Tunnel Label     : 249872
Tunnel MTU       : 9190
LSP ID           : 44032
LSP Bandwidth    : 0
Encap            : MPLS
Preference       : 7
Tunnel Metric    : 2000
Bypass Label     : 0
LSP Weight       : 0
-----

Destination      : 10.20.1.22/32
NextHop          : 120.1.18.7
Tunnel Flags     : exclude-for-lfa
Age              : 00h00m38s
CBF Classes      : af ll ef nc
Owner            : rsvp
Tunnel ID        : 244
Tunnel Label     : 249905
Tunnel MTU       : 9190
LSP ID           : 45568
LSP Bandwidth    : 0
Encap            : MPLS
Preference       : 7
Tunnel Metric    : 2000
Bypass Label     : 0
LSP Weight       : 0
-----

```

```

Destination      : 10.20.1.22/32
NextHop          : 120.1.17.7
Tunnel Flags     : exclude-for-lfa
Age              : 00h00m21s
CBF Classes      : h2
Owner            : RSVP
Tunnel ID        : 245
Tunnel Label     : 250063
Tunnel MTU       : 9190
LSP ID           : 39936
LSP Bandwidth    : 0
Encap            : MPLS
Preference       : 7
Tunnel Metric    : 2000
Bypass Label     : 0
LSP Weight       : 0

```

```

-----
Destination      : 10.20.1.22/32
NextHop          : 120.1.18.7
Tunnel Flags     : exclude-for-lfa
Age              : 01h29m40s
CBF Classes      : ef default-lsp
Owner            : RSVP
Tunnel ID        : 246
Tunnel Label     : 250024
Tunnel MTU       : 9190
LSP ID           : 38400
LSP Bandwidth    : 0
Encap            : MPLS
Preference       : 7
Tunnel Metric    : 2000
Bypass Label     : 0
LSP Weight       : 0

```

```

-----
Destination      : 211.1.0.254/32
NextHop          : 110.20.1.4
Tunnel Flags     : is-over-tunnel
Age              : 01h28m38s
CBF Classes      : (Not Specified)
Owner            : BGP
Tunnel ID        : 264115
Tunnel Label     : 260512
Tunnel MTU       : 9186
Encap            : MPLS
Preference       : 12
Tunnel Metric    : 1000

```

```

-----
Number of tunnel-table entries      : 2866
Number of tunnel-table entries with LFA : 0
=====

```

A:Dut-C#

Clear Commands

router

Syntax	router <i>router-instance</i>
Context	clear>router
Description	This command clears for a the router instance in which they are entered.

Parameters	<i>router-instance</i> — Specify the router name or service ID.		
	Values	<i>router-name:</i>	Base, management, vpls-management
		<i>service-id:</i>	1 — 2147483647
	Default	Base	

arp

Syntax	arp { all <i>ip-addr</i> interface { <i>ip-int-name</i> <i>ip-addr</i> }}
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. <i>ip-addr</i> — Clears the ARP cache entry for the specified IP address. interface <i>ip-int-name</i> — Clears all ARP cache entries for the IP interface with the specified name. interface <i>ip-addr</i> — Clears all ARP cache entries for the specified IP interface with the specified IP address.

bfd

Syntax	bfd src-ip <i>ip-address</i> dst-ip <i>ip-address</i> 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 <i>ip-address</i> dst-ip <i>ip-address</i>
Context	clear>router>bfd
Description	This command clears BFD sessions.
Parameters	src-ip <i>ip-address</i> — Specifies the address of the local endpoint of this BFD session. dst-ip <i>ip-address</i> — Specifies the address of the remote endpoint of this BFD session.

statistics

Syntax	statistics src-ip <i>ip-address</i> dst-ip <i>ip-address</i> statistics all
Context	clear>router>bfd
Description	This command clears BFD statistics.
Parameters	src-ip <i>ip-address</i> — Specifies the address of the local endpoint of this BFD session. dst-ip <i>ip-address</i> — 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 [<i>slot-number</i>]
Context	clear>router
Description	This command clears entries in the forwarding table (maintained by the). If the slot number is not specified, the command forces the route table to be recalculated.
Parameters	<i>slot-number</i> — Clears the specified card slot. Default all linecards

icmp-redirect-route

Syntax	icmp-redirect-route { all <i>ip-address</i> }
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. <i>ip-address</i> — Clears the routes associated with the specified IP address.

icmp6

Syntax	icmp6 all icmp6 global icmp6 interface <i>interface-name</i>
Context	clear>router
Description	This command clears ICMP statistics.
Parameters	all — Clears all statistics. global — Clears global statistics. <i>interface-name</i> — Clears ICMP6 statistics for the specified interface.

interface

Syntax	interface [<i>ip-int-name</i> <i>ip-addr</i>] [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	<i>ip-int-name</i> <i>ip-addr</i> — 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.

statistics

Syntax	statistics [<i>ip-address</i> <i>ip-int-name</i>]
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	<i>ip-address</i> <i>ip-int-name</i> — Displays statistics for the specified IP interface.

Syntax	neighbor { all <i>ip-address</i> } neighbor [interface <i>ip-int-name</i> <i>ip-address</i>]
Context	clear>router
Description	This command clears IPv6 neighbor information.
Parameters	all — Clears IPv6 neighbors. <i>ip-int-name</i> — Clears the specified neighbor interface information. Values 32 characters maximum <i>ip-address</i> — Clears the specified IPv6 neighbors. Values ipv6-address: 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 <i>interface-name</i>]
Context	clear>router
Description	This command clears all router advertisement counters.
Parameters	<i>all</i> — Clears all router advertisement counters for all interfaces. interface <i>interface-name</i> — Clear router advertisement counters for the specified interface.

Debug Commands

destination

Syntax	destination <i>trace-destination</i>
Context	debug>trace
Description	This command specifies the destination to send trace messages.
Parameters	<i>trace-destination</i> — 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 <i>module-name</i>] [type <i>event-type</i>] [class <i>event-class</i>] [task <i>task-name</i>] [function <i>function-name</i>]
Context	debug>trace
Description	This command adds trace points. The no form of the command removes the trace points.

router

Syntax	router <i>router-instance</i>
Context	debug
Description	This command configures debugging for a router instance.
Parameters	<i>router-instance</i> — Specify the router name or service ID. Values <i>router-name:</i> Base, management <i>service-id:</i> 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 [<i>ip-int-name</i>] no icmp6
Context	debug>router>ip
Description	This command enables ICMP6 debugging.

interface

Syntax	[no] interface [<i>ip-int-name</i> <i>ip-address</i> <i>ipv6-address</i> <i>ipv6-address</i>]
Context	debug>router>ip
Description	This command displays the router IP interface table sorted by interface index.

Parameters	<i>ip-address</i> — 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 (eight 16-bit pieces) x:x:x:x:x:d.d.d.d x: [0 — FFFF]H d: [0 — 255]D
	<i>ip-int-name</i> — Only displays the interface information associated with the specified IP interface name.		
	Values	32 characters maximum	

packet

Syntax	packet [<i>ip-int-name</i> <i>ip-address</i>] [headers] [<i>protocol-id</i>] no packet [<i>ip-int-name</i> <i>ip-address</i>]
Context	debug>router>ip
Description	This command enables debugging for IP packets.
Parameters	<i>ip-int-name</i> — Only displays the interface information associated with the specified IP interface name.
	Values 32 characters maximum
	<i>ip-address</i> — Only displays the interface information associated with the specified IP address.
	headers — Only displays information associated with the packet header.
	<i>protocol-id</i> — 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, hexadecimal, or binary)

route-table

Syntax	route-table [<i>ip-prefix/prefix-length</i>] route-table <i>ip-prefix/prefix-length</i> longer no route-table		
Context	debug>router>ip		
Description	This command configures route table debugging.		
Parameters	<i>ip-prefix</i> — 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 (eight 16-bit pieces) 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 [<i>ip-address</i>] [ldp rsvp [tunnel-id <i>tunnel-id</i>]] sdp [sdp-id <i>sdp-id</i>]]
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.

In This Chapter

This chapter provides information about configuring Virtual Router Redundancy Protocol (VRRP) parameters. Topics in this chapter include:

- [VRRP Overview on page 304](#)
 - [Virtual Router on page 305](#)
 - [IP Address Owner on page 305](#)
 - [Primary and Secondary IP Addresses on page 306](#)
 - [Virtual Router Master on page 306](#)
 - [Virtual Router Backup on page 307](#)
 - [Owner and Non-Owner VRRP on page 307](#)
 - [Configurable Parameters on page 308](#)
- [VRRP Priority Control Policies on page 316](#)
 - [VRRP Virtual Router Policy Constraints on page 316](#)
 - [VRRP Virtual Router Instance Base Priority on page 316](#)
 - [VRRP Priority Control Policy Delta In-Use Priority Limit on page 317](#)
 - [VRRP Priority Control Policy Priority Events on page 318](#)
- [VRRP Non-Owner Accessibility on page 322](#)
 - [Non-Owner Access Ping Reply on page 322](#)
 - [Non-Owner Access Telnet on page 322](#)
 - [Non-Owner Access SSH on page 323](#)
 - [VRRP Advertisement Message IP Address List Verification on page 314](#)
- [VRRP Configuration Process Overview on page 324](#)
- [Configuration Notes on page 325](#)

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 13 displays an example of a VRRP configuration.

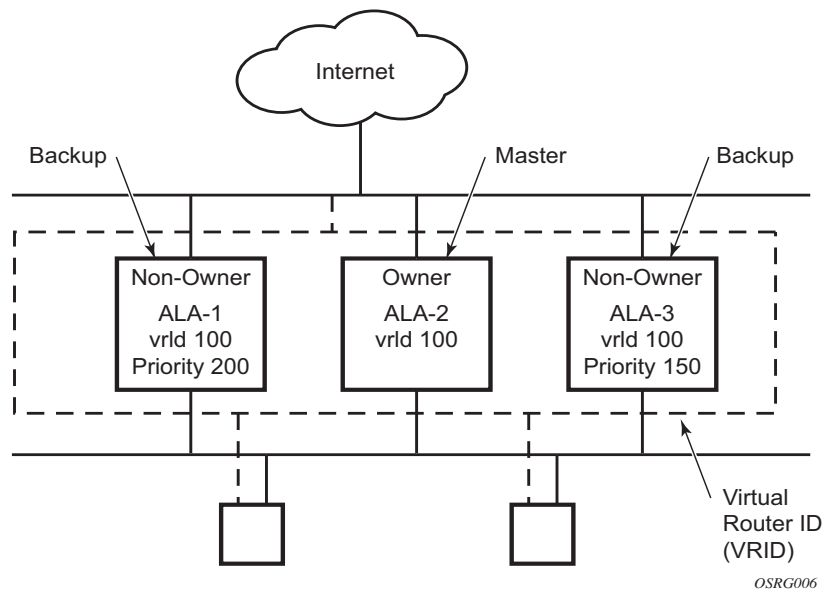


Figure 13: VRRP Configuration

VRRP Components

VRRP consists of the following components:

- [Virtual Router on page 305](#)
 - [IP Address Owner on page 305](#)
 - [Primary and Secondary IP Addresses on page 306](#)
 - [Virtual Router Master on page 306](#)
 - [Virtual Router Backup on page 307](#)
 - [Owner and Non-Owner VRRP on page 307](#)
-

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 322](#).

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 308](#)
- [Message Interval and Master Inheritance on page 310](#)
- [VRRP Message Authentication on page 312](#)
- [Authentication Data on page 314](#)
- [Virtual MAC Address on page 314](#)

The following parameters can be defined in non-owner configurations:

- [Virtual Router ID \(VRID\) on page 308](#)
 - [Priority on page 308](#)
 - [Message Interval and Master Inheritance on page 310](#)
 - [Master Down Interval on page 311](#)
 - [Preempt Mode on page 311](#)
 - [VRRP Message Authentication on page 312](#)
 - [Authentication Data on page 314](#)
 - [Virtual MAC Address on page 314](#)
 - [Inherit Master VRRP Router's Advertisement Interval Timer on page 315](#)
 - [Policies on page 315](#)
-

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 immediately 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: $\text{Skew Time} = ((256 - \text{priority}) / 256) \text{ seconds}$

For IPv6: $\text{Skew Time} = (((256 - \text{priority}) * \text{Master_Adver_Interval}) / 256) \text{ centiseconds}$

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:

$$\text{Master Down Interval} = (3 \times \text{Operational Advertisement Interval}) + \text{Skew Time}$$

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, a master non-owner virtual router will only allow 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

A backup router will only attempt to become the master router if the preempt mode is true and the received VRRP advertisement priority field is less than the virtual router in-use priority value.

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:

<u>Authentication Type</u>	<u>Authentication Data</u>
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 routers implementation 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 319](#).

LAG Degrad 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 its 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 7](#):

- 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 7: 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
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	

VRRP Priority Control Policy Priority Events

Table 7: LAG Events (Continued)

Time	LAG Port State	Parameter	State	Comments
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
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 14 displays the process to provision VRRP parameters.

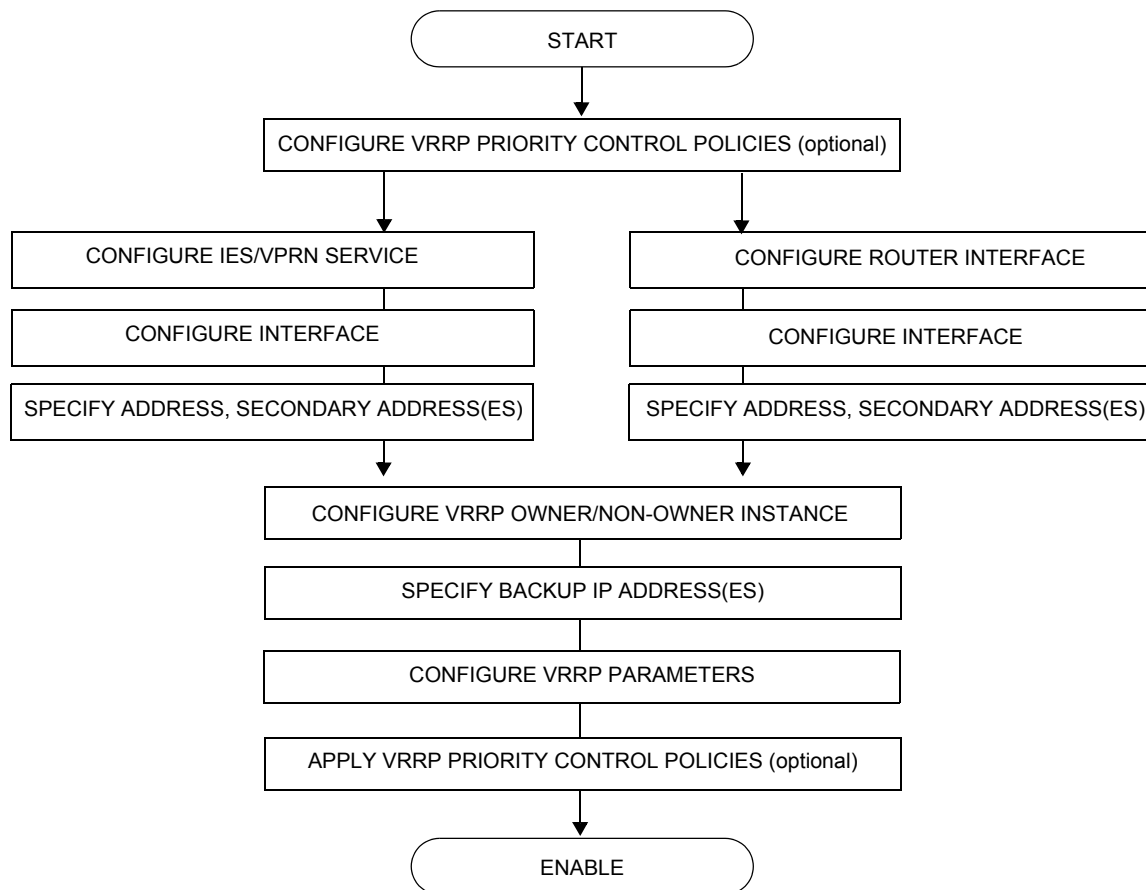


Figure 14: VRRP Configuration and Implementation Flow

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 on page 328](#)
- [Basic VRRP Configurations on page 329](#)
- [Common Configuration Tasks on page 333](#)
- [Configuring VRRP Policy Components on page 335](#)
- [VRRP Configuration Management Tasks on page 340](#)
- [Modifying a VRRP Policy on page 340](#)
- [Deleting a VRRP Policy on page 341](#)
- [Modifying Service and Interface VRRP Parameters on page 342](#)
 - [Modifying Non-Owner Parameters on page 342](#)
 - [Modifying Owner Parameters on page 342](#)
 - [Deleting VRRP on an Interface or Service on page 342](#)

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 329](#)
 - [VRRP IES Service Parameters on page 330](#)
 - [VRRP Router Interface Parameters on page 332](#)
-

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-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-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-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-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 a service 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 336](#)
 - [Owner Service VRRP on page 337](#)
-

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-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-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 338](#)
-

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-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-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 340](#)
 - [Deleting a VRRP Policy on page 341](#)
 - [Modifying Service and Interface VRRP Parameters on page 342](#)
 - [Modifying Non-Owner Parameters on page 342](#)
 - [Modifying Owner Parameters on page 342](#)
 - [Deleting VRRP on an Interface or Service on page 342](#)
-

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

- [IPv4 Interface Commands on page 344](#)
- [Router Interface Commands on page 345](#)
- [IPv6 Interface Commands on page 346](#)
- [Priority Control Event Policy Commands on page 346](#)
- [Show Commands on page 348](#)
- [Monitor Commands on page 348](#)
- [Clear Commands on page 348](#)
- [Debug Commands on page 348](#)

IPv4 Interface Commands

```

config
— router
— [no] interface interface-name
— 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**, **bfd-enable**, and **ssh-reply** commands are applicable only to IPv4 contexts, not IPv6.

Router Interface 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

```

IPv6 Interface 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

```

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
— weight-down lag-ports-down-weight
— no weight-down
— 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
— [no] shutdown

```

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 [<i>authentication-key</i> <i>hash-key</i>] [hash hash2] no authentication-key
Context	config>router>if>vrrp
Description	<p>This command sets the simple text authentication key used to generate master VRRP advertisement messages and validates VRRP advertisements.</p> <p>If simple text password authentication is not required, the authentication-key command is not required.</p> <p>The command is configurable in both non-owner and owner vrrp nodal contexts.</p> <p>The <i>key</i> 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 <i>key</i>.</p> <p>The <i>key</i> 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.</p> <p>If the command is re-executed with a different password key defined, the new key is used ediatly.</p> <p>The authentication-key command can be executed at anytime.</p> <p>To change the current in-use password key on multiple virtual router instances:</p> <ol style="list-style-type: none"> 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. <p>The no form of the command reverts to the default value.</p>
Default	no authentication-key — The authentication key value is the null string.
Parameters	<i>authentication-key</i> — 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 <i>ip-address</i>
Context	config>router>if>vrrp
Description	<p>This command associates router IP addresses with the parental IP interface IP addresses.</p> <p>The backup command has two distinct functions when used in an owner or a non-owner context of the virtual router instance.</p> <p>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.</p> <p>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 <i>ip-addr</i> must be equal to one of the existing parental IP interface IP addresses (primary or secondary) or the backup command will fail.</p> <p>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 <i>ip-addr</i> 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 <i>ip-addr</i> or if <i>ip-addr</i> is the same IP address as the parental IP interface IP address, the backup command will fail.</p> <p>The new interface IP address created with the backup command assumes the mask and parameters of the corresponding parent IP interface IP address. The <i>ip-addr</i> 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 <i>ip-addr</i>, nor will it route packets received with its <i>vrid</i> derived source MAC address. A non-master virtual router instance always silently discards packets destined to <i>ip-addr</i>. 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.</p>

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	<i>ip-address</i> — 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	<p>This command associates router IPv6 addresses with the parental IP interface IP addresses.</p> <p>The backup command has two distinct functions when used in an owner or a non-owner context of the virtual router instance.</p> <p>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.</p> <p>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 <i>ipv6-addr</i> must be equal to one of the existing parental IP interface IP addresses (link-local or global) or the backup command will fail.</p> <p>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 <i>ipv6-addr</i> 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 <i>ipv6-addr</i> or if <i>ipv6-addr</i> is the same IP address as the parental IP interface IP address, the backup command will fail.</p> <p>The new interface IP address created with the backup command assumes the mask and parameters of the corresponding parent IP interface IP address. The <i>ipv6-addr</i> 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.</p> <p>When not operating as master, the virtual router instance acts as if it is operationally down. It will not respond to ARP requests to <i>ipv6-addr</i>, nor will it route packets received with its <i>vrid</i> derived source MAC address. A non-master virtual router instance always silently discards packets destined to <i>ipv6-addr</i>. 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.</p>

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	<i>ipv6-address</i> — 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 (eight 16-bit pieces) x:x:x:x:x::d.d.d.d x: [0..FFFF]H d: [0..255]D	

bfd-enable

Syntax	[no] bfd-enable [<i>service-id</i>] interface <i>interface-name</i> dst-ip <i>ip-address</i> [no] bfd-enable interface <i>interface-name</i> dst-ip <i>ip-address</i>						
Context	config>router>if>vrrp config>router>if>ipv6>vrrp						
Description	<p>This commands assigns a bi-directional forwarding detect (BFD) session to a given VRRP/SRRP instance. This BFD sessions provided a heartbeat mechanism that can be used to speed up the transition of the standby VRRP router to an active state. If the associated BFD session fails, the VRRP routers will immediately send a VRRP Advertisement message. In addition, the standby VRRP router(s) will transition to a Master state to speed convergence. The normal VRRP election process will then take place based on the Advertisement messages sent by all VRRP routers.</p> <p>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.</p> <p>The parameters used for the BFD sessions are set by the BFD command under the IP interface.</p> <p>The no form of this command removes BFD from the configuration.</p>						
Default	none						
Parameters	<p><i>service-id</i> — Specifies the service ID of the interface running BFD.</p> <table><tr><td>Values</td><td><i>service-id:</i></td><td>1 — 2147483647</td></tr><tr><td></td><td><i>svc-name:</i></td><td>64 characters maximum</td></tr></table> <p>interface <i>interface-name</i> — 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.</p> <p>dst-ip <i>ip-address</i> — Specifies the destination address to be used for the BFD session.</p>	Values	<i>service-id:</i>	1 — 2147483647		<i>svc-name:</i>	64 characters maximum
Values	<i>service-id:</i>	1 — 2147483647					
	<i>svc-name:</i>	64 characters maximum					

init-delay

Syntax	init-delay <i>seconds</i> no init-delay		
Context	config>router>if>vrrp config>router>if>ipv6>vrrp		
Description	This command configures a VRRP initialization delay timer.		
Parameters	<p><i>seconds</i> — Specifies the initialization delay timer for VRRP, in seconds.</p> <table> <tr> <td>Values</td><td>1 — 65535</td></tr> </table>	Values	1 — 65535
Values	1 — 65535		

mac

Syntax	mac <i>mac-address</i> no mac
Context	config>router>if>vrrp config>router>if>ipv6>vrrp
Description	<p>This command sets an explicit MAC address used by the virtual router instance overriding the VRRP default derived from the VRID.</p> <p>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.</p> <p>The mac command sets the MAC address used in ARP responses when the virtual router instance is master. Routing of IP packets with <i>mac-address</i> 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 <i>mac-address</i> as the source MAC.</p> <p>The command can be configured in both non-owner and owner vrrp nodal contexts.</p> <p>The mac command can be executed at any time and takes effect ediatly. When the virtual router MAC on a master virtual router instance changes, a gratuitous ARP is ediatly 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.</p> <p>The no form of the command restores the default VRRP MAC address to the virtual router instance.</p>
Default	no mac — The virtual router instance uses the default VRRP MAC address derived from the VRID.
Parameters	<i>mac-address</i> — The 48-bit MAC address for the virtual router instance in the form <i>aa:bb:cc:dd:ee:ff</i> or <i>aa-bb-cc-dd-ee-ff</i> where <i>aa</i> , <i>bb</i> , <i>cc</i> , <i>dd</i> , <i>ee</i> and <i>ff</i> 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	<p>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.</p> <p>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.</p>

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	<p>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.</p> <p>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.</p> <p>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.</p> <ul style="list-style-type: none">• 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:

$$(3 \times (\text{in-use message interval}) + \text{skew time})$$

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	<i>seconds</i> — The number of seconds that will transpire before the advertisement timer expires expressed as a decimal integer. Values IPv4: 1 — 255 IPv6: 1 — 40 <i>milliseconds</i> <i>milliseconds</i> — Specifies the time interval, in milliseconds, between sending advertisement messages. Values 100 — 900 IPv6: 10 — 990

policy

Syntax	policy <i>policy-id</i> no policy
Context	config>router>if>vrrp config>router>if>ipv6>vrrp
Description	<p>This command adds a VRRP priority control policy association with the virtual router instance.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
Default	no policy — No VRRP priority control policy is associated with the virtual router instance.
Parameters	<i>policy-id</i> — The policy ID of the VRRP priority control expressed as a decimal integer. The <i>vrrp-policy-id</i> 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	<p>The preempt mode value controls whether a specific backup virtual router preempts a lower priority master.</p> <p>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.</p> <p>The IP address owner will always become master when available. Preempt mode cannot be disabled on the owner virtual router.</p> <p>The default value for preempt mode is enabled.</p>
Default	preempt

priority

Syntax	priority <i>base-priority</i> no priority
Context	config>router>if>vrrp config>router>if>ipv6>vrrp
Description	<p>This command configures the base router priority for the virtual router instance used in the master election process.</p> <p>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.</p> <p>The <i>base-priority</i> 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.</p> <p>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.</p> <p>For non-owner virtual router instances, the default base priority value is 100.</p> <p>The no form of the command reverts to the default value.</p>
Default	100

Parameters	<i>base-priority</i> — The base priority used by the virtual router instance expressed as a decimal integer. If no VRRP priority control policy is defined, the <i>base-priority</i> 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	<p>This command enables the non-owner master to reply to ICMP echo requests directed at the virtual router instances IP addresses.</p> <p>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.</p> <p>7950 SR 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.</p> <p>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).</p> <p>When ping-reply is not enabled, ICMP echo requests to non-owner master virtual IP addresses are silently discarded.</p> <p>Non-owner backup virtual routers never respond to ICMP echo requests regardless of the ping-reply setting.</p> <p>The ping-reply command is only available in non-owner vrrp nodal context.</p> <p>By default, ICMP echo requests to the virtual router instance IP addresses are silently discarded.</p> <p>The no form of the command configures discarding all ICMP echo request messages destined to the non-owner virtual router instance IP addresses.</p>
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>vrrp>policy
Description	<p>This command administratively disables an entity. When disabled, an entity does not change, reset, or remove any configuration settings or statistics.</p> <p>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.</p> <p>The no form of this command administratively enables an entity.</p>
Special Cases	<p>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.</p> <p>If the shutdown command is executed, no VRRP advertisement messages are generated and all received VRRP advertisement messages are silently discarded with no processing.</p> <p>By default, virtual router instances are created in the no shutdown state.</p> <p>Whenever the administrative state of a virtual router instance transitions, a log message is generated.</p> <p>Whenever the operational state of a virtual router instance transitions, a log message is generated.</p> <p>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.</p>

ssh-reply

Syntax	[no] ssh-reply
Context	config>router>if>vrrp
Description	<p>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.</p> <p>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.</p> <p>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.</p> <p>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</p>

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	<p>This command enables the non-owner master to reply to TCP port 23 Telnet requests directed at the virtual router instances' IP addresses.</p> <p>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.</p> <p>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.</p> <p>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</p>

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	<p>This command is valid only if the VRRP virtual router instance associated with this entry is a non-owner.</p> <p>When this command is enabled, a non-owner master can reply to traceroute requests directed to the virtual router instance IP addresses.</p> <p>A non-owner backup virtual router never responds to such traceroute requests regardless of the traceroute-reply status.</p>
Default	no traceroute-reply

vrrp

Syntax	vrrp vrid [owner] no vrrp vrid
Context	config>router>interface <i>ip-int-name</i> config>router>if>ipv6
Description	<p>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.</p> <p>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.</p>

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 then recreated without the **owner** keyword to remove ownership.

Priority Policy Commands

delta-in-use-limit

Syntax	delta-in-use-limit <i>in-use-priority-limit</i> no delta-in-use-limit
Context	config>vrrp>policy <i>vrrp-policy-id</i>
Description	<p>This command sets a lower limit on the virtual router in-use priority that can be derived from the delta priority control events.</p> <p>Each <i>vrrp-priority-id</i> 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.</p> <p>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.</p> <p>Only non-owner virtual router instances can be associated with VRRP priority control policies and their priority control events.</p> <p>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.</p> <p>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.</p> <p>Changing the <i>in-use-priority-limit</i> causes an ediate re-evaluation of the in-use priority values for all virtual router instances associated with this <i>vrrp-policy-id</i> based on the current sum of all active delta control policy events.</p> <p>The no form of the command reverts to the default value.</p>
Default	1 — The lower limit of 1 for the in-use priority, as modified, by delta priority control events.
Parameters	<p><i>in-use-priority-limit</i> — The lower limit of the in-use priority base, as modified by priority control policies. The <i>in-use-priority-limit</i> 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 <i>in-use-priority-limit</i>, the <i>in-use-priority-limit</i> value is used as the virtual router instances in-use priority value.</p> <p>Setting the <i>in-use-priority-limit</i> to a value equal to or larger than the virtual router instance <i>base-priority</i> prevents the delta priority control events from having any effect on the virtual router instance in-use priority value.</p>
Values	1 — 254

description

Syntax	description <i>string</i> no description
Context	config>vrrp>policy <i>vrrp-policy-id</i>
Description	<p>This command creates a text description stored in the configuration file for a configuration context.</p> <p>The description command associates a text string with a configuration context to help identify the content in the configuration file.</p> <p>The no form of the command removes the string from the configuration.</p>
Default	none
Parameters	<i>string</i> — 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 <i>policy-id</i> [context <i>service-id</i>] no policy <i>policy-id</i>
Context	config>vrrp
Description	<p>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.</p> <p>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.</p> <p>The policy <i>policy-id</i> command must be created first, before it can be associated with a virtual router instance.</p> <p>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.</p> <p>The <i>policy-id</i> do not have to be consecutive integers. The range of available policy identifiers is from 1 to 9999.</p> <p>The no form of the command deletes the specific <i>policy-id</i> from the system.</p> <p>The <i>policy-id</i> must be removed first from all virtual router instances before the no policy command can be issued. If the <i>policy-id</i> is associated with a virtual router instance, the command will fail.</p>
Default	none

Parameters	<i>vrp-policy-id</i> — 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 <i>service-id</i> — 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 <i>vrp-priority-id</i>
Description	<p>This command creates the context to configure VRRP priority control events used to define criteria to modify the VRRP in-use priority.</p> <p>A priority control event specifies an object to monitor and the effect on the in-use priority level for an associated virtual router instance.</p> <p>Up to 32 priority control events can be configured within the priority-event node.</p> <p>The no form of the command clears any configured priority events.</p>

Priority Policy Event Commands

hold-clear

Syntax	hold-clear <i>seconds</i> 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	<p>This command configures the hold clear time for the event. The <i>seconds</i> 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.</p> <p>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.</p>
Default	no hold-clear
Parameters	<i>seconds</i> — 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 <i>seconds</i> 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	<p>This command specifies 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. A flapping event continually transitions between clear and set.</p> <p>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.</p> <p>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.</p>

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 ediatly.
Parameters	<p><i>seconds</i> — 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.</p> <p>The value of 0 disables the hold set timer, preventing any delay in processing lower set thresholds or cleared events.</p> <p>Values 0 — 86400</p>

priority

Syntax	priority <i>priority-level</i> [{ delta explicit }] no priority
Context	config>vrrp>policy>priority-event>host-unreachable <i>ip-addr</i> config>vrrp>policy>priority-event>lag-port-down <i>lag-id</i> >number-down <i>number-of-lag-ports-down</i> config>vrrp>policy>priority-event>port-down <i>port-id</i> [. <i>channel-id</i>] config>vrrp>policy>priority-event>route-unknown <i>prefix/mask-length</i>
Description	<p>This command controls the effect the set event has on the virtual router instance in-use priority.</p> <p>When the event is set, the <i>priority-level</i> 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.</p> <p>Multiple set events in the same policy have interaction constraints:</p> <ul style="list-style-type: none"> • 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. <p>If the priority command is not configured on the priority event, the <i>priority-value</i> defaults to 0 and the qualifier keyword defaults to delta, thus, there is no impact on the in-use priority.</p> <p>The no form of the command reverts to the default values.</p>

Default	0 delta — The set event will subtract 0 from the base priority (no effect).
Parameters	<i>priority-level</i> — The priority level adjustment value expressed as a decimal integer.
Values	0 — 254
delta explicit	— Configures what effect the <i>priority-level</i> will have on the base priority value.
	When delta is specified, the <i>priority-level</i> 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 <i>priority-level</i> 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 <i>priority-level</i> is no longer used in the in-use priority calculation.
	When explicit is specified, the <i>priority-level</i> 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 <i>priority-level</i> . The set explicit priority value with the lowest <i>priority-level</i> determines the actual in-use protocol value for all virtual router instances associated with the policy.
Default	delta
Values	delta, explicit

weight-down

Syntax	weight-down <i>lag-ports-down-weight</i> no weight-down
Context	config>vrrp>policy>priority-event>lag-port-down
Description	<p>This command creates a context to configure an event set threshold within a lag-port-down priority control event. The weight-down command defines a sub-node within the lag-port-down event and is uniquely identified with the lag-ports-down-weight parameter. Each weight-down node within the same lag-port-down event node must have a unique lag-ports-down-weight value. Each weight-down node has its own priority command that takes effect whenever that node represents the current threshold. A single LAG can use either weight-threshold or port threshold. The command is required for proper operation on mixed port-speed LAGs and can be used for non-mixed port-speed LAGs as well.</p> <p>The total number of sub-nodes (uniquely identified by the lag-ports-down-weight parameter) allowed in the system is 2048.</p> <p>A weight-down node is not required for each possible number of ports that could be down. The active threshold is always the closest lower threshold.</p> <p>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.</p>
Default	no weight-down
Parameters	<i>lag-ports-down-weight</i> — The total weight of LAG ports down to create a set event threshold. This is the active threshold when the weight of down ports in the LAG equals or exceeds <i>lag-ports-down-weight</i> , but does not equal or exceed the next highest configured <i>lag-ports-down-weight</i> .

mc-ipsec-non-forwarding

Syntax	[no] mc-ipsec-non-forwarding <i>tunnel-grp-id</i>
Context	config>vrrp>policy>priority-event
Description	This 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	<i>tunnel-grp-id</i> — 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 <i>port-id</i>
Context	config>vrrp>policy>priority-event
Description	<p>This command configures a port down priority control event that monitors the operational state of a port . When the port enters the operational down state, the event is considered set. When the port enters the operational up state, the event is considered cleared.</p> <p>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.</p> <p>The port-down command can reference an arbitrary port. The port does not need to be pre-provisioned or populated within the system. The operational state of the port-down event is set as follows:</p> <ul style="list-style-type: none">• Set – non-provisioned• Set – not populated• Set – down• Cleared – up <p>When the port is provisioned, populated, or enters the operationally up or down state, the event operational state is updated appropriately.</p> <p>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 ediatly 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.</p> <p>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 ediatly removed from the in-use priority of all associated virtual router instances.</p> <p>The actual effect on the virtual router instance in-use priority value depends on the defined event priority and its delta or explicit nature.</p> <p>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.</p>
Default	no port-down — No port down priority control events are defined.
Parameters	<i>port-id</i> — 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.

Values port-id *slot/mda/port*

If the port is not provisioned, the event operational state is Set – non-provisioned.

Priority Policy LAG Events Commands

lag-port-down

Syntax	[no] lag-port-down <i>lag-id</i>
Context	config>vrrp>policy>priority-event
Description	<p>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.</p> <p>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.</p> <p>Multiple unique lag-port-down event nodes can be configured within the priority-event node up to the maximum of 32 events.</p> <p>The lag-port-down command can reference an arbitrary LAG. The <i>lag-id</i> does have to already exist within the system. The operational state of the lag-port-down event will indicate:</p> <ul style="list-style-type: none">• 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 <p>When the <i>lag-id</i> is created, or a port in <i>lag-id</i> becomes operationally up or down, the event operational state must be updated appropriately.</p> <p>When one or more of the LAG composite ports enters the operationally down state or the <i>lag-id</i> 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 ediatly 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.</p>

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 ediatly 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	<i>lag-id</i> — The LAG ID that the specific event is to monitor expressed as a decimal integer. The <i>lag-id</i> 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 <i>lag-id</i> the port is in is monitored by a lag-port-down event in the same policy.
Values	1 — 800

number-down

Syntax	[no] number-down <i>number-of-lag-ports-down</i>
Context	config>vrrp>policy>priority-event>lag-port-down <i>lag-id</i>
Description	<p>This command creates a context to configure an event set threshold within a lag-port-down priority control event.</p> <p>The number-down command defines a sub-node within the lag-port-down event and is uniquely identified with the <i>number-of-lag-ports-down</i> parameter. Each number-down node within the same lag-port-down event node must have a unique <i>number-of-lag-ports-down</i> value. Each number-down node has its own priority command that takes effect whenever that node represents the current threshold.</p> <p>The total number of sub-nodes (uniquely identified by the <i>number-of-lag-ports-down</i> parameter) allowed in a single lag-port-down event is equal to the total number of possible physical ports allowed in a LAG.</p> <p>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.</p>

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 <i>consecutive-failures</i> no drop-count
Context	config>vrrp <i>vrrp-policy-id</i> >priority-event>host-unreachable <i>ip-addr</i>
Description	<p>This command configures the number of consecutively sent ICMP echo request messages that must fail before the host unreachable priority control event is set.</p> <p>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.</p> <p>If the event's consecutive message drop counter reaches the drop-count value, the host-unreachable priority event enters the set state.</p> <p>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).</p> <p>The no form of the command reverts to the default value.</p>
Default	3 — 3 consecutive ICMP echo request failures are required before the host unreachable priority control event is set.
Parameters	<p><i>consecutive-failures</i> — 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.</p> <p>Values 1 — 60</p>

host-unreachable

Syntax	[no] host-unreachable <i>ip-address</i> [no] host-unreachable <i>ipv6-address</i>
Context	config>vrrp>policy>priority-event
Description	<p>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.</p> <p>A host unreachable priority event creates a continuous ICMP echo request (ping) probe to the specified <i>ip-address</i>. If a ping fails, the event is considered to be set. If a ping is successful, the event is considered to be cleared.</p>

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 <i>ip-addr</i> for drop-count consecutive attempts. Only applies when IP address is considered local.
Set – no route	No route exists for <i>ip-addr</i> 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 <i>ip-addr</i> - not enough failed attempts to set the event.
Cleared – no route	No route exists for <i>ip-addr</i> - 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 ediatly 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	<i>ip-addr</i> — The IP address of the host for which the specific event will monitor connectivity. The <i>ip-addr</i> 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 <i>ip-addr</i> 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	<i>seconds</i> — 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 <i>size</i> 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	<i>size</i> — Specifies amount of increase to ICMP PDU.
Values	0 — 16384

timeout

Syntax	timeout <i>seconds</i> no timeout
Context	config>vrrp <i>vrrp-policy-id</i> >priority-event>host-unreachable <i>ip-addr</i>
Description	<p>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.</p> <p>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.</p> <p>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.</p> <p>With each consecutive attempt to send an ICMP echo request message, the timeout timer is loaded with the timeout value. The timer decrements until:</p> <ul style="list-style-type: none"> • 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). <p>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.</p> <p>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.</p> <p>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.</p>

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 <i>prefix/mask-length</i>
Description	<p>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.</p> <p>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.</p> <p>The less-specific command eases the RTM lookup criteria when searching for the <i>prefix/mask-length</i>. 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).</p> <p>The no form of the command prevents RTM lookup results that are less specific than the route prefix from matching.</p>
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 <i>prefix/mask-length</i>
Description	<p>This command adds an allowed next hop IP address to match the IP route prefix for a route-unknown priority control event.</p> <p>If the next-hop IP address does not match one of the defined <i>ip-address</i>, the match is considered unsuccessful and the route-unknown event transitions to the set state.</p> <p>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.</p>

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	<i>ip-address</i> — 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[-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 <i>prefix/mask-length</i>
Description	<p>This command adds one or more route sources to match the route unknown IP route prefix for a route unknown priority control event.</p> <p>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.</p> <p>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.</p> <p>The no form of the command removes protocol route source as a match criteria for returned RTM route prefixes.</p> <p>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.</p>
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 <i>prefix/mask-length</i>
Context	config>vrrp>policy>priority-event
Description	<p>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.</p> <p>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.</p> <p>The command creates a route-unknown node identified by <i>prefix/mask-length</i> and containing event control commands.</p>

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 address 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 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 immediately 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	<i>prefix</i> — 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	<i>ip-prefix/mask:</i>	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 <i>interface-name</i> [vrid <i>virtual-router-id</i>] instance interface <i>interface-name vrid</i> <i>virtual-router-id ipv6</i>
Context	show>vrrp
Description	<p>This command displays information for VRRP instances.</p> <p>If no command line options are specified, summary information for all VRRP instances displays.</p>
Parameters	<p>interface <i>ip-int-name</i> — Displays detailed information for the VRRP instances on the specified IP interface including status and statistics.</p> <p>Default Summary information for all VRRP instances.</p> <p>vrid <i>virtual-router-id</i> — Displays detailed information for the specified VRRP instance on the IP interface.</p> <p>Default All VRIDs for the IP interface.</p> <p>Values 1 — 255</p> <p>ipv6 — Specifies the IPv6 instance.</p>
Output	<p>VRRP Instance Output — The following table describes the instance command output fields for VRRP.</p>

Label	Description
Interface name	The name of the IP interface.
VR ID	The virtual router ID for the IP interface
Own Owner	<p>Yes — Specifies that the virtual router instance as owning the virtual router IP addresses.</p> <p>No — Indicates that the virtual router instance is operating as a non-owner.</p>
Adm	<p>Up — Indicates that the administrative state of the VRRP instance is up.</p> <p>Down — Indicates that the administrative state of the VRRP instance is down.</p>
Op r	<p>Up — Indicates that the operational state of the VRRP instance is up.</p> <p>Down — Indicates that the operational state of the VRRP instance is down.</p>

Label	Description (Continued)
State	<p>When owner, backup defines the IP addresses that are advertised within VRRP advertisement messages.</p> <p>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).</p>
Pol Id	The value that uniquely identifies a Priority Control Policy.
Base Priority	The <i>base-priority</i> 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	<p>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.</p> <p>No — When the VRRP instance is operating as a backup and the master-int-inherit command is <i>not</i> 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.</p> <p>If the VRRP instance is operating as a master, this value has no effect.</p>
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	<p>The VRRP priority control policy associated with the VRRP virtual router instance.</p> <p>A value of 0 indicates that no control policy policy is associated with the virtual router instance.</p>
Preempt Mode	<p>Yes — The preempt mode is enabled on the virtual router instance where it will preempt a VRRP master with a lower priority.</p> <p>No — The preempt mode is disabled and prevents the non-owner virtual router instance from preempting another, less desirable virtual router.</p>

Label	Description (Continued)
Ping Reply	<p>Yes — A non-owner master is enabled to reply to ICMP Echo requests directed to the virtual router instance IP addresses.</p> <p>Ping Reply is valid only if the VRRP virtual router instance associated with this entry is a non-owner.</p> <p>A non-owner backup virtual router never responds to such ICMP echo requests irrespective if Ping Reply is enabled.</p> <p>No — ICMP echo requests to the virtual router instance IP addresses are discarded.</p>
Telnet Reply	<p>Yes — Non-owner masters can to reply to TCP port 23 Telnet requests directed at the virtual router instances IP addresses.</p> <p>No — Telnet requests to the virtual router instance IP addresses are discarded.</p>
SSH Reply	<p>Yes — Non-owner masters can to reply to SSH requests directed at the virtual router instances IP addresses.</p> <p>No — All SSH request messages destined to the non-owner virtual router instance IP addresses are discarded.</p>
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	<p>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.</p> <p>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.</p>
Master Priority	The priority of the virtual router instance which is the current master.
Master Since	<p>The date and time when operational state of the virtual router changed to master.</p> <p>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.</p>

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
Auth Type Mismatch : 0
Invalid Auth Type : 0
IP TTL Errors : 0
Total Discards : 0
Addr List Errors : 0
Auth Failures : 0
Invalid Pkt Type : 0
Pkt Length Errors : 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 [*vrrip-policy-id* [**event** *event-type* *specific-qualifier*]]

Context

show>vrrip

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

vrrip-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	<p>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.</p> <p>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.</p>
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	<p>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.</p> <p>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.</p> <p>Explicit events override all delta Events. When multiple explicit events occur simultaneously, the event with the lowest priority value defines the in-use priority.</p>
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	<p>Delta — The <i>priority-level</i> 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 <i>priority-level</i> 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.</p> <p>If the delta priority event is cleared, the <i>priority-level</i> is no longer used in the in-use priority calculation.</p>

Label	Description (Continued)
	Explicit — The <i>priority-level</i> 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 <i>priority-level</i> .
	The set explicit priority value with the lowest <i>priority-level</i> 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        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	<p>The VRRP priority control policy associated with the VRRP virtual router instance.</p> <p>A value of 0 indicates that no control policy is associated with the virtual router instance.</p>
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	<p>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.</p> <p>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.</p>
Applied to Interface Name	The interface name where the VRRP policy is applied.
VR ID	The virtual router ID for the IP interface.
Opr	<p>Up — Indicates that the operational state of the VRRP instance is up.</p> <p>Down — Indicates that the operational state of the VRRP instance is down.</p>
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	<p>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.</p> <p>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.</p> <p>Explicit events override all delta events. When multiple explicit events occur simultaneously, the event with the lowest priority value defines the in-use priority.</p>
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	<p>Delta — The <i>priority-level</i> 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 <i>priority-level</i> 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.</p> <p>If the delta priority event is cleared, the <i>priority-level</i> is no longer used in the in-use priority calculation.</p> <p>Explicit — The <i>priority-level</i> 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 <i>priority-level</i>.</p> <p>The set explicit priority value with the lowest <i>priority-level</i> determines the actual in-use protocol value for all virtual router instances associated with the policy.</p>
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      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      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      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 8: 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 <i>interface-name</i> vr-id <i>virtual-router-id</i> [ipv6] [interval <i>seconds</i>] [repeat <i>repeat</i>] [absolute rate]
Context	monitor>router>vrrp
Description	Monitor statistics for a VRRP instance.
Parameters	<p><i>interface-name</i> — The name of the existing IP interface on which VRRP is configured.</p> <p>vr-id <i>virtual-router-id</i> — The virtual router ID for the existing IP interface, expressed as a decimal integer.</p> <p>interval <i>seconds</i> — Configures the interval for each display in seconds.</p> <p>Default 5 seconds</p> <p>Values 3 — 60</p> <p>repeat <i>repeat</i> — Configures how many times the command is repeated.</p> <p>Default 10</p> <p>Values 1 — 999</p> <p>absolute — When the absolute keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.</p> <p>rate — When the rate keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.</p> <p>ipv6 — Specifies to monitor IPv6 instances.</p>

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 <i>ip-int-name</i> [vrid <i>virtual-router-id</i>] interface <i>ip-int-name</i> vrid <i>virtual-router-id</i> ipv6
Context	clear>router>vrrp
Description	This command resets VRRP protocol instances on an IP interface.
Parameters	<i>ip-int-name</i> — The IP interface to reset the VRRP protocol instances. vrid <i>vrid</i> — 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 <i>policy-id</i>]
Context	clear>router>vrrp
Description	This command enables the context to clear and reset VRRP entities.
Parameters	policy <i>policy-id</i> — Clears statistics for the specified policy. Values 1 — 9999

statistics

Syntax	statistics interface <i>interface-name</i> [vrid <i>virtual-router-id</i>] statistics statistics interface <i>interface-name</i> vrid <i>virtual-router-id</i> ipv6
Context	clear>router>vrrp
Description	This command clears statistics for VRRP instances on an IP interface or VRRP priority control policies.
Parameters	interface <i>ip-int-name</i> — 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.

Debug Commands

events

Syntax	events
	events interface <i>ip-int-name</i> [vrid <i>virtual-router-id</i>] events interface <i>ip-int-name</i> vrid <i>virtual-router-id</i> ipv6 no events no events interface <i>ip-int-name</i> vrid <i>virtual-router-id</i> ipv6 no events interface <i>ip-int-name</i> [vrid <i>virtual-router-id</i>]
Context	debug>router>vrrp
Description	This command enables debugging for VRRP events. The no form of the command disables debugging.
Parameters	<i>ip-int-name</i> — Displays the specified interface name.
	vrid <i>virtual-router-id</i> — Displays the specified VRID.
	ipv6 — Debugs the specified IPv6 VRRP interface.

packets

Syntax	packets interface <i>ip-int-name</i> [vrid <i>virtual-router-id</i>] packets no packets interface <i>ip-int-name</i> [vrid <i>virtual-router-id</i>] [ipv6] no packets
Context	debug>router>vrrp
Description	This command enables debugging for VRRP packets. The no form of the command disables debugging.
Parameters	<i>ip-int-name</i> — Displays the specified interface name.
	vrid <i>virtual-router-id</i> — Displays the specified VRID.

Filter Policies

In This Chapter

The SROS supports filter policies for services and network interfaces (described in this chapter), and CPM security and Management Interface (described in SROS Router Configuration Guide).

Topics in this chapter include:

- [ACL Filter Policy Overview on page 408](#)
 - [Filter Policy Packet Match Criteria on page 411](#)
 - [IPv4/IPv6 Filter Policy Entry Match Criteria on page 411](#)
 - [MAC Filter Policy Entry Match Criteria on page 415](#)
 - [Filter Policy Actions on page 417](#)
 - [Filter Policy Statistics on page 420](#)
 - [Filter Policy Logging on page 421](#)
 - [Filter Policy cflowd Sampling on page 421](#)
 - [Filter Policy Management on page 422](#)
 - [Match-list for Filter Policies on page 423](#)
 - [Embedded Filters on page 427](#)
 - [System-level IPv4/IPv6 Line Card Filter Policy on page 429](#)
 - [Network-port VPRN Filter Policy on page 430](#)
 - [ISID MAC Filters on page 430](#)
 - [VID MAC filters on page 431](#)
 - [Redirect Policies on page 435](#)
 - [HTTP-redirect \(Captive Portal\) on page 438](#)
 - [Filter Policies and Dynamic, Policy-Driven Interfaces on page 440](#)

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.
- A **system** filter policy allows defining common set of policy rules that can then be activated within other exclusive/template filters. A system filter policy is intended mainly for system-level blacklisting rules but can be used for other applications as well. This allows optimized management of common rules (similarly to embedded filters); however, active system filter policy entries are not duplicated inside each policy that activates the system policy (as is the case when embedding is used). The active system policy is downloaded once to line cards, and activating filter policies are chained to it.

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.

ACL Filter Policy Commands

The command **action** (with all types and related parameters defining) used to define an action to be performed on a packet matching IPv4/IPv6/MAC ACL policy entry has been deprecated and replaced by a new **action** command that allow operator to enter a new CLI context under which individual actions can be selected using **drop**, **forward**, **gtp-local-breakout**, **http-redirect**, **nat**, reassemble action type commands and their parameters as applicable to a given action type and a given filter type.

Operational impact of the above-described restructuring:

- Since all command and parameter names were preserved, any ACL configuration prior to Release 13.0 R4 remains valid and results in same configuration result for all but the below highlighted case
- Prior to release 13R4 executing an action command without any parameters
 - config>filter>ip-filter>entry>action
 - config>filter>ipv6-filter>entry>action
 - config>filter>mac-filter>entry>action

would result in “**action drop**” configuration (implicit **action drop** configuration). After an upgrade to release 13.0 R4, this functionality is no longer supported and **action drop** must be explicitly specified. An operator must add drop keyword to any existing manually edited CLI configuration files that do not explicitly specify **action drop**. Note that the system would always save a configuration with implicit action drop defined as explicit **action drop**.
- Starting with release 13.0 R4, **admin save** and **info** commands will save/display filter entry action configuration in a multi-line format (as illustrated in [Table 9](#)).
- Note that CLI configuration continues to accept a single line format to specify an action with its type and related parameters.

Table 9: Display Filter Entry Action

Command prior to Release 13.0R4	Command in Release 13.0R4
<pre>configure filter {ip-filter ipv6-filter mac-filter} entry action drop [optional parameters]</pre>	<pre>configure filter {ip-filter ipv6-filter mac-filter} entry action drop [optional parameters]</pre>
<pre>configure filter {ip-filter ipv6-filter mac-filter} entry action forward [optional parameters]</pre>	<pre>configure filter {ip-filter ipv6-filter mac-filter} entry action forward [optional parameters]</pre>
<pre>configure filter {ip-filter ipv6-filter mac-filter} entry action http-redirect [optional parameters]</pre>	<pre>configure filter {ip-filter ipv6-filter mac-filter} entry action http-redirect [optional parameters]</pre>
<pre>configure filter {ip-filter ipv6-filter} entry action nat [optional parameters]</pre>	<pre>configure filter {ip-filter ipv6-filter} entry action nat [optional parameters]</pre>
<pre>configure filter ip-filter entry action gtp-local-breakout</pre>	<pre>configure filter ip-filter entry action gtp-local-breakout</pre>
<pre>configure filter ip-filter entry action reassemble</pre>	<pre>configure filter ip-filter entry action reassemble</pre>

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.

Conditional action match criteria:

- **packet-length** — Match for the specified packet-length value/range against the Total Length field in IPv4 packet header or Payload Length field in IPv6 packet header. 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. When a filter entry with a packet-length condition is used as a mirror source, only forwarded packets are mirrored. Supported for ingress filters only. Requires minimum FP-2 based line cards. The packet-length match condition is always true if a filter is configured on egress or on an older H/W.
- **TTL** — Match for the specified TTL value/range against the Total Length field in IPv4 packet header . 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 TTL match criterion is met and forwarded if the TTLmatch criterion is not met. When a filter entry with a TTL condition is used as a mirror source, only forwarded packets are mirrored. When a filter entry with a TTL condition is used in cflowd processing, the TTL condition is ignored for cflowd processing. Supported for ingress filters only and requires minimum FP-2 based line cards. The TTL match condition is always true if a filter is configured on egress or on an 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.

IPv4 match fragment criteria are supported on both ingress and egress. IPv6 match fragment 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/port** — Match for the specified port value or port range against the Source Port Number/Destination Port Number of the UDP/TCP/SCTP 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”, “UDP”, “SCTP”, or “TCP or UDP” protocols. Note that a non-initial fragment will never match an entry with non-zero 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.
- **Operational note for upper-layer protocol match criteria** — For fragmented traffic, when non-initial fragments do not contain the L4 header, the L4 match criteria in the filter policy look-up key are set to zero (0). If a filter policy contains an entry that specifies L4 zero match criterion (for example, TCP/UDP/SCTP port/src-port/dst-port eq 0), the non-initial fragment will match the entry if other match criteria are also met.

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):
 - **egress-pbr** — enabling **egress-pbr** activates a PBR action on egress, while disabling **egress-pbr** activates a PBR action on ingress (default).

The following subset of the below-defined PBR actions can be activated on egress: **redirect-policy**, **next-hop-router**, and **esi**.

Egress PBR is supported in IPv4 and IPv6 filter policies for ESM only. Unicast traffic that is subject to slow-path processing on ingress (for example IPv4 packets with options or IPv6 packets with hop-by-hop extension header) will not match egress pbr entries. Filter logging, cflowd, and mirror source are mutually exclusive to configuring a filter entry with an egress PBR action. Configuring **pbr-down-action-override**, if supported with a given PBR ingress action type, is also supported when the action is an egress PBR action. Processing defined by **pbr-down-action-override** does not apply if the action is deployed in the wrong direction. If a packet matches a filter PBR entry and the entry is not activated for the direction in which the filter is deployed, **action forward** is executed. Egress PBR cannot be enabled in system filters.

Egress PBR functionality requires chassis mode D.

- **esi** — forwards the incoming traffic using VXLAN tunnel resolved using EVPN MP BGP control plane to the first service chain function identified by ESI (L2) or ESI/SF-IP (L3). Supported with VPLS (L2) and IES/VPRN (L3) services. If the service function forwarding cannot be resolved, traffic matches an entry and action forward is executed.

For VPLS, no cross service PBF is supported – i.e. the filter specifying ESI PBF entry must be deployed in the VPLS service where BGP EVPN control plane resolution takes place as configured for a given ESI PBF action. The functionality is supported in filter policies deployed on ingress VPLS interfaces. BUM traffic that matches a filter entry with ESI PBF will be unicast forwarded to the VTEP:VNI resolved through PBF forwarding.

For IES/VRN, the outgoing R-VPLS interface can be in any VRN service. The outgoing interface and VRN service for BGP EVN control plane resolution must again be configured as part of ESI PBR entry configuration. The functionality is supported in filter policies deployed on ingress IES/VRN interfaces and in filter policies deployed on ingress and egress for ESM subscribers. Only unicast traffic is subject to ESI PBR, any other traffic matching a filter entry with L3 ESI action will be subject to **action forward**.

The functionality requires chassis mode D. When deployed in unsupported direction, traffic matching a filter policy ESI PBR/PBF entry will be subject to action forward.

- **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.
- **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.
- **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.
- **redirect-policy** — implements PBR **next-hop** or PBR **next-hop router** 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 and IPv6 filter policies deployed on L3 interfaces only. See [Redirect Policies](#) in this chapter for more 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 VRN redirect). This action requires incoming interfaces to be on FP2 line cards or newer. It is supported for ingress IPv4/IPv6 filter policies deployed on L3

interfaces. The action can be combined with the **next-hop** action specifying direct/indirect IP/IPv6 next hop. Packets are dropped if they cannot be routed in the configured routing instance.

- **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.
- **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):
 - **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.
 - **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.
- **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:

- An operator can select a **default-action** for a filter policy. The 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.
- An operator can override default action applied to packets matching a PBR/PBF entry when the PBR/PBF target is down using **pbr-down-action-override**. Supported options are to drop the packet, forward the packet, or apply the same action as configured for filter’s **default-action**. The override is supported for the following PBR/PBF actions:
 - **forward esi**

The following table defines default behavior for packets matching a PBR/PBF filter entry when the target is down:

Table 10: Display Filter Entry Action

PBR/PBF action	Default behavior when down
forward esi (any type)	Forward
forward lsp	Forward
forward next-hop (any type)	Drop
forward redirect-policy	Forward when redirect policy is shutdown
forward redirect-policy	Forward - when destination tests are enabled and the best destination is not reachable
forward redirect-policy	Drop - when destination tests are not enabled and the best destination is not reachable
forward sap	Drop
forward sdp	Drop
forward router	Drop

Filter Policy Statistics

Filter policies support per-entry, packet/Byte match statistics. The cumulative matched packet/Byte 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/Byte 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 statistics for the filter are reset to 0 (zero). Downloading a filter policy to a new line card keeps incrementing existing statistics.

Starting with SR-OS Release 13.0R4, filter policies support bulk requests CPM cache for policy interfaces created entries. The cache is periodically refreshed through a background collection of counters from hardware. The counters are also refreshed when the ACL entry corresponding to the cache entry has statistics read from hardware through any direct-read from hardware mechanism. If a cache entry represents an entry for an ACL filter policy not downloaded to any line cards, the cache returns values of 0 (zero). If a cache entry represents an ACL filter entry that was removed

from a line card since the previous refresh, the current refresh will reload the cache with the most recent values from hardware. The cache has to be rebuilt on a High Availability (HA) switchover, thus initial statistics requests after an HA switchover may require reads from hardware.

Operational Notes:

- Two consecutive bulk requests for one entry will return the same values if the cache has not been refreshed between the two requests. The refresh interval is platform/release dependent. Please contact your Alcatel-Lucent representative for further details.
- The cache is currently used only for Open Flow statistics retrieval. Please see “ Hybrid OpenFlow Switch” section for more details.

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 conditional action match criteriam, for example, **packet-length** or **ttl**).

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 15 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.

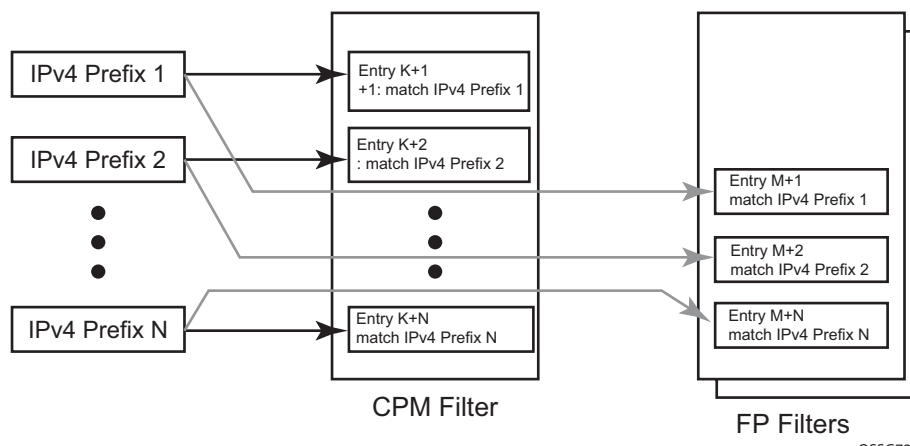


Figure 15: FP/CPM Filter Policy using Individual Address Prefixes

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 linecard 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 FP filter policies are introduced to eliminate above operational complexity by simplifying the FP 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 linecard 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 16 depicts how the linecard/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).

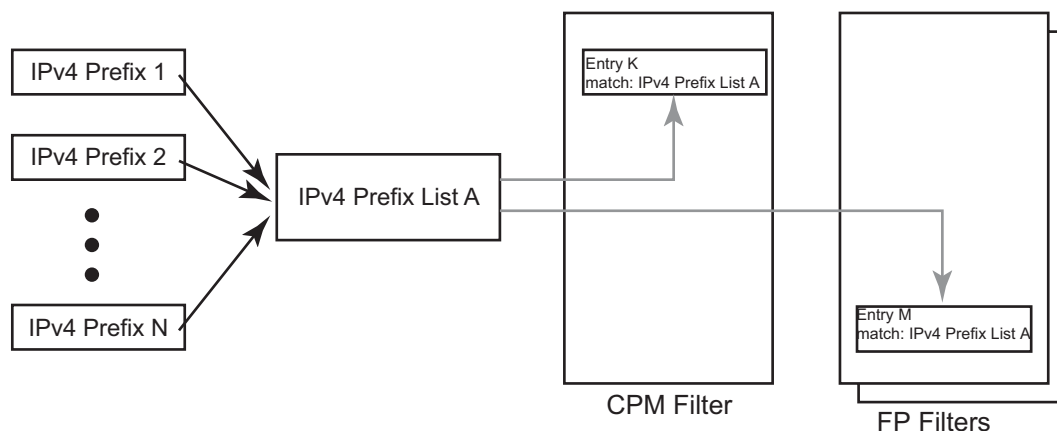


Figure 16: FP/CPM Filter Policy Using an Address Prefix Match List

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 FP 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 filter 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 $(X + \text{offset})$ 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 $20 + \text{offset } 100$) 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 17 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):

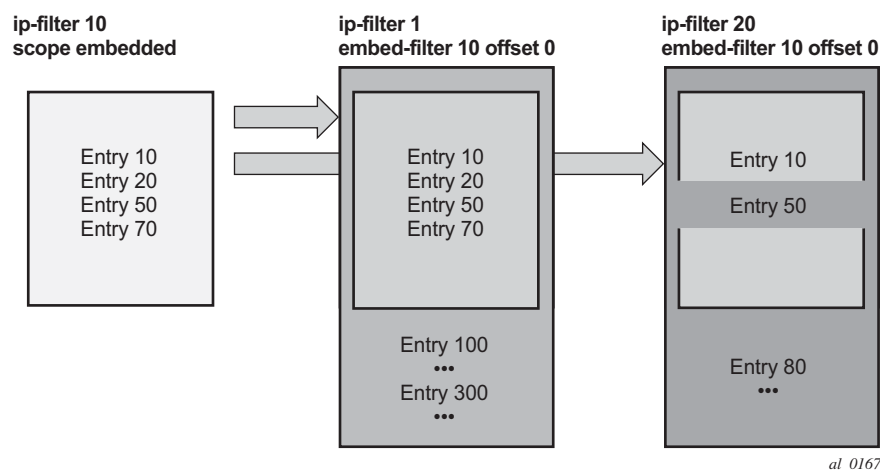


Figure 17: Embedded Filter Policy



NOTE: Embedded filter policies are supported for line card IP(v4) and IPv6 filter policies only.

System-level IPv4/IPv6 Line Card Filter Policy

A system filter policy allows the definition of a common set of policy rules that can then be activated within other exclusive/template filters. IPv4/IPv6 system filter policies supports all IPv4/IPv6 filter policy match rules and actions respectively but system policy entries cannot be the sources of mirroring.

System filter policy cannot be used directly; the active system policy is deployed by activating it within any IPv4 or IPv6 exclusive/template filter policy (chaining the system policy and a given interface policy). When an IPv4/IPv6 filter policy is chained to the active IPv4/IPv6 system filter, system filter rules are evaluated first before any rules of the chaining filter are evaluated (i.e. chaining filter's rules are only matched against if no system filter match took place).

A system filter policy is intended mainly for system-level blacklisting rules, thus it is recommended to use system policies with drop/forward actions. Other actions like, for example, PBR actions, or redirect to ISAs should not be used unless the system filter policy is activated only in filters used by services that support such action. The “nat” action is not supported and should not be configured. Failure to observe these restrictions can lead to undesired behavior as system filter actions are not verified against the services the chaining filters are deployed for.

System filter policies can be populated using CLI/SNMP/Netconf management interfaces and Openflow policy interface. System filter policy entries cannot be populated using flowspec, Radius, or Gx.

System filter policy scale is identical to a corresponding IPv4 or IPv6 filter policy scale. System filter policy consumes single set of H/W resources on each line card as soon as it is activated, regardless of how many IPv4/IPv6 filters chain to that system policy. This optimizes resource allocation when multiple filter policies activate a given system policy.

System filter policy requires chassis mode D.

An example (IPv4) configuration is shown below:

```
*A:vm1>config>filter#
# Configure system-policy
    ip-filter 1 create
        scope system
        entry 5 create
            match protocol *
            fragment true
        exit
        action drop
    exit
exit
# Activate it
system-filter
    ip 1
exit
# Use it in another filter:
```

```
ip-filter 10 create
  chain-to-system-filter
  filter-name "test-name"
  embed-filter open-flow "test" offset 100
  exit
exit
```

Network-port VPRN Filter Policy

Network-port L3 service-aware filter feature allows operators to deploy VPRN service aware ingress filtering on network ports. A single ingress filter of scope template can each be defined for IPv4 and for IPv6 against a VPRN service. The filter applies to all unicast traffic arriving on auto-bind and explicit-spoke network interfaces for that service. The network interface can be either Inter-AS, or Intra-AS. The filter does not apply to traffic arriving on access interfaces (SAP, spoke-sdp, network-ingress (CsC), rVPLS, eVPN).

The same filter can be used on access interfaces of the given VPRN, can embed other filters (including OpenFlow), can be chained to a system filter, and can be used by other L2 or L3 services.

The filter is deployed on all line cards (chassis network mode D is required). There are no limitations related to filter match/action criteria or embedding. The filter is programmed on line cards against ILM entries for this service. All label-types are supported. If an ILM entry has a filter index programmed, that filter is used when the ILM is used in packet forwarding; otherwise, no filter is used on the service traffic.

Caveats:

- Network port L3 service-aware filters do not support flowspec and LI (cannot use filter inside LI infrastructure nor have LI sources within the VPRN filter).

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 18](#). 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.

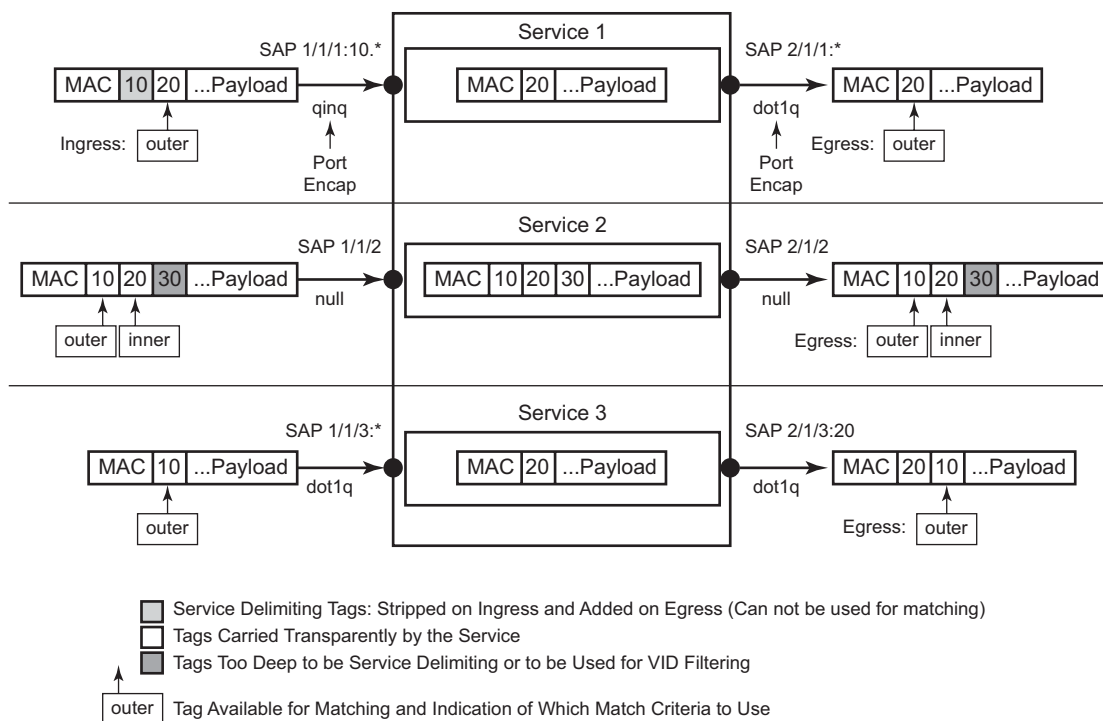
VID Filters add the capability to perform VID value filter policies on default tags (1/1/1:* or 1/1/1:x.*, or 1/1/1:*.0), or null tags (1/1/1, 1/1/1:0 or 1/1/1:x.0). The matching is based on the port configuration and the SAP configuration.

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 18](#) 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.



OSSG735

Figure 18: 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

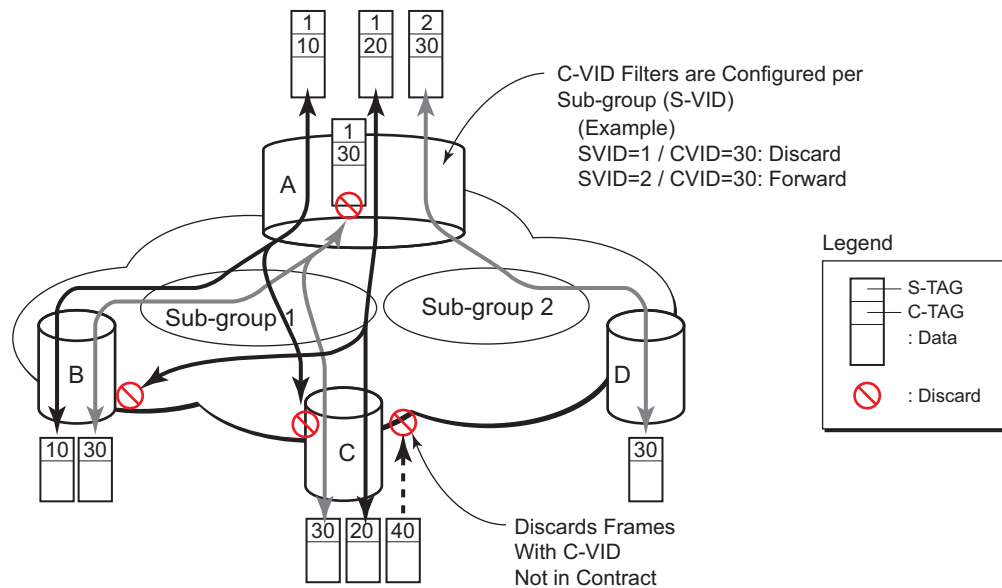
In addition to matching an exact value, a VID filter mask allows masking any set of bits. The masking operation is $((\text{value} \& \text{vid-mask}) == (\text{tag and vid-mask}))$. For example: A value of 6 and a mask of 7 would match all VIDs with the lower 3 bits set to 6. VID filters allow explicit 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



OSSG734

Figure 19: Port Groups

Figure 19 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 IPv4 and IPv6 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. To specify IPv4 redirect policy, define all destinations to be IPv4. To specify IPv6 redirect policy define all destinations to be IPv6. IPv4 redirect policy can only be deployed in IP filter policies. IPv6 redirect policy can only be deployed in IPv6 filter policies.

Redirect policy supports the following destination tests:

- **ping test** – with configurable interval, drop-count, and time-out for the test
- **url-test** – with configurable URL to test, interval, drop-count, timeout, and configurable action (disable destination, lower or raise priority) based upon return error code
- **snmp-test** – with configurable OID and Community strings, interval, drop-count, timeout for the test, and configurable action (disable destination, lower or raise priority) based upon SNMP return value.
- **unicast-rt-test** – unicast routing reachability, supported only when router instance is configured for a given redirect policy. The test yields true if the route to the specified destination exists in RTM for the configured router instance.

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.

In some deployments, it may not be desirable to switch from a currently active, most-preferred redirect-policy destination when a new more-preferred destination becomes available. To support such deployments, operators can enable the sticky destination functionality (**config>filter>redirect-policy>sticky-dest**). When enabled, the currently active destination remains active unless it goes down or an operator forces the switch using the **tools>perform>filter>redirect-policy>activate-best-dest** command. An optional sticky destination **hold-time-up** is available to delay programming the sticky destination in redirect-policy (transition from "action forward" to PBR action to the most-preferred destination). When the timer is enabled, the first destination that comes up will not be programmed and instead the timer is started. Once the timer expires, the most-preferred destination at that time will be programmed (which may be a different destination from the one that started the timer). Note the following:

- When manual switchover to most-preferred destination is executed as described above, the hold-time-up is stopped

- When the timer value is changed, the new value takes immediate effect and the timer is restarted with the new value (or expired if **no-hold-time-up** is configured)

Operational note: **unicast-rt-test** will fail when performed in the context of a VPRN routing instance when the destination is routable only through **grt-leak** functionality. **ping-test** is recommended in such cases.

Feature caveats:

- Redirect policy is supported for ingress IPv4 and IPv6 filter policies only.
- SNMP and URL tests are not supported for IPv6.
- 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.

Router Instance Support for Redirect Policies

There are two modes of deploying redirect policies on VPRN interfaces. The functionality supported depends on the configuration of redirect-policy router option with (**config>filter>redirect-policy-router**):

- Redirect policy with router option enabled (recommended):
 - When a PBR destination is up, the PBR lookup is performed in the redirect policy's configured routing instance. When that instance differs from the incoming interface where the filter policy using the given redirect policy is deployed, the PBR action is equivalent to forward next-hop router filter policy action.
 - When all PBR destinations are down (or a given hardware does not support action router), action forward is programmed and the PBR lookup is performed in the routing instance of the incoming interface where the filter policy using the given redirect policy is deployed.
 - Any destination tests configured are executed in the routing context specified by the redirect-policy.
 - Note that changing router configuration for a redirect policy, brings all destinations with a test configured down. The destinations are brought up once the test confirm reachability based on the new redirect policy router configuration.

- Redirect policy without router option disabled (**no router**) or with router options not supported (legacy):
 - When a PBR destination is up, the PBR lookup is performed in the routing instance of the incoming interface where the filter policy using the given redirect policy is deployed.
 - When all PBR destinations are down, action forward is programmed and the PBR lookup is performed in the routing instance of the incoming interface where the filter policy using the given redirect policy is deployed.
 - Any destination tests configured are always executed in the "Base" router instance regardless of the router instance of the incoming interface where the filter policy using the given redirect policy is deployed.

Feature caveats:

- Only unicast-rt-test and ping-test are supported when router option is enabled.

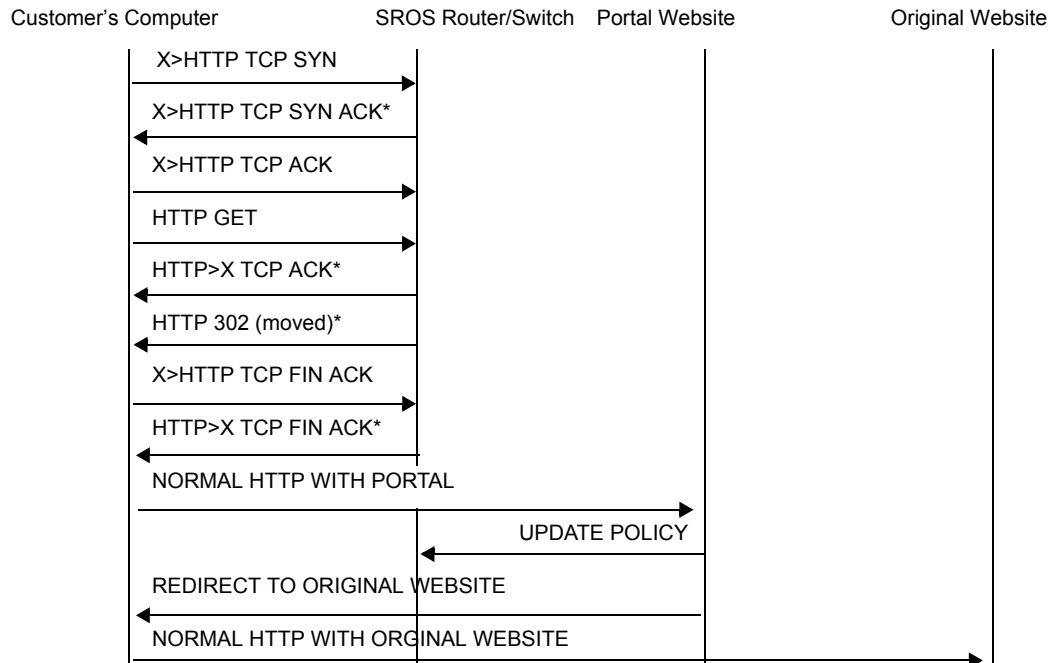
HTTP-redirect (Captive Portal)

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 20: 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.

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.

Filter Policy-based ESM Service Chaining

In some deployments, operators may select to redirect ESM subscribers to Value Added Services (VAS). Various deployment models can be used but often subscribers are assigned to a particular residential tier-of-service, which also defines the VAS available to subscribers of the given tier. The subscribers are redirected to VAS based on tier-of-service rules but such an approach can be hard to manage when many VAS services/tiers of service are desired. Often the only way to identify a subscriber’s traffic with a particular tier-of-service is to pre-allocate IP/IPv6 address pools to a given service tier and use those addresses in VAS PBR match criteria. This creates an application-services to network infrastructure dependency that can be hard to overcome, especially if fast and flexible application service delivery is desired.

Filter policy-based ESM service chaining removes ESM VAS steering to network infrastructure inter-dependency. An operator can configure per tier of service or per individual VAS service upstream and downstream service chaining rules without a need to define subscriber or tier-of-service match conditions. [Figure 21](#) shows a possible ACL model (embedded filters are used for VAS service chaining rules).

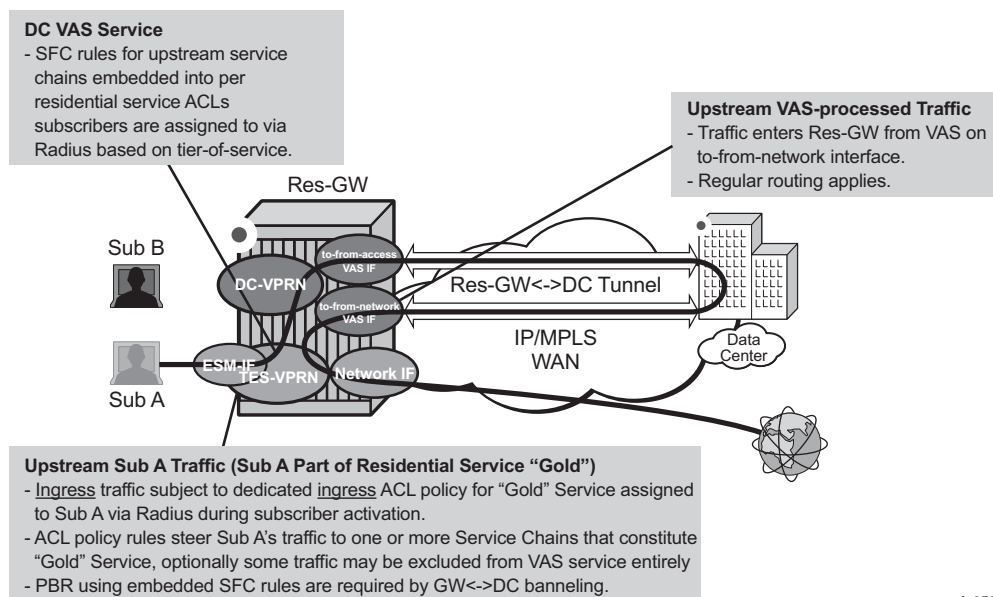
On the left in [Figure 21](#), the per-tier-of-service ACL model is depicted. Each tier of service (Gold or Silver) has a dedicated embedded VAS filter (“Gold VAS”, “Silver VAS”) that contains all steering rules for all service chains applicable to the given tier. Each VAS filter is then embedded by the ACL filter used by a given tier. A subscriber is subject to VAS service chain rules based on the per-tier ACL assigned to that subscriber (for example, via Radius). If a new VAS rule needs to

be added, an operator must program that rule in all applicable tiers. Upstream and downstream rules can be configured in a single filter (as shown) or can use dedicated ingress and egress filters.

On the right in [Figure 21](#), the per-VAS-service ACL model is depicted. Each VAS has a dedicated embedded filter (“VAS 1”, “VAS 2”, “VAS 3”) that contains all steering rules for all service chains applicable to that VAS service. A tier of service is then created by embedding multiple VAS-specific filters: Gold: VAS 1, VAS 2, VAS 3; Silver: VAS 1 and VAS 3. A subscriber is subject to VAS service chain rules based on the per-tier ACL assigned to that subscriber. If a new VAS rule needs to be added, an operator needs to program that rule in a single VAS-specific filter only. Again, upstream and downstream rules can be configured in a single filter (as shown) or can use dedicated ingress and egress filters.

Figure 21: ACL filter modeling for ESM Service Chaining

[Figure 22](#) shows upstream VAS service chaining steering using filter policies. Upstream subscriber traffic entering Res-GW is subject to the subscriber's ingress ACL filter assigned to that subscriber by a policy server. If the ACL contains VAS steering rules, the VAS-rule-matching subscriber traffic is steered for VAS processing over a dedicated to-from-access VAS interface in the same or a different routing instance. After the VAS processing, the upstream traffic can be returned to Res-GW by a to-from-network interface (shown in [Figure 22](#)) or can be injected to WAN to be routed towards the final destination (not shown).



al_0701

Figure 22: Upstream ESM ACL-policy based service chaining

[Figure 23](#) shows downstream VAS service chaining steering using filter policies. Downstream subscriber traffic entering Res-GW is forwarded to a subscriber-facing line card. On that card, the traffic is subject to the subscriber's egress ACL filter policy processing assigned to that subscriber

by a policy server. If the ACL contains VAS steering rules, the VAS rule-matching subscriber's traffic is steered for VAS processing over a dedicated to-from-network VAS interface (in the same or a different routing instance). After the VAS processing, the downstream traffic must be returned to Res-GW via a "to-from-network" interface (shown in [Figure 23](#)) to ensure the traffic is not redirected to VAS again when the subscriber-facing line card processes that traffic.

Figure 23: Downstream ESM ACL-policy based service chaining

The ESM filter policy-based service chaining allows operators to do the following:

- Steer upstream and downstream traffic per-subscriber with full ACL-flow-defined granularity without the need to specify match conditions that identify subscriber or tier-of-service
- Steer both upstream and downstream traffic on a single Res-GW
- Flexibly assign subscribers to tier-of-service by changing the ACL filter policy a given subscriber uses
- Flexibly add new services to a subscriber or tier-of-service by adding the subscriber-independent filter rules required to achieve steering
- Achieve isolation of VAS steering from other ACL functions like security through the use of embedded filters
- Deploy integrated Application Assurance (AA) as part of a VAS service chain - both upstream and downstream traffic is processed by AA before a VAS redirect
- Select whether to use IP-Src/IP-Dst address hash or IP-Src/IP-Dst address plus TCP/UDP port hash when LAG/ECMP connectivity to DC is used. L4 inputs are not used in hash with IPv6 packets with extension headers present.

ESM filter policy-based traffic steering supports the following:

- IPv4 and IPv6 steering of unicast traffic using IPv4 and IPv6 ACLs
- **action forward redirect-policy** or **action forward next-hop router** for IP-steering with TCAM-based load-balancing, fail-to-wire, and sticky destination
- **action forward esi sf-ip vas-interface router** for integrated service chaining solution

Operational notes:

- Downstream traffic steered towards a VAS on the subscriber-facing IOM is reclassified (FC and profile) based on the subscriber egress QoS policy, and is queued towards the VAS based on the network egress QoS configuration. Packets sent toward VAS will not have DSCP remarked (since they are not yet forwarded to a subscriber). DSCP remarking based on subscriber's egress QoS profile will only apply to traffic ultimately forwarded to the subscriber (after VAS or not subject to VAS).
- If mirroring of subscriber traffic is configured using ACL entry/subscriber/SAP/port mirror, the mirroring will apply to traffic ultimately forwarded to subscriber (after VAS or

not subject to VAS). Note that traffic that is being redirected to VAS cannot be mirrored using an ACL filter implementing PBR action (the same egress ACL filter entry being a mirror source and specifying egress PBR action is not supported).

- Use dedicated ingress and egress filter policies to prevent accidental match of an ingress PBR entry on egress and vice-versa that will result in forwarding/dropping of traffic matching the entry (based on the filter's default action configuration).

Feature caveats:

- Requires chassis mode D
- Is not supported with HSMDAs on subscriber ingress
- Is not supported when the traffic is subject to non-AA ISA on Res-GW
- Traffic that matches an egress filter entry with egress PBR action cannot be mirrored, cannot be sampled using cflowd, and cannot be logged using filter logging while being redirected to VAS on a sub-facing line card.

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 446](#)
- [Common Configuration Tasks on page 447](#)
 - [Creating an IP Filter Policy on page 447](#)
 - [Creating an IPv6 Filter Policy on page 452](#)
 - [Applying \(IPv4/v6\) Filter Policies to a Network Port on page 459](#)
 - [Creating a Redirect Policy on page 460](#)
 - [Configuring Policy-Based Forwarding for Deep Packet Inspection in VPLS on page 461](#)
- [Filter Management Tasks on page 464](#)
 - [Renumbering Filter Policy Entries on page 464](#)
 - [Modifying a Filter Policy on page 466](#)
 - [Deleting a Filter Policy on page 468](#)
 - [Deleting a Filter Policy on page 468](#)
 - [Copying Filter Policies on page 471](#)

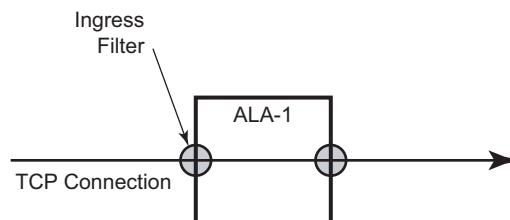
Basic Configuration

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 24](#) 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#
```



OSRG007

Figure 24: 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 447](#)
 - [Creating an IPv6 Filter Policy on page 452](#)
 - [Creating a MAC Filter Policy on page 453](#)
 - [Creating a Match List for Filter Policies on page 457](#)
 - [Applying \(IPv4/v6\) Filter Policies to a Network Port on page 459](#)
-

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.

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 447](#).

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 7950 SR OS Services Guide.

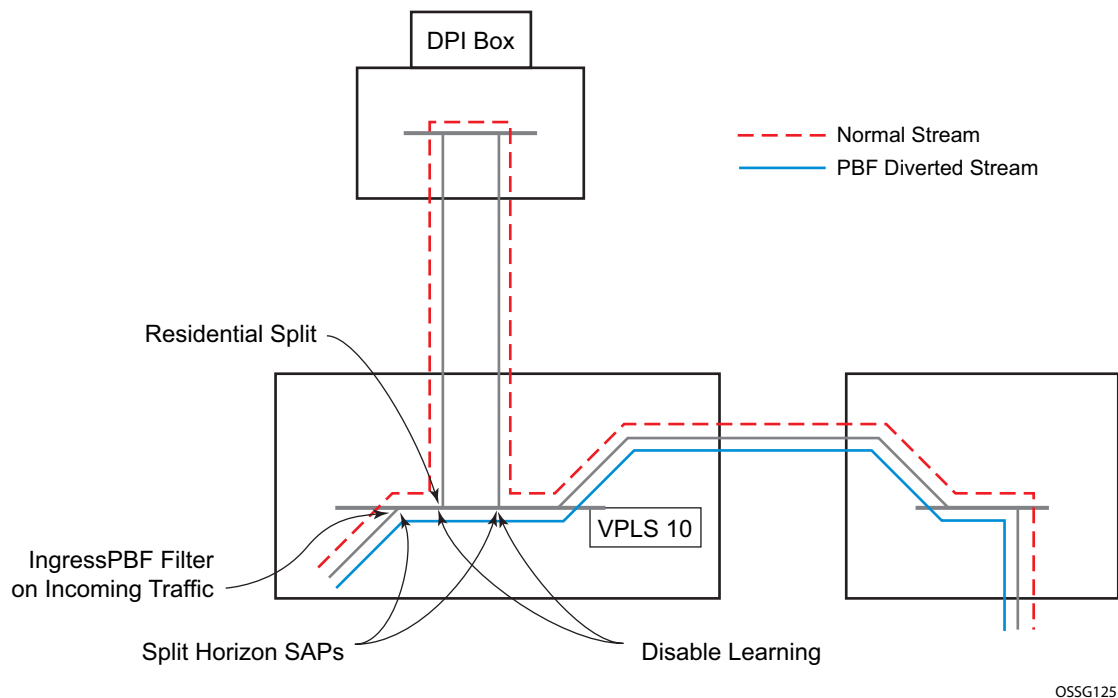


Figure 25: Policy-Based Forwarding for Deep Packet Inspection

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 464](#)
 - [Modifying a Filter Policy on page 466](#)
 - [Deleting a Filter Policy on page 468](#)
 - [Modifying a Redirect Policy on page 469](#)
 - [Deleting a Redirect Policy on page 470](#)
 - [Copying Filter Policies on page 471](#)
-

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 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

- [DHCP Filter Policy Commands on page 473](#)
- [Match Filter List Commands on page 480](#)
- [IP Filter Policy Commands on page 474](#)
- [IPv6 Filter Policy Commands on page 477](#)
- [System Filter Policy Commands on page 478](#)
- [Log Filter Commands on page 479](#)
- [Redirect Policy Configuration Commands on page 480](#)
- [Copy Filter Commands on page 481](#)
- [Show Commands on page 481](#)
- [Clear Commands on page 482](#)
- [Monitor Commands on page 482](#)
- [Debug Commands on page 482](#)

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
— chain-to-system-filter
— no chain-to-system-filter
— default-action {drop | forward}
— description description-string
— no description
— embed-filter filter-id [offset offset] [{active | inactive}]
— embed-filter open-flow ofs-name [{system | service {service-id | service-name} |
  sap sap-id}] [offset offset] [{active | inactive}]
— embed-filter open-flow ofs-name [offset offset] [{active | inactive}]
— embed-filter open-flow ofs-name system [offset offset] [{active | inactive}]
— embed-filter open-flow ofs-name service {service-id | service-name} [offset off-
  set] [{active | inactive}]
— embed-filter open-flow ofs-name sap sap-id] [offset offset] [{active | inac-
  tive}]
— no embed-filter filter-id
— no embed-filter open-flow ofs-name service {service-id | service-name}
— no embed-filter open-flow ofs-name sap sap-id
— no embed-filter open-flow ofs-name system
— no embed-filter open-flow ofs-name [{system | service {service-id | service-
  name} | sap sap-id}]
— entry entry-id [time-range time-range-name] [create]
— no entry entry-id
— action (IPv4)
— no action (IPv4)
— drop
— drop packet-length {{lt | eq | gt} packet-length-value | range
  packet-length-value packet-length-value}
— drop [ttl {lt | gt | eq} ttl-value | range ttl-value ttl-value}]
— forward
— forward esi esi sf-ip ip-address vas-interface interface-name
  router {router-instance | service-name service-name}
— forward esi esi service-id vpls-service-id
— forward lsp lsp-name
— forward next-hop [indirect] ip-address
— forward next-hop [indirect] ip-address router {router-
  instance | service-name service-name}
— forward next-hop interface ip-int-name
— forward redirect-policy policy-name
— forward router {router-instance | service-name service-
  name}
— forward sap sap-id
— forward sdp sdp-id:vc-id
— gtp-local-breakout
— http-redirect rdr-url-string [allow-radius-override]
— nat [nat-policy nat-policy-name]
— reassemble
— description description-string
— no description
— egress-pbr {default-load-balancing | l4-load-balancing}
— no egress-pbr

```

```

— 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
    — pbr-down-action-override {drop | forward | filter-default-action}
    — no pbr-down-action-override
— filter-name filter-name
— no filter-name
— renum old-entry-id new-entry-id
— scope {exclusive | template | embedded | system}
— 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-pccrule start-entry entry-id count count
— no sub-insert-shared-pccrule

```

- **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
— chain-to-system-filter
— no chain-to-system-filter
— default-action {drop | forward}
— description description-string
— no description
— embed-filter filter-id [offset offset] [{active | inactive}]
— embed-filter open-flow ofs-name [{system | service {service-id | service-name} |
sap sap-id}] [offset offset] [{active | inactive}]
— embed-filter open-flow ofs-name [offset offset] [{active | inactive}]
— embed-filter open-flow ofs-name system [offset offset] [{active | inactive}]
— embed-filter open-flow ofs-name service {service-id | service-name} [offset offset]
[{active | inactive}]
— embed-filter open-flow ofs-name sap sap-id] [offset offset] [{active | inactive}]
— no embed-filter filter-id
— no embed-filter open-flow ofs-name service {service-id | service-name}
— no embed-filter open-flow ofs-name sap sap-id
— no embed-filter open-flow ofs-name system
— no embed-filter open-flow ofs-name [{system | service {service-id | service-name} |
sap sap-id}]
— entry entry-id [time-range time-range-name] [create]
— no entry entry-id
— action(IPv6)
— no action(IPv6)
— drop
— drop packet-length {{lt | eq | gt} packet-length-value | range
packet-length-value packet-length-value}
— forward
— forward next-hop [indirect] ipv6-address
— forward next-hop [indirect] ipv6-address router {router-instance |
service-name service-name}
— forward redirect-policy policy-name
— forward router {router-instance service-name service-name}
— forward sap sap-id
— forward sdp sdp-id:vc-id
— http-redirect rdr-url-string [allow-radius-override]
— nat [nat-policy nat-policy-name] nat-type nat-type
— description description-string
— no description
— 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
— renum old-entry-id new-entry-id
— scope {exclusive | template | embedded | system}
— 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-pccrule start-entry entry-id count count
— no sub-insert-shared-pccrule
— 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

```

System Filter Policy Commands

```

config
— filter
— system-filter

```

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

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
—
—

```

## 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
 — destination ipv6-address [create]
 — no destination ipv6-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
 — router router-instance
 — router service-name service-name
 — no router
 — [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**
- **sticky-dest** {**hold-time-up** *seconds* | **no-hold-time-up**}
- **no sticky-dest**
- [**no**] **unicast-rt-test**
- **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**] **router** [*router-instance* | **service-name** *service-name*]
- [**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]
 — dhcp6 [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]

```

## Command Hierarchies

- **log** [bindings]
- **log** *log-id* [**match** *string*]
- 
- **match-list**
  - **ip-prefix-list** [*prefix-list-name*]
  - **ip-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**]}
- **system-filter** [**chained-to**]

## Clear Commands

- clear**
  - **filter**
    - **ip** *filter-id* [**entry** *entry-id*] [**ingress** | **egress**]
    - **log** *log-id*

## Monitor Commands

- monitor**
  - **filter ip** *ip-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**]

## Debug Commands

- tools**
  - **dump**
    - **filter**
      - **resources**
        - **cpm**
        - **egress-pbr** **detail**
        - **ip** <*filter-id*>
        - **iom**
        - **ip** <*filter-id*>
        - **ipv6** <*filter-id*>
        - **mac** <*filter-id*>

---

## Configuration Commands

---

### Generic Commands

#### description

|                    |                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>description</b> <i>string</i><br><b>no description</b>                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter<br>config>filter>ip-filter>entry<br>config>filter>ip-filter>entry<br>config>filter>ipv6-filter>entry<br>config>filter>log<br>config>filter>redirect-policy<br>config>filter>redirect-policy>destination<br>config>filter>match-list>ip-prefix-list<br>config>filter>match-list>ip-filter<br>config>filter>match-list>port-list |
| <b>Description</b> | <p>This command creates a text description stored in the configuration file for a configuration context.</p> <p>The <b>description</b> command associates a text string with a configuration context to help identify the context in the configuration file.</p> <p>The <b>no</b> form of the command removes any description string from the context.</p>                          |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <i>string</i> — 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dhcp-filter</b> <i>filter-id</i> [ <b>create</b> ]<br><b>no dhcp-filter</b> <i>filter-id</i>                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | This command configures the identification number of a DHCP filter.                                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>  | <i>filter-id</i> — Specifies the DHCP filter policy ID number.<br><b>Values</b> 1 — 65535<br><b>create</b> — Keyword required when first creating the configuration context. Once the context is created, one can navigate into the context without the <b>create</b> keyword.<br><i>filter-name</i> — A string of up to 64 characters uniquely identifying this filter policy. |

### ip-filter

|                    |                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip-filter</b> <i>filter-id</i> [ <b>create</b> ]<br><b>ip-filter</b> { <i>filter-id</i>   <i>filter-name</i> }<br><b>no ip-filter</b> <i>filter-id</i>                                                                                                                                                                                                                     |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | This command creates a configuration context for an IP (v4) filter policy.<br>The <b>no</b> 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.                                                                                                                                     |
| <b>Parameters</b>  | <i>filter-id</i> — Specifies the IP filter policy ID number.<br><b>Values</b> 1 — 65535<br><b>create</b> — Keyword required when first creating the configuration context. Once the context is created, one can navigate into the context without the <b>create</b> keyword.<br><i>filter-name</i> — A string of up to 64 characters uniquely identifying this filter policy. |

### ipv6-filter

|                |                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>ipv6-filter</b> <i>filter-id</i> [ <b>create</b> ]<br><b>ip-filter</b> { <i>filter-id</i>   <i>filter-name</i> }<br><b>no ipv6-filter</b> <i>ipv6-filter-id</i> |
| <b>Context</b> | config>filter                                                                                                                                                      |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command creates a configuration context for an IP (v6) filter policy.</p> <p>The <b>no</b> 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.</p>                                                                                                                                                         |
| <b>Parameters</b>  | <p><i>filter-id</i> — specifies the IPv6 filter policy ID number.</p> <p><b>Values</b>      1 — 65535</p> <p><b>create</b> — Keyword required when first creating the configuration context. Once the context is created, one can navigate into the context without the <b>create</b> keyword.</p> <p><i>filter-name</i> — A string of up to 64 characters uniquely identifying this IPv6 filter policy.</p> |

## system-filter

|                    |                                                                      |
|--------------------|----------------------------------------------------------------------|
| <b>Syntax</b>      | <b>system-filter</b>                                                 |
| <b>Context</b>     | config>filter                                                        |
| <b>Description</b> | This command enables the context to activate system filter policies. |
| <b>Parameters</b>  | none                                                                 |

## redirect-policy

|                    |                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] redirect-policy</b> <i>redirect-policy-name</i>                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command configures redirect policies.</p> <p>The <b>no</b> 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).</p>                                                                                                       |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><i>redirect-policy-name</i> — 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.</p> |

## log

|                    |                                                                 |
|--------------------|-----------------------------------------------------------------|
| <b>Syntax</b>      | <b>log</b> <i>log-id</i> [ <b>create</b> ]<br><b>no log</b>     |
| <b>Context</b>     | config>filter                                                   |
| <b>Description</b> | 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

|                    |                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>action</b> { <b>bypass-host-creation</b> }<br><b>action drop</b><br><b>no action</b>                                                                                                               |
| <b>Context</b>     | config>filter>dhcp-filter>entry                                                                                                                                                                       |
| <b>Description</b> | This command specifies the action to take on DHCP host creation when the filter entry matches. The <b>no</b> form of the command reverts to the default wherein the host creation proceeds as normal. |
| <b>Default</b>     | no action                                                                                                                                                                                             |
| <b>Parameters</b>  | <b>bypass-host-creation</b> — Specifies that the host creation is bypassed.<br><b>drop</b> — Specifies the DHCP message is dropped.                                                                   |

### option

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>option</b> <i>dhcp-option-number</i> { <b>present</b>   <b>absent</b> }<br><b>option</b> <i>dhcp-option-number</i> <b>match hex</b> <i>hex-string</i> [ <b>exact</b> ] [ <b>invert-match</b> ]<br><b>option</b> <i>dhcp-option-number</i> <b>match string</b> <i>ascii-string</i> [ <b>exact</b> ] [ <b>invert-match</b> ]<br><b>no option</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>filter>dhcp-filter>entry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command configures the action to take on DHCP host creation when the filter entry matches. The <b>no</b> form of the command reverts to the default.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <i>dhcp-option-number</i> —<br><div style="margin-left: 40px;"><b>Values</b>      0 — 255</div> <div style="margin-left: 40px;"><b>present</b> — Specifies that the related DHCP option must be present.</div> <div style="margin-left: 40px;"><b>absent</b> — Specifies that the related DHCP option must be absent.</div> <div style="margin-left: 40px;"><b>match hex</b> <i>hex-string</i> — The option must (partially) match a specified hex string.<br/> <div style="margin-left: 40px;"><b>Values</b>      0x0..0xFFFFFFFF...(max 254 hex nibbles)</div> </div> <div style="margin-left: 40px;"><b>match string</b> <i>ascii-string</i> — The option must (partially) match a specified ASCII string.<br/> <div style="margin-left: 40px;"><b>Values</b>      Up to 127 characters</div> </div> <div style="margin-left: 40px;"><b>exact</b> — This option requires an exact match of a hex or ascii string.</div> <div style="margin-left: 40px;"><b>invert-match</b> — Requires the option not to (partially) match.</div> |

---

## Filter Log Commands

### destination

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>destination memory</b> <i>num-entries</i><br><b>destination syslog</b> <i>syslog-id</i><br><b>no destination</b>                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>filter>log                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | This command configures the destination for filter log entries for the filter log ID.<br>Filter logs can be sent to either memory ( <b>memory</b> ) or to an existing Syslog server definition ( <b>syslog</b> ).<br>If the filter log destination is <b>memory</b> , the maximum number of entries in the log must be specified.<br>The <b>no</b> form of the command deletes the filter log association.                                                  |
| <b>Default</b>     | <b>no destination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <b>memory</b> <i>num-entries</i> — Specifies the destination of the filter log ID is a memory log. The <i>num-entries</i> value is the maximum number of entries in the filter log expressed as a decimal integer.<br><b>Values</b> 10 — 50000<br><b>syslog</b> <i>syslog-id</i> — Specifies the destination of the filter log ID is a Syslog server. The <i>syslog-id</i> parameter is the number of the Syslog server definition.<br><b>Values</b> 1 — 10 |

### shutdown

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>[no] shutdown</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b> | config>filter>log<br>config>filter>log>summary<br><br>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.<br><br>The <b>shutdown</b> command administratively downs an entity. Administratively downing an entity changes the operational state of the entity to down.<br><br>Unlike other commands and parameters where the default state will not be indicated in the configuration file, <b>shutdown</b> and <b>no shutdown</b> are always indicated in system generated configuration files.<br><br>The <b>no</b> form of the command puts an entity into the administratively enabled state. |
| <b>Default</b> | no shutdown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |



## summary

|                    |                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>summary</b>                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>filter>log                                                                                                                                                                                                                                     |
| <b>Description</b> | 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. |
| <b>Parameters</b>  | none                                                                                                                                                                                                                                                  |

## summary-crit

|                    |                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>summary-crit dst-addr</b><br><b>summary-crit src-addr</b><br><b>no summary-crit</b>                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>filter>log>summary                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>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.</p> <p>The <b>no</b> form of the command reverts to the default parameter.</p> |
| <b>Default</b>     | dst-addr                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <b>dst-addr</b> — Specifies that received log packets are summarized based on the destination IP, IPv6, or MAC address.<br><br><b>src-addr</b> — Specifies that received log packets are summarized based on the source IP, IPv6 or MAC address.                                                                                                                                                          |

## wrap-around

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] wrap-around</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>filter>log                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | <p>This command configures a memory filter log to log until full or to store the most recent log entries (circular buffer).</p> <p>Specifying <b>wrap-around</b> 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.</p> <p>The <b>no</b> 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.</p> |
| <b>Default</b>     | wrap-around                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

---

## ACL Filter Policy Commands

### default-action

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>default-action {drop   forward}</b>                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>mac-filter                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command defines default action to be applied to packets not matching any entry in this ACL filter policy or to packets for that match a PBR filter entry for which the PBR target is down and pbr-down-action per-entry override is set to filter-default-action.</p> <p>The options are the following:</p> <p><b>drop</b> – default action is to drop a packet.</p> <p><b>forward</b> – default action is to forward a packet.</p> |
| <b>Default</b>     | drop                                                                                                                                                                                                                                                                                                                                                                                                                                        |

### chain-to-system-filter

|                    |                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>chain-to-system-filter</b><br><b>no chain-to-system-filter</b>                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command chains this filter to a currently active system filter. When the filter is chained to the system filter, the system filter rules are executed first, and the filter rules are only evaluated if no match on the system filter was found.</p> <p>The <b>no</b> form of the command detaches this filter from the system filter.</p> |
| <b>Default</b>     | <b>no chain-to-system-filter</b>                                                                                                                                                                                                                                                                                                                   |
|                    | <b>Operational note:</b><br>If no system filter is currently active, the command has no effect.                                                                                                                                                                                                                                                    |

### ip

|                    |                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip filter-id</b><br><b>no ip filter-id</b>                                                        |
| <b>Context</b>     | config>filter>system-filter                                                                          |
| <b>Description</b> | This command activates an IPv4 system filter policy. Once activated, all IP ACL filter policies that |

chain to the system filter (**config filter ip-filter chain-to-system-filter**) will automatically execute system filter policy rules first.

The **no** form of the command deactivates the system filter policy.

**Default** None of the IPv4 system filters is available by default.

**Parameters** *filter-id* — An existing IP filter policy with scope system.

**Values** [1..65535] | <filter-name:64 char max>

## ipv6

**Syntax** **ipv6** *filter-id*  
**no ipv6** *filter-id*

**Context** config>filter>system-filter

**Description** This command activates an IPv6 system filter policy. Once activated, all IPv6 ACL filter policies that chain to the system filter (**config filter ipv6-filter chain-to-system-filter**) will automatically execute system filter policy rules first.

The **no** form of the command deactivates the system filter policy.

**Default** None of the IPv6 system filters is available by default.

**Parameters** *filter-id* — An existing IPv6 filter policy with scope system.

**Values** [1..65535] | <filter-name:64 char max>

## embed-filter

**Syntax** **embed-filter** *filter-id* [**offset** *offset*] [{**active** | **inactive**}]  
**embed-filter open-flow** *ofs-name* [{**system** | **service** {*service-id* | *service-name*} | **sap** *sap-id*}] [**offset** *offset*] [{**active** | **inactive**}]  
**embed-filter open-flow** *ofs-name* **system** [**offset** *offset*] [{**active** | **inactive**}]  
**embed-filter open-flow** *ofs-name* **service** {*service-id* | *service-name*} [**offset** *offset*] [{**active** | **inactive**}]  
**embed-filter open-flow** *ofs-name* **sap** *sap-id*} [**offset** *offset*] [{**active** | **inactive**}]  
**no embed-filter** *filter-id*  
**no embed-filter open-flow** *ofs-name* [{**system** | **service** {*service-id* | *service-name*} | **sap** *sap-id*}]  
**no embed-filter open-flow** *ofs-name* **service** {*service-id* | *service-name*}  
**no embed-filter open-flow** *ofs-name* **sap** *sap-id*}  
**no embed-filter open-flow** *ofs-name* **system**

**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 instance into this exclusive, template or system filter policy at the specified offset value.

The **embed-filter open-flow** *ofs-name* form of this command enables OpenFlow (OF) in GRT either by embedding the specified OpenFlow switch (OFS) instance with **switch-defined-cookie** disabled, or by embedding rules with sros-cookie:type “grt-cookie”, value 0 from the specified OFS instance with **switch-defined-cookie** enabled. The embedding filter can only be deployed in GRT context or be unassigned.

The **embed-filter open-flow** *ofs-name system* form of this command enables OF in system filters by embedding rules with sros-cookie:type “system-cookie”, value 0 from the specified OFS instance with **switch-defined-cookie** enabled. The embedding filter can only be of scope system.

The **embed-filter open-flow** *ofs-name service* {*service-id* | *service-name*} form of this command enables OF in VPRN/VPLS filters by embedding rules with sros-cookie:type “service-cookie”, value *service-id* from the specified OFS instance with **switch-defined-cookie** enabled – per service rules. The embedding filter can only be deployed in the specified VPRN/VPLS service. Note that a single VPLS service can only support OF rules per SAP or per service.

The **embed-filter open-flow** *ofs-name sap* *sap-id* form of this command enables OF in VPLS SAP filters by embedding rules with sros-cookie:type “service-cookie”, value *service-id* and flow match conditions specifying the *sap-id* from the specified OFS instance with **switch-defined-cookie** enabled – per SAP OF rules. The embedding filter must be of type exclusive and can only be deployed on the specified SAP in the context of the specified VPLS service. Note that a single VPLS service can only support OF rules per SAP or per service.

The **no embed-filter** *filter-id* form of this command removes the embedding from this filter policy.

The **no embed-filter open-flow** *ofs-name* form of this command removes the OF embedding for the GRT context.

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.

**open-flow** *ofs-name* — Specifies the name of the currently configured Hybrid OpenFlow Switch (OFS) instance.

Not including the **system**, **service** or **sap** parameters will specify OF in a GRT instance context by default. This allows embedding of OF rules into filters deployed in GRT instances from OFS with **switch-defined-cookie** disabled, or embedding rules from OFS with **switch-defined-cookie** enabled, when the FlowTable cookie encodes sros-cookie:type “grt-cookie”.

**system** — Used for OF control of system filters. Allows embedding of OF rules into system filters from OFS with **switch-defined-cookie** enabled. Only the rules with cookie value encoding “system-cookie” are embedded.

**service** {*service-id* | *service-name*} — Used for OF control of VPRN or VPLS services. Allows embedding of OF rules into a VPRN or VPLS access or network filters. Only the rules with cookie value encoding the specified service ID are embedded into the filter. The embedding filter can only be deployed in the context of the specified service.

*service-id* — Specifies an existing 7x50 VPRN or VPLS service ID that the embedding filter can be used for.

*service-name* — Specifies an existing 7x50 VPRN or VPLS service name that the embedding filter can be used for.

**sap** *sap-id* — Used for OF control of VPLS services when a PortID and VLAN ID match is required. Allows embedding of OF rules with a PortID and VLAN ID match into exclusive VPLS SAP filters. Only the rules with cookie value encoding the VPLS service, and flow table match encoding the specified SAP are embedded into the filter. The embedding filter can only be deployed in the context of the specified SAP.

*sap-id* — Specifies an existing 7x50 SAP that the embedding filter can be used for.

*offset* — An embedded filter entry X will have an entry X + offset in the embedding filter.

**Values** 0 — 65535

**active** — Specifies that 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** — Specifies that no embedded filter policy entries are to be included in this embedded filter policy. The embedding is configured but will not do anything.

## filter-name

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>filter-name</b> <i>filter-name</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>mac-filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | 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.                                                                                                                                                                                                                                                                                                                                                           |
| <b>Default</b>     | no filter-name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b>  | <p><i>filter-name</i> — A string of up to 64 characters uniquely identifying this filter policy.</p> <p>The following restrictions apply to the filter-name:</p> <ul style="list-style-type: none"> <li>– Policy names may not begin with a number (0-9).</li> <li>– Policy names may not begin with the underscore “_” character (e.g. _myPolicy). Names that start with underscore are reserved for system generated names.</li> <li>– “fSpec-x” (where x is any number) cannot be used as a user defined filter name.</li> </ul> |

## scope

|                    |                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>scope {exclusive   template   embedded   system}</b><br><b>no scope</b>                  |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter<br>config>filter>mac-filter            |
| <b>Description</b> | This command configures the filter policy scope as exclusive, template, embedded or system. |

The scope of the policy cannot be changed when:

- the scope is **template** and the policy is applied to one or more services or network interfaces
- the scope is **embedded** and the policy is embedded by another policy

Changing the scope to/from system is only allowed when a policy is not active and the policy has no entries configured.

The **no** form of the command sets the scope of the policy to the default of **template**.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | <b>template</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b> | <p><b>exclusive</b> — When the scope of a policy is defined as exclusive, the policy can only be applied to a single entity. Attempting to assign the policy to a second entity will result in an error message.</p> <p><b>template</b> — When the scope of a policy is defined as template, the policy can be applied to multiple entities.</p> <p><b>embedded</b> — When the scope of a policy is defined as embedded, the policy cannot be applied directly. The policy defines embedded filter rules, which are embedded by other exclusive/template/system filter policies. The <b>embedded</b> scope is supported for IP and IPv6 filter policies only.</p> <p><b>system</b> — When the scope of a policy is defined as system, the policy defines system-wide filter rules. To apply system policy rules, activate system filter and chain exclusive/template ACL filter policy to the system filter. The <b>system</b> scope is supported for IP and IPv6 filter policies only.</p> |

## shared-radius-filter-wmark

|                    |                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>shared-radius-filter-wmark low low-watermark high high-watermark</b><br><b>no shared-radius-filter-wmark</b>                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | This command configures the low and high watermark for the number of RADIUS shared filters reporting                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><b>low low-watermark</b> — Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be raised by the agent.</p> <p><b>Values</b> 0 — 8000</p> <p><b>high high-watermark</b> — Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be cleared by the agent.</p> <p><b>Values</b> 1 — 8000</p> |

## sub-insert-credit-control

|                    |                                                                                                                                                                              |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sub-insert-credit-control start-entry</b> <i>entry-id</i> <b>count</b> <i>count</i><br><b>no sub-insert-credit-control</b>                                                |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                         |
| <b>Description</b> | This command inserts point information for credit control for the filter.<br>The <b>no</b> form of the command reverts to the default.                                       |
| <b>Default</b>     | none                                                                                                                                                                         |
| <b>Parameters</b>  | <b>entry</b> <i>entry-id</i> — Identifies a filter on this system.<br><b>Values</b> 1 — 65535<br><b>count</b> <i>count</i> — Specifies the count.<br><b>Values</b> 1 — 65535 |

## sub-insert-radius

|                    |                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sub-insert-radius start-entry</b> <i>entry-id</i> <b>count</b> <i>count</i><br><b>no sub-insert-radius</b>                                                                                                                            |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                                                                                     |
| <b>Description</b> | This command insert point information for RADIUS for the filter.<br>The <b>no</b> form of the command reverts to the default.                                                                                                            |
| <b>Default</b>     | none                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <b>entry</b> <i>entry-id</i> — Specifies at what place the filter entries received from RADIUS will be inserted in the filter.<br><b>Values</b> 1 — 65535<br><b>count</b> <i>count</i> — Specifies the count.<br><b>Values</b> 1 — 65535 |

## sub-insert-shared-pccrule

|                |                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>sub-insert-shared-pccrule start-entry</b> <i>entry-id</i> <b>count</b> <i>count</i><br><b>no sub-insert-shared-pccrule</b> |
| <b>Context</b> | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                          |

|                    |                                                                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command defines the range of filter and QoS policy entries that are reserved for shared entries received in Flow-Information AVP via Gx interface (PCC rules – Policy and Charging Control). The <b>no</b> version of this command disables the insertion, which will result in a failure of PCC rule installation. |
| <b>Default</b>     | no sub-insert-shared-pccrule                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>  | <b>start-entry entry-id</b> — Specifies the lowest entry in the range.<br><b>Values</b> 1 — 65535<br><b>count count</b> — Specifies the number of entries in the range.<br><b>Values</b> 1 — 65535                                                                                                                       |

## sub-insert-shared-radius

|                    |                                                                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sub-insert-shared-radius start-entry entry-id count count</b><br><b>no sub-insert-shared-radius</b>                                                                                                                                                                                             |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command configures the insert point for shared host rules from RADIUS.</p> <p><b>entry entry-id</b> — Identifies a filter on this system.<br/>             <b>Values</b>      1 — 65535</p> <p><b>count count</b> — Specifies the count.<br/>             <b>Values</b>      1 — 65535</p> |

## sub-insert-wmark

|                    |                                                                                                                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sub-insert-wmark low low-watermark high high-watermark</b><br><b>no sub-insert-wmark</b>                                                                                                                  |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                                                         |
| <b>Description</b> | <p>This command configures the low and high watermark percentage for inserted filter entry usage reporting.</p> <p>The <b>no</b> form of the command reverts to the default.</p>                             |
| <b>Default</b>     | none                                                                                                                                                                                                         |
| <b>Parameters</b>  | <p><b>low low-watermark</b> — Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be cleared by the agent.</p> <p>    <b>Values</b>      0 — 100</p> |



**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

---

## General Filter Entry Commands

### entry

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>entry</b> <i>entry-id</i> [ <b>time-range</b> <i>time-range-name</i> ] [ <b>create</b> ]<br><b>no entry</b> <i>entry-id</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>dhcp-filter<br>config>filter>ip-filter<br>config>filter>ipv6-filter<br>config>filter>mac-filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command creates or edits an IP (v4) or MAC filter entry. Multiple entries can be created using unique <i>entry-id</i> numbers within the filter. Entries must be sequenced from most to least explicit.</p> <p>An entry may not have any match criteria defined (in which case, everything matches) but must have at least the keyword <b>action</b> for it to be considered complete. Entries without the <b>action</b> keyword will be considered incomplete and hence will be rendered inactive.</p> <p>The <b>no</b> form of the command removes the specified entry from the filter. Entries removed from the filter are immediately removed from all services or network ports where that filter is applied.</p>                                                                  |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <p><i>entry-id</i> — An entry-id uniquely identifies a match criteria and the corresponding action. It is recommended that multiple entries be given <i>entry-ids</i> in staggered increments. This allows users to insert a new entry in an existing policy without requiring renumbering of all the existing entries.</p> <p><b>Values</b>      1 — 65535</p> <p><b>time-range</b> <i>time-range-name</i> — 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&gt;system&gt;cron context.</p> <p><b>create</b> — Keyword required when first creating the configuration context. Once the context is created, one can navigate into the context without the <b>create</b> keyword.</p> |

### action

|                    |                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>action</b><br><b>no action</b>                                                                                                                                                                   |
| <b>Context</b>     | config>filter>ip-filter>entry<br>config>filter>ipv6-filter>entry<br>config>filter>mac-filter>entry                                                                                                  |
| <b>Description</b> | This command enters the context to configure an action to be performed on packets matching this filter entry. An ACL filter entry remains inactive (is not programmed in hardware) until a specific |

action is configured for that entry.

The **no** form of this command removes the specific action configured in the context of action command.

**Default** no action

## 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

## pbr-down-action-override

**Syntax** **pbr-down-action-override**  
**no pbr-down-action-override**

**Context** config>filter>ip-filter>entry  
config>filter>mac-filter>entry

**Description** This command allows overriding the default action that is applied for entries with PBR/PBF action defined, when the PBR/PBF target is down.

The **no** form of the command preserves default behavior when PBR/PBF target is down.

**Default** no pbr-down-action-override

**Parameters** **drop** — Packets matching the entry will be dropped if PBR/PBF target is down.

**forward** — Packets matching the entry will be forwarded if PBR/PBF target is down.

**filter-default-action** — Packets matching the entry will be processed as per **default-action** configuration for this filter if PBR/PBF target is down.

---

## IP (v4/v6) Filter Entry Commands

### action (IPv4)

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>For IPv4:</b></p> <p><b>drop</b></p> <p><b>drop packet-length</b> {{lt   eq   gt} <i>packet-length-value</i>   <b>range</b> <i>packet-length-value</i> <i>packet-length-value</i>}</p> <p><b>drop ttl</b> {{lt   eq   gt} <i>ttl-value</i>   <b>range</b> <i>ttl-value</i> <i>ttl-value</i>}</p> <p><b>forward</b></p> <p><b>forward esi esi sf-ip ip-address vas-interface interface-name router</b> {<i>router-instance</i>   <b>service-name</b> <i>service-name</i>}</p> <p><b>forward esi esi service-id vpls-service-id</b></p> <p><b>forward lsp lsp-name</b></p> <p><b>forward next-hop [indirect] ip-address</b></p> <p><b>forward next-hop [indirect] ip-address router</b> {<i>router-instance</i>   <b>service-name</b> <i>service-name</i>}</p> <p><b>forward next-hop interface ip-int-name</b></p> <p><b>forward redirect-policy policy-name</b></p> <p><b>forward router</b> {<i>router-instance</i>   <b>service-name</b> <i>service-name</i>}]</p> <p><b>forward sap sap-id</b></p> <p><b>forward sdp sdp-id:vc-id</b></p> <p><b>gtp-local-breakout</b></p> <p><b>http-redirect rdr-url-string [allow-radius-override]</b></p> <p><b>nat [nat-policy nat-policy-name]</b></p> <p><b>reassemble</b></p> |
| <b>Context</b>     | <p>config&gt;filter&gt;ip-filter&gt;entry</p> <p>config&gt;filter&gt;ip-filter&gt;entry&gt;action</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>The <b>action</b> command (under the config&gt;filter&gt;ip-filter context) sets the context for specific action commands to be performed (under the config&gt;filter&gt;ip-filter&gt;action context) on packets matching this filter entry.</p> <p>The following commands are available under the config&gt;filter&gt;ip-filter&gt;entry&gt;action context:</p> <p><b>drop</b> – A packet matching the entry will be dropped.</p> <p><b>drop packet-length</b> – A packet matching the entry will be dropped only if “Total Length” field in the packet’s IPv4 header meets the configured condition.</p> <p><b>drop ttl</b> – A packet matching the entry will be dropped only if “Time-to-live” field in the packet’s IPv4 header meets the configured condition.</p> <p><b>forward</b> – A packet matching the entry will be forwarded using regular routing.</p> <p><b>forward esi service-id</b> - A packet matching the entry will be forwarded to ESI identified first appliance in Nuage service chain using EVPN-resolved VXLAN tunnel in the specified VPLS service.</p> <p><b>forward esi sf-ip vas-interface router</b> - A packet matching the entry will be forwarded to ESI/SF-IP</p>                       |

identified first appliance in Nuage service chain using EVPN-resolved VXLAN tunnel over the configured VAS interface in the specified VPRN service.

**forward lsp** – A packet matching the entry will be forwarded using the specified lsp.

**forward next-hop** – A packet matching the entry will be forwarded in the routing context of the incoming interface using direct or indirect IP address in the routing lookup.

**forward next-hop router** – A packet matching the entry will be forwarded in the configured routing context using direct or indirect IP address in the routing lookup.

**forward next-hop interface** – A packet matching the entry will be forwarded using the configured local interface.

**forward redirect-policy** – A packet matching the entry will be forwarded using **forward next-hop** or **forward next-hop router** and the IP address of destination selected by the configured redirect policy. If no destination is selected, packets are subject to **action forward**.

**forward router** – A packet matching the entry will be routed in the configured routing instance and not in the incoming interface routing instance.

**forward sap** – A packet matching the entry will be forwarded using the configured sap.

**forward sdp** – A packet matching the entry will be forwarded using the configured SDP.

**gtp-local-breakout** – A packet matching the entry will be forwarded to NAT instead of being GTP tunneled to mobile operator's PGW or GGSN.

**http-redirect** – An HTTP GET packet matching an entry is forwarded to CPM for HTTP captive portal processing

**nat** – A packet matching the entry will be forwarded to NAT

**reassemble** – A packets matching the entry will be forwarded to the reassembly function

**Default** no specific action is configured by default.

## Parameters

*esi* — Specifies a 10-Byte Ethernet Segment Identifier.

*ip-address* — Specifies the IPv4 address of a direct or indirect next-hop to which to forward matching packets.

*ip-int-name* — Specifies the name of an 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.

*interface-name* — Specifies the name of an egress r-VPLS IP interface used to forward the packets using ESI redirect for VPRN/IES service.

*lsp-name* — Specifies an existing RSVP-TE or MPLS-TP LSP that supports LSP redirect.

*nat-policy-name* — Specifies the NAT policy to be used in NAT redirect.

*policy-name* — Specifies an IPv4 redirect policy configured in the `config>filter>redirect-policy` context.

*sap-id* — Specifies an existing VPLS Ethernet SAP.

*sdp-id:vc-id* — Specifies an existing VPLS SDP.

*packet-length-value* — Specifies integer value to be compared against “Total Length” field in the packet’s IPv4 header.

*rdr-url-string* — Specifies the HTTP web address that will be sent to the user’s browser.

*router-instance* — Specifies “Base” or an existing VPRN service ID.

*service-name* — Specifies an existing VPRN service name.

*ttl-value* — specifies an integer value to be compared against “Time-to-live” field in the packet’s IPv4 header.

*vpls-service-id* — Specifies an existing VPLS service ID or service name.

**lt** — Specifies “less than”. **lt** cannot be used with the lowest possible numerical value for the parameter.

**eq** — Specifies “equal to”. **gt** cannot be used with the highest possible numerical value for the parameter.

**gt** — Specifies “greater than”.

**range** — Specifies "an inclusive range". When range is used, the start of the range (first value entered) must be smaller than the end of the range (second value entered).

## action(IPv6)

**Syntax**

```

drop
drop packet-length {{lt | eq | gt} packet-length-value | range packet-length-value packet-length-value}
forward
forward lsp lsp-name
forward next-hop [indirect] ipv6-address
forward next-hop [indirect] ipv6-address router {router-instance | service-name service-name}
forward redirect-policy policy-name
forward router {router-instance | service-name service-name}
forward sap sap-id
forward sdp sdp-id:vc-id
http-redirect rdr-url-string [allow-radius-override]
nat [nat-policy nat-policy-name] nat-type nat-type

```

**Context**

```

config>filter>ipv6-filter>entry
config>filter>ipv6-filter>entry>action

```

**Description**

The action command (under the config>filter>ipv6-filter context) sets the context for specific action commands to be performed (under the config>filter>ip-filter>action context) on packets matching this filter entry.

The following commands are available under the config>filter>ipv6-filter>entry>action context::

**drop** – A packet matching the entry will be dropped.

**drop packet-length** – A packet matching the entry will be dropped only if “Total Length” field in the

packet's IPv4 header meets the configured condition.

**forward** – A packet matching the entry will be forwarded using regular routing.

**forward lsp** – A packet matching the entry will be forwarded using the specified lsp.

**forward next-hop** – A packet matching the entry will be forwarded in the routing context of the incoming interface using direct or indirect IP address in the routing lookup.

**forward next-hop router** – A packet matching the entry will be forwarded in the configured routing context using direct or indirect IP address in the routing lookup.

**forward redirect-policy** – A packet matching the entry will be forwarded using **forward next-hop** or **forward next-hop router** and the IP address of destination selected by the configured redirect policy. If no destination is selected, packets are subject to **action forward**.

**forward router** – A packet matching the entry will be routed in the configured routing instance and not in the incoming interface routing instance.

**forward sap** – A packet matching the entry will be forwarded using the configured sap.

**forward sdp** – A packet matching the entry will be forwarded using the configured SDP.

**gtp-local-breakout** – A packet matching the entry will be forwarded to NAT instead of being GTP tunneled to mobile operator's PGW or GGSN.

**http-redirect** – An HTTP GET packet matching an entry is forwarded to CPM for HTTP captive portal processing

**nat** – A packet matching the entry will be forwarded to NAT

**reassemble** – A packets matching the entry will be forwarded to the reassembly function.

#### Default

no specific action is configured by default.

#### Parameters

*ipv6-address* — Specifies the IPv6 address of a direct or indirect next-hop to which to forward matching packets.

*ip-int-name* — Specifies the name of an 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.

*lsp-name* — Specifies an existing RSVP-TE or MPLS-TP LSP that supports LSP redirect.

*nat-policy-name* — Specifies the NAT policy to be used in NAT redirect.

*nat-type* — Specifies the nat-type to be either dslite or nat64.

*policy-name* — Specifies an IPv6 redirect policy configured in the config>filter>redirect-policy context.

*sap-id* — Specifies an existing VPLS Ethernet SAP.

*sdp-id:vc-id* — Specifies an existing VPLS SDP.

*packet-length-value* — Specifies integer value to be compared against "Total Length" field in the packet's IPv4 header.

*rdr-url-string* — Specifies the HTTP web address that will be sent to the user's browser.

*router-instance* — Specifies "Base" or an existing VPRN service ID.

*service-name* — Specifies an existing VPRN service name.

**lt** — Specifies “less than”. **lt** cannot be used with the lowest possible numerical value for the parameter.

**eq** — Specifies “equal to”. **gt** cannot be used with the highest possible numerical value for the parameter.

**gt** — Specifies “greater than”.

**range** — Specifies "an inclusive range". When range is used, the start of the range (first value entered) must be smaller than the end of the range (second value entered).

### egress-pbr

**egress-pbr {default-load-balancing | l4-load-balancing}**  
**no egress-pbr**

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>filter>ip-filter>entry                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>This command specifies that the configured PBR action is applicable to egress processing. The command should only be enabled in ACL policies used by residential subscribers. Enabling <b>egress-pbr</b> on filters not deployed for residential subscribers is not blocked but can lead to unexpected behavior and thus should be avoided.</p> <p>The <b>no</b> form of this command removes the <b>egress-pbr</b> designation of the filter entry's action.</p> |
| <b>Default</b>     | <b>no egress-pbr</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><b>load-balancing</b> — Set load-balancing to default (hash based on SA/DA of the packet).</p> <p><b>l4-load-balancing</b> — SInclude TCP/UDP port (if available) in hash.</p>                                                                                                                                                                                                                                                                                    |

### match

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>match [protocol <i>protocol-id</i>]</b><br><b>no match</b>                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>filter>ip-filter>entry                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>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.</p> <p>A <b>match</b> context may consist of multiple match criteria, but multiple <b>match</b> statements cannot be entered per entry.</p> <p>The <b>no</b> form of the command removes the match criteria for the <i>entry-id</i>.</p> |
| <b>Parameters</b>  | <b>protocol</b> — The <b>protocol</b> 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, hexadecimal, or binary - DHB)

| 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                                |
| idrp     | 45          | Inter-Domain Routing Protocol                         |
| rsvp     | 46          | Reservation Protocol                                  |
| gre      | 47          | General Routing Encapsulation                         |
| iso-ip   | 80          | ISO Internet Protocol                                 |
| eigrp    | 88          | EIGRP                                                 |
| ospf-igp | 89          | OSPF-IGP                                              |
| 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>match</b> [ <i>next-header next-header</i> ]<br><b>no match</b>                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>filter>ipv6-filter>entry                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>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.</p> <p>IA <b>match</b> context may consist of multiple match criteria, but multiple <b>match</b> statements cannot be entered per entry.</p> <p>The <b>no</b> form of the command removes the match criteria for the <i>entry-id</i>.</p> |
| <b>Parameters</b>  | <i>next-header</i> — Specifies the IPv6 next header to match. Note that this parameter is analogous to the protocol parameter used in IP-Filter match criteria.                                                                                                                                                                                                                                                                    |

## dscp

|                    |                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dscp</b> <i>dscp-name</i><br><b>no dscp</b>                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command configures a DiffServ Code Point (DSCP) name to be used as an IP filter match criterion.</p> <p>The <b>no</b> form of the command removes the DSCP match criterion.</p>                                                                                                                                                                |
| <b>Default</b>     | <b>no dscp</b>                                                                                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <p><i>dscp-name</i> — Configure a dscp name that has been previously mapped to a value using the <b>dscp-name</b> command. The DiffServ code point may only be specified by its name.</p> <p><b>Values</b>      be, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cs1, cp9, af11, cp11, af12, cp13, af13, cp15, cs2, cp17, af21, cp19, af22, cp21, af23, cp23</p> |

## dst-ip

|                    |                                                                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dst-ip</b> { <i>ip-address/mask</i>   <b>ip-address</b> <i>ipv4-address-mask</i>   <b>ip-prefix-list</b> <i>prefix-list-name</i> }}<br><b>dst-ip</b> { <i>ipv6-address/prefix-length</i>   <b>ipv6-address</b> <i>ipv6-address-mask</i> }<br><b>no dst-ip</b> |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                     |
| <b>Description</b> | <p>This command configures a destination address range to be used as a filter policy match criterion.</p> <p>To match on the IPv4 or IPv6 destination address, specify the address and its associated mask, e.g.,</p>                                            |

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.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no destination IP match criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b> | <p><i>ip-address</i> — Specifies the destination IPv4 address specified in dotted decimal notation.</p> <p><b>Values</b> ip-address: a.b.c.d</p> <p><i>mask</i> — Specify the length in bits of the subnet mask.</p> <p><b>Values</b> 1 — 32</p> <p><i>ipv4-address-mask</i> — Specify the subnet mask in dotted decimal notation.</p> <p><b>Values</b> a.b.c.d (dotted quad equivalent of mask length)</p> <p><i>ip-prefix-list</i> — Creates a list of IPv4 prefixes for match criteria in QoS policies. An ip-prefix-list must contain only IPv4 address prefixes.</p> <p><i>prefix-list-name</i> — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.</p> <p><i>ipv6-address</i> — The IPv6 prefix for the IP match criterion in hex digits.</p> <p><b>Values</b> ipv6-address x:x:x:x:x:x:x:x (eight 16-bit pieces)<br/> x:x:x:x:x:x::d.d.d.d<br/> x: [0..FFFF]H<br/> d: [0..255]D</p> <p><i>prefix-length</i> — The IPv6 prefix length for the ipv6-address expressed as a decimal integer.</p> <p><b>Values</b> 1 — 128</p> <p><i>mask</i> — Eight 16-bit hexadecimal pieces representing bit match criteria.</p> <p><b>Values</b> x:x:x:x:x:x:x:x (eight 16-bit pieces)</p> |

## dst-port

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dst-port {lt   gt   eq} dst-port-number</b><br><b>dst-port port-list-name</b><br><b>dst-port range dst-port-number dst-port-number</b><br><b>no dst-port</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>This command configures a destination TCP, UDP, or SCTP port number or port range for an IP filter match criterion. Note that an entry containing Layer 4 non-zero 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. Similarly an entry containing "<b>dst-port eq 0</b>" match criterion, may match non-initial fragments when the destination port value is not present in a packet fragment and other match criteria are also met.</p> <p>The <b>no</b> form of the command removes the destination port match criterion.</p> |

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | <b>none</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b> | <p><b>lt</b>   <b>gt</b>   <b>eq</b> — Specifies the operator to use relative to <i>dst-port-number</i> for specifying the port number match criteria.</p> <p><b>lt</b> specifies all port numbers less than <i>dst-port-number</i> match.</p> <p><b>gt</b> specifies all port numbers greater than <i>dst-port-number</i> match.</p> <p><b>eq</b> specifies that <i>dst-port-number</i> must be an exact match.</p> <p><b>eq</b> — Specifies the operator to use relative to <i>dst-port-number</i> for specifying the port number match criteria. The <b>eq</b> keyword specifies that <i>dst-port-number</i> must be an exact match.</p> <p><i>dst-port-number</i> — The destination port number to be used as a match criteria expressed as a decimal integer.</p> <p><b>Values</b>      0 — 65535</p> <p><i>port-list-name</i> — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.</p> <p><b>range</b> <i>dst-port-number dst-port-number</i> — Specifies inclusive port range between two <i>dst-port-number</i> values.</p> |

## flow-label

|                    |                                                                                                                                                                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>flow-label</b> <i>flow-label</i> [ <i>mask</i> ]<br><b>no flow-label</b>                                                                                                                                                                                                      |
| <b>Context</b>     | config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command configures the flow-label and optional mask match condition.</p> <p>The <b>no</b> form of the command reverts to the default.</p>                                                                                                                                |
| <b>Default</b>     | no flow-label                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <p><i>flow-label</i> — Specifies the flow label to be used as a match criterion.</p> <p><b>Values</b>      0 — 1048575</p> <p><i>mask</i> — Specifies the flow label mask value for this policy IP Filter entry.</p> <p><b>Values</b>      0 — 1048575 decimal hex or binary</p> |

## fragment

|                    |                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b><u>IPv4:</u></b><br><b>fragment {true false}</b><br><b>no fragment</b><br><b><u>IPv6:</u></b><br><b>fragment {true false first-only non-first-only}</b><br><b>no fragment</b>                                                                                                                                                                               |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | This command specifies match criterion for fragmented packets.<br>The <b>no</b> form of the command removes the match criterion.                                                                                                                                                                                                                               |
| <b>Default</b>     | <b>no fragment</b>                                                                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>  | <b>true</b> — Specifies to match on all fragmented IP packets.<br><b>false</b> — Specifies to match on all non-fragmented IP packets.<br><b>first-only</b> — For IPv6: Matches if a packet is an initial fragment of a fragmented IPv6 packet.<br><b>non-first-only</b> — For IPv6: Matches if a packet is a non-initial fragment of a fragmented IPv6 packet. |

## ah-ext-hdr

|                    |                                                                                                                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | <b>ah-ext-hdr {true false }</b><br><b>no ah-ext-hdr</b>                                                                                                                                                                                                 |
| <b>Context</b>     | config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                   |
| <b>Description</b> | This command enables match on existence of AH Extension Header in the IPv6 filter policy.<br>The <b>no</b> form of this command ignores AH Extension Header presence/absence in a packet when evaluating match criteria of a given filter policy entry. |
| <b>Default</b>     | <b>no ah-ext-hdr</b>                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <b>true</b> — Matches a packet with an AH Extension Header.<br><b>false</b> — Match a packet without an AH Extension Header.                                                                                                                            |

## esp-ext-hdr

|                |                                                           |
|----------------|-----------------------------------------------------------|
| <b>Syntax</b>  | <b>esp-ext-hdr {true false }</b><br><b>no esp-ext-hdr</b> |
| <b>Context</b> | config>filter>ipv6-filter>entry>match                     |

|                    |                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command enables match on existence of ESP Extension Header in the IPv6 filter policy.<br>The <b>no</b> form of this command ignores ESP Extension Header presence/absence in a packet when evaluating match criteria of a given filter policy entry. |
| <b>Default</b>     | <b>no esp-ext-hdr</b>                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <b>true</b> — Matches a packet with an ESP Extension Header.<br><b>false</b> — Match a packet without an ESP Extension Header.                                                                                                                            |

### hop-by-hop-opt

|                    |                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>hop-by-hop-opt {true false}</b><br><b>no hop-by-hop-opt</b>                                                                                                                                                                                                                          |
| <b>Context</b>     | config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                   |
| <b>Description</b> | This command enables match on existence of Hop-by-Hop Options Extension Header in the IPv6 filter policy.<br>The <b>no</b> 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. |
| <b>Default</b>     | <b>hop-by-hop-opt</b>                                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <b>true</b> — Matches a packet <i>with</i> a Hop-by-hop Options Extensions header.<br><b>false</b> — Matches a packet <i>without</i> a Hop-by-hop Options Extensions header.                                                                                                            |

### icmp-code

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>icmp-code icmp-code</b><br><b>no icmp-code</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | Configures matching on ICMP/ICMPv6 code field in the ICMP/ICMPv6 header of an IPpacket as a filter match criterion. Note that an entry containing Layer 4 non-zero 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. Similarly an entry containing " <b>icmp-code 0</b> " match criterion, may match non-initial fragments when the Layer 4 header is not present in a packet fragment and other match criteria are also met.<br>The <b>no</b> form of the command removes the criterion from the match entry. |
| <b>Default</b>     | <b>no icmp-code</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <i>icmp-code</i> — The ICMP/ICMPv6 code values that must be present to match.<br><b>Values</b> 0 — 255                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## icmp-type

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>icmp-type</b> <i>icmp-type</i><br><b>no icmp-type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | <p>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 non-zero 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. Similarly an entry containing "<b>icmp-type 0</b>" match criterion, may match non-initial fragments when the Layer 4 header is not present in a packet fragment if other match criteria are also met.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | <b>no icmp-type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <i>icmp-type</i> — The ICMP/ICMPv6 type values that must be present to match.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                    | <b>Values</b> 0 — 255                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

## ip-option

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip-option</b> <i>ip-option-value</i> [ <i>ip-option-mask</i> ]<br><b>no ip-option</b>                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>filter>ip-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | <p>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.</p> <p>The option-type octet contains 3 fields:</p> <ul style="list-style-type: none"> <li>1 bit copied flag (copy options in all fragments)</li> <li>2 bits option class</li> <li>5 bits option number</li> </ul> <p>The <b>no</b> form of the command removes the match criterion.</p>                                    |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>  | <p><i>ip-option-value</i> — 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.</p> <p>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).</p> <p><b>Values</b>      0 — 255</p> |

*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 |
| <b>Default</b> | <b>255 (decimal) (exact match)</b> |           |
| <b>Values</b>  | 1 — 255 (decimal)                  |           |

## multiple-option

|                    |                                                                                                                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>multiple-option {true   false}</b><br><b>no multiple-option</b>                                                                                                                                                                                                             |
| <b>Context</b>     | config>filter>ip-filter>entry>match                                                                                                                                                                                                                                            |
| <b>Description</b> | This command configures matching packets that contain one or more than one option fields in the IP header as an IP filter match criterion.<br><br>The <b>no</b> form of the command removes the checking of the number of option fields in the IP header as a match criterion. |
| <b>Default</b>     | <b>no multiple-option</b>                                                                                                                                                                                                                                                      |
| <b>Parameters</b>  | <b>true</b> — Specifies matching on IP packets that contain more than one option field in the header.<br><b>false</b> — Specifies matching on IP packets that do not contain multiple option fields present in the header.                                                     |

## option-present

|                    |                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>option-present {true   false}</b><br><b>no option-present</b>                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>ip-filter>entry>match                                                                                                                                                                                                               |
| <b>Description</b> | This command configures matching packets that contain the option field in the IP header as an IP filter match criterion.<br><br>The <b>no</b> 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.
- Operational note:** Configuring "**port eq 0**", may match non-initial fragments when source/destination port values are not present in a packet fragment and other match criteria are also met.
- Parameters**
- lt|gt|eq** — Specifies the lower, greater or equal value for the TCP/UDP/SCTP 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>src-ip</b> { <i>ip-address/mask</i>   <i>ip-address ipv4-address-mask</i>   <b>ip-prefix-list</b> <i>prefix-list-name</i> }<br><b>src-ip</b> { <i>ipv6-address/prefix-length</i>   <i>ipv6-address ipv6-address-mask</i>   <b>ipv6-prefix-list</b> <i>prefix-list-name</i> }<br><b>no src-ip</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This command configures a source IPv4 or IPv6 address range to be used as an IP filter match criterion.</p> <p>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.</p> <p>The <b>no</b> form of the command removes the source IP address match criterion.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Default</b>     | <b>no src-ip</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <p><i>ip-address</i> — Specifies the destination IPv4 address specified in dotted decimal notation.</p> <p><b>Values</b> ip-address: a.b.c.d</p> <p><i>mask</i> — Specify the length in bits of the subnet mask.</p> <p><b>Values</b> 1 — 32</p> <p><i>ipv4-address-mask</i> — Specify the subnet mask in dotted decimal notation.</p> <p><b>Values</b> a.b.c.d (dotted quad equivalent of mask length)</p> <p><i>ip-prefix-list</i> — Creates a list of IPv4 prefixes for match criteria in QoS policies. An ip-prefix-list must contain only IPv4 address prefixes.</p> <p><i>prefix-list-name</i> — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.</p> <p><i>ipv6-address</i> — The IPv6 prefix for the IP match criterion in hex digits.</p> <p><b>Values</b> ipv6-address x:x:x:x:x:x:x:x (eight 16-bit pieces)<br/> x:x:x:x:x::d.d.d.d<br/> x: [0..FFFF]H<br/> d: [0..255]D</p> <p><i>prefix-length</i> — The IPv6 prefix length for the ipv6-address expressed as a decimal integer.</p> <p><b>Values</b> 1 — 128</p> <p><i>mask</i> — Eight 16-bit hexadecimal pieces representing bit match criteria.</p> <p><b>Values</b> x:x:x:x:x:x:x:x (eight 16-bit pieces)</p> |

## src-port

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>src-port {eq} <i>src-port-number</i></b><br><b>src-port port-list <i>port-list-name</i></b><br><b>no src-port</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command configures a source TCP, UDP, or SCTP port number or port match list for an IP filter match criterion. Note that an entry containing Layer 4 non-zero 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. Similarly an entry containing "<b>src-port eq 0</b>" match criterion, may match non-initial fragments when the source port value is not present in a packet fragment and other match criteria are also met.</p> <p>The <b>no</b> form of the command removes the source port match criterion.</p> |
| <b>Default</b>     | no src-port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>  | <p><i>src-port-number</i> — The source port number to be used as a match criteria expressed as a decimal integer.</p> <p><b>Values</b>      0 — 65535</p> <p><i>port-list-name</i> — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes. &lt;&lt;<b>R12.0</b>&gt;&gt;</p>                                                                                                                                                                                                                                                             |

## src-route-option

|                    |                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>src-route-option {true false}</b><br><b>no source-route-option</b>                                                                                                                                                                             |
| <b>Context</b>     | config>filter>ip-filter>entry>match                                                                                                                                                                                                               |
| <b>Description</b> | <p>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.</p> |
| <b>Parameters</b>  | <p><b>true</b> — Enables source route option match conditions.</p> <p><b>false</b> — Disables source route option match conditions.</p>                                                                                                           |

## tcp-ack

|                |                                                                              |
|----------------|------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>tcp-ack {true   false}</b><br><b>no tcp-ack</b>                           |
| <b>Context</b> | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>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 non-zero 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.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | no tcp-ack                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b>  | <p><b>true</b> — Specifies matching on IP packets that have the ACK bit set in the control bits of the TCP header of an IP packet.</p> <p><b>false</b> — 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.</p>                                                                                                                                                                          |

### tcp-syn

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tcp-syn {true   false}</b><br><b>no tcp-syn</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>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 non-zero 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.</p> <p>The SYN bit is normally set when the source of the packet wants to initiate a TCP session with the specified destination IP address.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | no tcp-syn                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><b>true</b> — Specifies matching on IP packets that have the SYN bit set in the control bits of the TCP header.</p> <p><b>false</b> — Specifies matching on IP packets that do not have the SYN bit set in the control bits of the TCP header.</p>                                                                                                                                                                                                                                                                                                                                                       |

---

## Match List Configuration Commands

### match-list

|                    |                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>match-list</b>                                                                                          |
| <b>Context</b>     | config>filter                                                                                              |
| <b>Description</b> | This command enables the configuration context for match lists to be used in filter policies (FP and CPM). |

### ip-prefix-list

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip-prefix-list</b> <i>ip-prefix-list-name</i> <b>create</b><br><b>no ip-prefix-list</b> <i>ip-prefix-list-name</i>                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>filter>match-list                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command creates a list of IPv4 prefixes for match criteria in IPv4 ACL and CPM filter policies. The <b>no</b> form of this command deletes the specified list.</p> <p>Operational notes:</p> <p>An <b>ip-prefix-list</b> must contain only IPv4 address prefixes.</p> <p>An IPv4 prefix match list cannot be deleted if it is referenced by a filter policy.</p> <p>Please see general description related to match-list usage in filter policies.</p> |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <i>ip-prefix-list-name</i> — 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

|                    |                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ipv6-prefix-list</b> <i>ipv6-prefix-list-name</i> <b>create</b><br><b>no ipv6-prefix-list</b> <i>ipv6-prefix-list-name</i>                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter>match-list                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command creates a list of IPv6 prefixes for match criteria in ACL and CPM IPv6 filter policies. The <b>no</b> form of this command deletes the specified list.</p> <p>Operational notes:</p> <p>An <b>ipv6-prefix-list</b> must contain only IPv6 address prefixes.</p> <p>An IPv6 prefix match list cannot be deleted if it is referenced by a filter policy.</p> |

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

|                    |                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>apply-path</b><br><b>no apply-path</b>                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>filter>match-list>ip-pfx-list<br>config>filter>match-list>ipv6-pfx-list                                                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>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.</p> <p>The <b>no</b> form of this command removes all auto-generation configuration under the apply-path context.</p> |
| <b>Default</b>     | no apply path                                                                                                                                                                                                                                                                                                                                         |

### bgp-peers

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>bgp-peers index group reg-exp neighbor reg-exp</b><br><b>no bgp-peers index</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>filter>match-list>ip-pfx-list>apply-path<br>config>filter>match-list>ipv6-pfx-list>apply-path                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>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.</p> <p><b>group:</b></p> <p>Configures a match against base router BGP instance group configuration.<br/>Regex wildcard match (.) can be used to match against any group.</p> <p><b>neighbor:</b></p> <p>Configures a match against base router BGP instance neighbor configuration.<br/>Regex wildcard match (.) can be used to match against any neighbor.</p> <p>The <b>no</b> form of this command removes the bgp-peers configuration for auto-generation of address prefixes for the specified index value.</p> |
| <b>Default</b>     | No embedded filter policies are included in a filter policy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <i>index</i> — An integer from 1 to 255 enumerating bgp-peers auto-generation configuration within this list.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

*reg-exp* — A regular expression defining a match 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>port-list</b> <i>port-list-name</i> <b>create</b><br><b>no port-list</b> <i>port-list-name</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>filter>match-list                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | This command creates a list of TCP/UDP/SCTP port values or ranges for match criteria in IPv4 and IPv6 ACL and CPM filter policies.<br>The <b>no</b> form of this command deletes the specified list.<br><b>Operational notes:</b><br>SCTP port match is supported in ACL filter policies only.<br>A port-list must contain only TCP/UDP/SCTP port values or ranges.<br>A TCP/UDP/SCTP port match list cannot be deleted if it is referenced by a filter policy.<br>Please see general description related to match-list usage in filter policies. |
| <b>Parameters</b>  | <i>port-list-name</i> — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Default</b>     | no ports are added to a port list by default.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

## port

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>port</b> <i>port-number</i><br><b>port range</b> <i>start end</i><br><b>no port</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>filter>match-list>port-list                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | This command configures a TCP/UDP/SCTP source or destination port match criterion in IPv4 and IPv6 CPM (SCTP not supported) and/or ACL filter policies. A packet matches this criterion if the packet TCP/UDP/SCTP (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.<br><b>Operational notes:</b><br>This command is mutually exclusive with <b>src-port</b> and <b>dst-port</b> commands.<br>Configuring <b>port</b> value of "0", may match non-initial fragments where the source/destination port values are not present in a packet fragment if other match criteria are also met.<br>The <b>no</b> form of this command deletes the specified port match criterion. |

## Match List Configuration Commands

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | <b>no port</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b> | <i>port-number</i> — A source or destination port to be used as a match criterion specified as a decimal integer.<br><br><b>Values</b> 0 — 65535<br><br><b>range</b> <i>start end</i> — an inclusive range of source or destination port values to be used as match criteria. <i>start</i> of the range and <i>end</i> of the range are expressed as decimal integers.<br><br><b>Values</b> 0 — 65535<br><br><i>port-list-name</i> — 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>prefix</b> <i>ipv6-prefix/prefix-length</i><br><b>no prefix</b> <i>ipv6-prefix/prefix-length</i>                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>filter>match-list>ipv6-pfx-list                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | This command adds an IPv6 address prefix to an existing IPv6 address prefix match list.<br>The <b>no</b> form of this command deletes the specified prefix from the list.<br>Operational notes:<br>To add set of different prefixes, execute the command with all unique prefixes. The prefixes are allowed to overlap IPv6 address space.<br>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. |
| <b>Default</b>     | No prefixes are in the list by default                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <i>ipv6-prefix</i> — 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<br><br><b>Values</b> <i>ipv6-prefix</i> : - IPv6 address prefix<br>x:x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:x:d.d.d.d<br>x: [0..FFFF]H<br>d: [0..255]D<br><br><i>prefix-length</i> — Length of the entered IP prefix.<br><br><b>Values</b> 1 — 128                              |



## prefix

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>prefix</b> <i>ip-prefix/prefix-length</i><br><b>no prefix</b> <i>ip-prefix/prefix-length</i>                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>filter>match-list>ip-prefix-list                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>This command adds an IPv4 address prefix to an existing IPv4 address prefix match list.</p> <p>The <b>no</b> form of this command deletes the specified prefix from the list.</p> <p>Operational notes:</p> <p>To add set of unique prefixes, execute the command with all unique prefixes. The prefixes are allowed to overlap IPv4 address space.</p> <p>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.</p> |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <p><i>ip-prefix</i> — A valid IPv4 address prefix in dotted decimal notation.</p> <p><b>Values</b> 0.0.0.0 to 255.255.255.255 (host bit must be 0)</p> <p><i>prefix-length</i> — Length of the entered IP prefix.</p> <p><b>Values</b> 0 — 32</p>                                                                                                                                                                                                                                                                                       |

The action command (under the config>filter>mac-filter context) sets the context for specific action commands to be performed (under the config>filter>mac-filter>action context) on packets matching this filter entry.

The following commands are available under the config>filter>mac-filter>entry>action context:

**service-id** forwarded to an ESI identified first appliance in Nuage service chain using EVPN-resolved VXLAN tunnel in the specified VPLS service

---

## Policy and Entry Maintenance Commands

### copy

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>copy ip-filter src-filter-id [src-entry src-entry-id] to dst-filter-id [dst-entry dst-entry-id] [overwrite]</b><br><b>copy ipv6-filter src-filter-id [src-entry src-entry-id] to dst-filter-id [dst-entry dst-entry-id] [overwrite]</b><br><b>copy mac-filter src-filter-id [src-entry src-entry-id] to dst-filter-id [dst-entry dst-entry-id] [overwrite]</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command copies existing filter list entries for a specific filter ID to another filter ID. The <b>copy</b> 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 <b>overwrite</b> keyword. If <b>overwrite</b> is not specified, an error will occur if the destination policy ID exists.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <p><b>ip-filter</b> — Indicates that the <i>source-filter-id</i> and the <i>dest-filter-id</i> are IP filter IDs.</p> <p><b>ipv6-filter</b> — This keyword indicates that the <i>source-filter-id</i> and the <i>dest-filter-id</i> are IPv6 filter IDs.</p> <p><i>source-filter-id</i> — The <i>source-filter-id</i> 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 (<b>ip-filter</b>, <b>ipv6-filter</b> ).</p> <p><i>dest-filter-id</i> — The <i>dest-filter-id</i> identifies the destination filter policy to which the copy command will attempt to copy. If the <b>overwrite</b> 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 <b>overwrite</b> keyword is present, the destination policy ID may or may not exist.</p> <p><b>overwrite</b> — The <b>overwrite</b> 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 <b>overwrite</b> must be specified or an error message will be returned. If <b>overwrite</b> is specified, the function of copying from source to destination occurs in a ‘break before make’ manner and therefore should be handled with care.</p> |

### renum

|                    |                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>renum old-entry-id new-entry-id</b>                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>ip-filter                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>This command renumbers existing 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.</p> |

**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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>destination</b> <i>ip-address</i> [ <b>create</b> ]<br><b>[no]</b> <b>destination</b> <i>ip-address</i><br><b>destination</b> <i>ipv6-address</i> [ <b>create</b> ]<br><b>[no]</b> <b>destination</b> <i>ipv6-address</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>filter>redirect-policy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command defines a destination in a redirect policy. More than one destination can be configured. Whether a destination IPv4/IPv6 address will receive redirected packets depends on the effective priority value after evaluation.</p> <p>The most preferred destination is programmed in hardware as action forward next-hop. If all destinations are down (as determined by the supported tests), action forward is programmed in hardware. All destinations within a given policy must be either IPv4 or (exclusive) IPv6. The redirect policy with IPv4 destinations configured can only be used by IP filter policies. The redirect policy with IPv6 destinations configured can only be used by IPv6 filter policies.</p> |
| <b>Default</b>     | <b>no destination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <i>ip-address</i> — Specifies the IPv4 address to send the redirected traffic.<br><b>Values</b> ip-address: a.b.c.d<br><i>ipv6-address</i> — Specifies the IPv6 address to send the redirected traffic.<br><b>Values</b> ipv6-address: x:x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x::d.d.d.d<br>x:        [0..FFFF]H<br>d:        [0..255]D                                                                                                                                                                                                                                                                                                                                                                                       |

### router

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>router</b> <i>router-instance</i><br><b>router service name</b> <i>service-name</i><br><b>no router</b>                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>filter>redirect-policy                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command enhances VRF support in redirect policies. The following applies when a router instance is specified:</p> <ul style="list-style-type: none"> <li>the configured destination tests are run in the specified router instance</li> <li>the PBR action is executed in the specified router instance.</li> </ul> <p><b>Note</b> – If no destination is active or if the hardware does not support the PBR action <b>next-hop</b></p> |

**router**, action **forward** will be executed (i.e. routing will be performed in the context of the incoming interface routing instance).

The **no** form of the command preserves backward-compatibility. Any test is always run in the "Base" routing instance context. The PBR action is executed in the routing context of the ingress interface the filter using this redirect policy is deployed on.

|                   |                                                                                                                                                    |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | <b>no router</b>                                                                                                                                   |
| <b>Parameters</b> | <i>router-instance</i> - < <i>router-name</i> >   < <i>service-id</i><br><i>router-name</i> — Base.<br><i>service-id</i> — An existing L3 service. |
| <b>Values</b>     | 1..2147483647                                                                                                                                      |
|                   | <i>service-name</i> — Name of the configured L3 service.                                                                                           |

## sticky-dest

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sticky-dest no-hold-time-up</b><br><b>sticky-dest hold-time-up seconds</b><br><b>no sticky-dest</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>redirect-policy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command configures sticky destination behavior for redirect policy. When enabled, the active destination is not changed to a new better destination, unless the active destination goes down or manual switch is forced using the <b>tools&gt;perform&gt;filter&gt;redirect-policy&gt;activate-best-dest</b> command.</p> <p>An optional <b>hold-time-up</b> allows the operator to delay programming of the PBR to the most-preferred destination for a specified amount of time when the first destination comes up (action forward remains in place). When the first destination comes up, the timer is started and upon the expiry, the current most-preferred destination is selected (which may differ from the one that triggered the timer to start) and programmed as a sticky PBR destination. Changing the value of the timer, while the timer is running takes immediate effect.</p> <p>The <b>no</b> form of the command disables sticky destination behavior.</p> |
| <b>Default</b>     | <b>no sticky-dest</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <i>seconds</i> — Initial delay in seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                    | <b>Values</b> 0 to 65535<br>where 0 is equivalent to <b>no-hold-time-up</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## ping-test

|                |                                     |
|----------------|-------------------------------------|
| <b>Syntax</b>  | <b>[no] ping-test</b>               |
| <b>Context</b> | 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

|                    |                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>timeout</b> <i>seconds</i><br><b>no timeout</b>                                                                                                                                                 |
| <b>Context</b>     | config>filter>destination>snmp-test<br>config>filter>destination>url-test                                                                                                                          |
| <b>Description</b> | 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. |
| <b>Default</b>     | 1                                                                                                                                                                                                  |
| <b>Parameters</b>  | <i>seconds</i> — Specifies the amount of time, in seconds, that is allowed for receiving a response from the far end host.<br><b>Values</b> 1 — 60                                                 |

## priority

|                    |                                                                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>priority</b> <i>priority</i><br><b>no priority</b>                                                                                                                           |
| <b>Context</b>     | config>filter>destination                                                                                                                                                       |
| <b>Description</b> | Redirect policies can contain multiple destinations. Each destination is assigned an initial or base <b>priority</b> which describes its relative importance within the policy. |
| <b>Default</b>     | 100                                                                                                                                                                             |
| <b>Parameters</b>  | <i>priority</i> — The priority, expressed as a decimal integer, used to weigh the destination's relative importance within the policy.<br><b>Values</b> 1 — 255                 |

## snmp-test

|                    |                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>snmp-test</b> <i>test-name</i>                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>filter>redirect-policy>destination                                                                                                                                                                                                                                               |
| <b>Description</b> | This command enables the context to configure SNMP test parameters.                                                                                                                                                                                                                     |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <i>test-name</i> — 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

|                    |                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>oid</b> <i>oid-string</i> <b>community</b> <i>community-string</i>                                                                                                                                              |
| <b>Context</b>     | config>filter>redirect-policy>destination>snmp-test                                                                                                                                                                |
| <b>Description</b> | This command specifies the OID of the object to be fetched from the destination.                                                                                                                                   |
| <b>Default</b>     | none                                                                                                                                                                                                               |
| <b>Parameters</b>  | <i>oid-string</i> — Specifies the object identifier (OID) in the OID field.<br><b>community</b> <i>community-string</i> — The SNMP v2 community string or the SNMP v3 context name used to conduct this SNMP test. |

### return-value

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>return-value</b> <i>return-value</i> <b>type</b> <i>return-type</i> [ <b>disable</b>   <b>lower-priority</b> <i>priority</i>   <b>raise-priority</b> <i>priority</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>filter>redirect-policy>destination>snmp-test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>  | <i>return-value</i> — Specifies the SNMP value against which the test result is matched.<br><b>Values</b> A maximum of 256 characters.<br><i>return-type</i> — Specifies the SNMP object type against which the test result is matched.<br><b>Values</b> integer, unsigned, string, ip-address, counter, time-ticks, opaque<br><b>disable</b> — 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.<br><b>lower-priority</b> <i>priority</i> — Specifies the amount to lower the priority of the destination.<br><b>Values</b> 1 — 255<br><b>raise-priority</b> <i>priority</i> — Specifies the amount to raise the priority of the destination.<br><b>Values</b> 1 — 255 |

### unicast-rt-test

|                |                                                     |
|----------------|-----------------------------------------------------|
| <b>Syntax</b>  | <b>unicast-rt-test</b><br><b>no unicast-rt-test</b> |
| <b>Context</b> | config>filter>redirect-policy>destination           |



|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command configures a unicast route test for this destination. A destination is eligible for redirect if a valid unicast route to that destination exists in the routing instance specified by <b>config filter redirect-policy router</b>. The unicast route test is mutually exclusive with other redirect-policy test types.</p> <p>The test cannot be configured if <b>no router</b> is configured for this redirect policy.</p> <p>The <b>no</b> form of the command disables the test.</p> |
| <b>Default</b>     | <b>no unicast-rt-test</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## url-test

|                    |                                                                                                                                                                                                                                                                              |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>url-test</b> <i>test-name</i>                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>filter>redirect-policy>destination                                                                                                                                                                                                                                    |
| <b>Description</b> | The context to enable URL test parameters. IP filters can be used to selectively cache some web sites.                                                                                                                                                                       |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <b>test-name</b> — 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                        |                |  |                        |                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------|----------------|--|------------------------|----------------|
| <b>Syntax</b>      | <b>return-code</b> <i>return-code-1</i> [ <i>return-code-2</i> ] [ <b>disable</b>   <b>lower-priority</b> <i>priority</i>   <b>raise-priority</b> <i>priority</i> ]<br><b>no return-code</b> <i>return-code-1</i> [ <i>return-code-2</i> ]                                                                                                                                                                                                                                                                                                                       |                |                        |                |  |                        |                |
| <b>Context</b>     | config>filter>redirect-policy>destination>url-test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |                        |                |  |                        |                |
| <b>Description</b> | <p>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.</p> <p>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.</p>                                                                                                |                |                        |                |  |                        |                |
| <b>Default</b>     | none                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |                        |                |  |                        |                |
| <b>Parameters</b>  | <p><i>return-code-1</i>, <i>return-code-2</i> — Specifies a range of return codes. When the URL test return-code falls within the specified range, the corresponding action is performed.</p> <table><tr><td><b>Values</b></td><td><i>return-code-1</i>:</td><td>1 — 4294967294</td></tr><tr><td></td><td><i>return-code-2</i>:</td><td>2 — 4294967295</td></tr></table> <p><b>disable</b> — 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.</p> | <b>Values</b>  | <i>return-code-1</i> : | 1 — 4294967294 |  | <i>return-code-2</i> : | 2 — 4294967295 |
| <b>Values</b>      | <i>return-code-1</i> :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1 — 4294967294 |                        |                |  |                        |                |
|                    | <i>return-code-2</i> :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2 — 4294967295 |                        |                |  |                        |                |

**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

|                    |                                                                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>url</b> <i>url-string</i> [ <b>http-version</b> <i>version-string</i> ]                                                                                            |
| <b>Context</b>     | config>filter>redirect-policy>destination>url-test                                                                                                                    |
| <b>Description</b> | This command specifies the URL to be probed by the URL test.                                                                                                          |
| <b>Default</b>     | none                                                                                                                                                                  |
| <b>Parameters</b>  | <i>url-string</i> — Specify a URL up to 255 characters in length.<br><b>http-version</b> <i>version-string</i> — Specifies the HTTP version, 80 characters in length. |

### router

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>router</b> <i>router-instance</i><br><b>router</b> <b>service-name</b> <i>service-name</i><br><b>no router</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter>redirect-policy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command enhances VRF support in redirect policies. When a router instance is specified, the configured destination tests are run in the specified router instance, and the PBR action is executed in the specified router instance. Note that if no destination is active or if the hardware does not support PBR action “next-hop router”, action forward will be executed (i.e. routing will be performed in the context of the incoming interface routing instance).</p> <p>The <b>no</b> form of the command preserves backward-compatibility. Tests always run in the “Base” routing instance context, and the PBR action executes in the routing context of the ingress interface that the filter using this redirect policy is deployed on.</p> |
| <b>Default</b>     | <b>no router</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <i>router-instance</i> — Specifies a router instance in the form of <i>router-name</i> or <i>service-id</i> .<br><b>Values</b><br><i>router-name</i> — “Base”<br><i>service-id</i> — an existing Layer 3 service [1..2147483647]<br><i>service-name</i> — Specifies the name of a configured Layer 3 service.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## shutdown

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] shutdown</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>filter>redirect-policy<br>config>filter>redirect-policy>destination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>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.</p> <p>The <b>shutdown</b> command administratively downs an entity. Administratively downing an entity changes the operational state of the entity to down.</p> <p>Unlike other commands and parameters where the default state will not be indicated in the configuration file, <b>shutdown</b> and <b>no shutdown</b> are always indicated in system generated configuration files.</p> <p>The <b>no</b> form of the command puts an entity into the administratively enabled state.</p> |
| <b>Default</b>     | no shutdown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |



---

## Show Commands

### dhcp

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dhcp</b> [ <i>filter-id</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | show>filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command displays DHCP filter information.</p> <pre>*B:TechPubs&gt;config# show filter dhcp ===== DHCP Filters ===== Filter-Id   Applied Description ----- 10          No      test-dhcp-filter ----- Num filter entries: 1 ===== *B:TechPubs&gt;config#  *B:TechPubs&gt;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&gt;config#</pre> |

### dhcp6

|                    |                                                 |
|--------------------|-------------------------------------------------|
| <b>Syntax</b>      | <b>dhcp</b> [< <i>filter-id</i> >]              |
| <b>Context</b>     | show>filter                                     |
| <b>Description</b> | This command displays DHCP6 filter information. |

# download-failed

|                    |                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>download-failed</b>                                                                           |
| <b>Context</b>     | show>filter                                                                                      |
| <b>Description</b> | This command shows all filter entries for which the download has failed.                         |
| <b>Output</b>      | <b>download-failed Output</b> — 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip</b><br><b>ip embedded [inactive]</b><br><b>ip <i>ip-filter-id</i> embedded [inactive]</b><br><b>ip <i>ip-filter-id</i> [detail]</b><br><b>ip <i>ip-filter-id</i> associations</b><br><b>ip <i>ip-filter-id</i> type <i>entry-type</i></b><br><b>ip <i>ip-filter-id</i> counters [<i>type entry-type</i>]</b><br><b>ip <i>ip-filter-id</i> entry <i>entry-id</i> counters</b><br><b>ip <i>ip-filter-id</i> entry <i>entry-id</i> [detail]</b> |
| <b>Context</b>     | show>filter                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | This command shows IP filter information.                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <i>ip-filter-id</i> — Displays detailed information for the specified filter ID and its filter entries.<br><b>Values</b> 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**

**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.<br>Exclusive — The filter policy is of type exclusive.                                                                                                                                                         |
| Applied     | No — The filter policy ID has not been applied.<br>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<br>Status:<br><b>OK</b> —embedding operation successful, if any entries are overwritten this will also be indicated.<br><b>Failed</b> —embedding failed, the reason is displayed (out of resources). |

### Sample Output

```
A:ALA-49# show filter ip
=====
Configured IP Filters Total: 2
=====
Filter-Id Scope Applied Description

```

## Show Commands

```
5 Template Yes
6 Template Yes
```

```
=====
Host Common IP Filters Total: 2
=====
Filter-Id Description

5:P4 Auto-created PCC-Rule Ingress Filter
6:P5 Auto-created PCC-Rule Egress Filter
=====
Num IP filters: 4
=====
```

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#
```

show filter ip "5:P4"

```
=====
IP Filter
=====
Filter Id : 5:P4 Applied : Yes
Scope : Template Def. Action : Forward
System filter: Unchained
Radius Ins Pt: n/a
CrCtl. Ins Pt: n/a
RadSh. Ins Pt: n/a
PccRl. Ins Pt: 40000 (size 10000)
Entries : 0
PccRl Entries: 11
Description : Auto-created PCC-Rule Ingress Filter
=====
Filter Match Criteria : IP
```



```

Entry : 40000 - inserted on ingress by PCC-Rule
Description : Inserted (ingress) entry for pcc-rule RULE_ingress_DROP
Log Id : n/a
Src. IP : 0.0.0.0/0
Src. Port : n/a
Dest. IP : 75.24.24.0/32
Dest. Port : n/a
Protocol : 6
ICMP Type : Undefined
Fragment : Off
Sampling : Off
IP-Option : 0/0
TCP-syn : Off
Option-pres : Off
Egress PBR : Undefined
Match action : Drop
Ing. Matches : 0 pkts
Egr. Matches : 0 pkts

Entry : 40001 - inserted on ingress by PCC-Rule
Description : Inserted (ingress) entry for pcc-rule RULE_ingress_FC_HTTP
Log Id : n/a
Src. IP : 0.0.0.0/0
Src. Port : n/a
Dest. IP : 75.24.24.4/32
Dest. Port : n/a
Protocol : 6
ICMP Type : Undefined
Fragment : Off
Sampling : Off
IP-Option : 0/0
TCP-syn : Off
Option-pres : Off
Egress PBR : Undefined
Match action : HTTP-Redirect (http://pcc.portal.com/RULE_ingress_FC_HTTP)
Ing. Matches : 0 pkts
Egr. Matches : 0 pkts

Entry : 40002 - inserted on ingress by PCC-Rule
Description : Inserted (ingress) entry for pcc-rule RULE_ingress_FC_RDR
Log Id : n/a
Src. IP : 0.0.0.0/0
Src. Port : n/a
Dest. IP : 75.24.24.5/32
Dest. Port : n/a
Protocol : 6
ICMP Type : Undefined
Fragment : Off
Sampling : Off
IP-Option : 0/0
TCP-syn : Off
Option-pres : Off
Egress PBR : Undefined
Match action : Forward
Next Hop : 10.10.10.10 (Indirect)
PBR Down Act : Drop (entry-default)
Ing. Matches : 0 pkts
Egr. Matches : 0 pkts

```

```
...
=====

show filter ip "5:P4" associations
=====
IP Filter
=====
Filter Id : 5:P4 Applied : Yes
Scope : Template Def. Action : Forward
System filter: Unchained
Radius Ins Pt: n/a
CrCtl. Ins Pt: n/a
RadSh. Ins Pt: n/a
PccRl. Ins Pt: 40000 (size 10000)
Entries : 0
PccRl Entries: 11
Description : Auto-created PCC-Rule Ingress Filter

Filter Association : IP

Subscriber Hosts
- Sub : 1/1/3:1.1|00:00:00:00:00:01 (Ingress)
 - sap : 1/1/3:1.1
 - IP Address : 22.1.0.1

Filter associated with IOM: 1
=====
```

**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.<br>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.<br>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.<br>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.                                                                                                                                                                          |

| Label          | Description (Continued)                                                                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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.                                                                                                                                                                      |
| ICMP Type      | The ICMP type match criterion. Undefined indicates no ICMP type specified.                                                                                                                                                                                                                                                         |
| Fragment       | False – Configures a match on all non-fragmented IP packets.<br>True – Configures a match on all fragmented IP packets.<br>Off – Fragments are not a matching criteria. All fragments and non-fragments implicitly match.                                                                                                          |
| TCP-syn        | False – Configures a match on packets with the SYN flag set to false.<br>True – Configured a match on packets with the SYN flag set to true.<br>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.<br>Drop – Drop packets matching the filter entry.<br>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, UDP, or SCTP port number or port match list.                                                                                                                                                                                                                                                                       |
| Dest. Port     | The destination TCP, UDP, or SCTP port number or port match list.                                                                                                                                                                                                                                                                  |
| 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.<br>On – Matches packets that contain the option field or have an option field of zero be used as IP filter match criteria.                                                                                                |
| TCP-ack        | False – Configures a match on packets with the ACK flag set to false.<br>True – Configures a match on packets with the ACK flag set to true.<br>Off – The state of the TCP ACK flag is not considered as part of the match criteria. as part of the match criteria.                                                                |

| Label        | Description (Continued)                                        |
|--------------|----------------------------------------------------------------|
| 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
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
Dest. IP : 0.0.0.0/0
Protocol : 6
ICMP Type : Undefined
Fragment : Off
Sampling : Off
IP-Option : 0/0
TCP-syn : 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
Dest. IP : 0.0.0.0/0
Protocol : 6
ICMP Type : Undefined
Fragment : Off
Sampling : Off
IP-Option : 0/0
TCP-syn : 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
Dest. IP : 0.0.0.0/0
Protocol : 17
ICMP Type : Undefined
Fragment : Off
Sampling : Off
IP-Option : 0/0
TCP-syn : 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

```

```

Src. IP : 0.0.0.0/0
Dest. IP : 10.10.100.1/24
Protocol : Undefined
ICMP Type : Undefined
Fragment : Off
TCP-syn : Off
Match action : Forward
Ing. Matches : 0

Src. Port : None
Dest. Port : None
Dscp : Undefined
ICMP Code : Undefined
Option-present : Off
TCP-ack : Off
Egr. Matches : 0

Entry : 1020
time-range : night
Src. IP : 0.0.0.0/0
Dest. IP : 10.10.1.1/16
Protocol : Undefined
ICMP Type : Undefined
Fragment : Off
TCP-syn : Off
Match action : Forward
Ing. Matches : 0

Cur. Status : Active
Src. Port : None
Dest. Port : None
Dscp : Undefined
ICMP Code : Undefined
Option-present : Off
TCP-ack : Off
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.<br>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.<br>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.<br>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.                                                                                                                                                                                     |

| Label        | Description (Continued)                                                                                                                                                                                                                                 |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TCP-ack      | False — Configures a match on packets with the ACK flag set to false.<br><br>True — configures a match on packets with the ACK flag set to true.<br><br>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 :
- 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             | The IP filter policy ID.                                                                                                                                                                                                   |
| Filter Id             |                                                                                                                                                                                                                            |
| Scope                 | Template — The filter policy is of type Template.<br>Exclusive — The filter policy is of type Exclusive.                                                                                                                   |
| Applied               | No — The filter policy ID has not been applied.<br>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.<br>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.<br><br>Note that egress counters count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.            |

**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                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------|
| Scope       | Template — The filter policy is of type Template.<br>Exclusiv — The filter policy is of type Exclusive. |
| Description | The IP filter policy description.                                                                       |

| Label          | Description (Continued)                                                                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Applied        | <p>No – The filter policy ID has not been applied.</p> <p>Yes – The filter policy ID is applied.</p>                                                                                                                                                                                                                                                               |
| Def. Action    | <p>Forward – The default action for the filter ID for packets that do not match the filter entries is to forward.</p> <p>Drop – The default action for the filter ID for packets that do not match the filter entries is to drop.</p>                                                                                                                              |
| 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      | <p>Ethernet – The entry ID match frame type is Ethernet IEEE 802.3.</p> <p>Ethernet II – The entry ID match frame type is Ethernet Type II.</p>                                                                                                                                                                                                                    |
| Dot1p          | The IEEE 802.1p value for the match criteria. Undefined indicates no value is specified.                                                                                                                                                                                                                                                                           |
| Ethertype      | The Ethertype value match criterion.                                                                                                                                                                                                                                                                                                                               |
| DSAP           | <p>The DSAP value match criterion.</p> <p>Undefined indicates no value specified.</p>                                                                                                                                                                                                                                                                              |
| 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 | <p>Non-Zero – Filter entry matches a non-zero value for the Ethernet SNAP OUI.</p> <p>Zero – Filter entry matches a zero value for the Ethernet SNAP OUI.</p> <p>Undefined – No Ethernet SNAP OUI value specified.</p>                                                                                                                                             |
| Match action   | <p>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.</p> <p>Drop – Packets matching the filter entry criteria will be dropped.</p> <p>Forward – Packets matching the filter entry criteria is forwarded.</p> |
| 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.                                                                                                                                                                                                                                                                                                     |

## 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 | <i>ip address</i> — Specifies the IP address of the active destination.<br><i>none</i> — 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.                                                                                                                                      |
| Admin State        | Specifies the configured state of the destination.<br><i>Out of Service</i> — 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 be declared unreachable.                                                                                      |

| Label          | Description (Continued)                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------------------|
| 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#

```

## system-filter

|                    |                                                                                       |
|--------------------|---------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>system-filter [chained-to]</b>                                                     |
| <b>Context</b>     | show>filter                                                                           |
| <b>Description</b> | This command shows system filter information.                                         |
| <b>Parameters</b>  | <b>chained-to</b> — This option displays filters that chain to a given system filter. |

Sample Output

```
*A:Dut-C>show>filter# system-filter

=====
IP system filters
=====
Filter-Id Active

100 Yes
65535 No

No. of IP system filters (total / active): 2 / 1
=====

=====
IPv6 system filters
=====
Filter-Id Active

No Matching Entries

No. of IPv6 system filters (total / active): 0 / 0
=====

*A:Dut-C>show>filter# system-filter chained-to

=====
IP filters that chain to the active IP system filter
=====
3 4 5 6
5:23 6:24

No. of IP filters that chain to the active IP system filter: 6
=====

=====
IPv6 filters that chain to the active IPv6 system filter
=====
No Matching Entries

No. of IPv6 filters that chain to the active IPv6 system filter: 0
=====
```

match-list

|                    |                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------|
| <b>Syntax</b>      | match-list                                                                              |
| <b>Context</b>     | show>filter                                                                             |
| <b>Description</b> | This command displays information for match lists used in filter policies (FP and CPM). |

## ip-prefix-list

|                    |                                                                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip-prefix-list</b> [ <i>prefix-list-name</i> ]<br><b>ip-prefix-list</b> <i>prefix-list-name</i> <b>references</b>                                                          |
| <b>Context</b>     | show>filter>match-list                                                                                                                                                        |
| <b>Description</b> | This command displays IPv4 prefixes information for match criteria in IPv4 ACL and CPM filter policies.                                                                       |
| <b>Parameters</b>  | <i>ip-prefix-list-name</i> — 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

|                    |                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>port-list</b> [ <i>port-list-name</i> ]<br><b>port-list</b> <i>port-list-name</i> <b>references</b>                                                                   |
| <b>Context</b>     | show>filter>match-list                                                                                                                                                   |
| <b>Description</b> | This command displays TCP/UDP/SCTP port values or ranges for match criteria in IPv4 and IPv6 ACL and CPM filter policies.                                                |
| <b>Parameters</b>  | <i>port-list-name</i> — 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip</b> <i>ip-filter-id</i> [ <b>entry</b> <i>entry-id</i> ] [ <b>ingress</b>   <b>egress</b> ]                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | clear>filter                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>Clears the counters associated with the IP filter policy.</p> <p>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.</p>                                                                                                                                                     |
| <b>Default</b>     | clears all counters associated with the IP filter policy entries.                                                                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <p><i>ip-filter-id</i> — The IP filter policy ID.</p> <p><b>Values</b>      1 — 65535</p> <p><i>entry-id</i> — Specifies that only the counters associated with the specified filter policy entry will be cleared.</p> <p><b>Values</b>      1 — 65535</p> <p><b>ingress</b> — Specifies to only clear the ingress counters.</p> <p><b>egress</b> — Specifies to only clear the egress counters.</p> |

## log

|                    |                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>log</b> <i>log-id</i>                                                                                                         |
| <b>Context</b>     | clear                                                                                                                            |
| <b>Description</b> | <p>Clears the contents of a memory or file based filter log.</p> <p>This command has no effect on a syslog based filter log.</p> |
| <b>Parameters</b>  | <p><i>log-id</i> — The filter log ID destination expressed as a decimal integer.</p> <p><b>Values</b>      101 — 199</p>         |



---

## Monitor Commands

### filter

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>filter ip</b> <i>ip-filter-id</i> <b>entry</b> <i>entry-id</i> [ <b>interval</b> <i>seconds</i> ] [ <b>repeat</b> <i>repeat</i> ] [ <b>absolute</b>   <b>rate</b> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | This command monitors the counters associated with the IP filter policy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <p><i>ip-filter-id</i> — The IP filter policy ID.</p> <p><b>Values</b> 1 — 65535</p> <p><i>entry-id</i> — Specifies that only the counters associated with the specified filter policy entry will be monitored.</p> <p><b>Values</b> 1 — 65535</p> <p><b>interval</b> — Configures the interval for each display in seconds.</p> <p><b>Default</b> 10 seconds</p> <p><b>Values</b> 3 — 60</p> <p><b>repeat</b> <i>repeat</i> — Configures how many times the command is repeated.</p> <p><b>Default</b> 10</p> <p><b>Values</b> 1 — 999</p> <p><b>absolute</b> — When the <b>absolute</b> keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.</p> <p><b>rate</b> — When the <b>rate</b> keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.</p> |

---

## Debug Commands

### cpm

|                    |                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>cpm</b>                                                                                                                                                                                      |
| <b>Context</b>     | tools>dump>filter>resources                                                                                                                                                                     |
| <b>Description</b> | This command displays information about filter resource utilization on the CPM, consumption by filter-using services like TMS, Flowspec, OpenFlow, and the filters that use the most resources. |

**Sample Output**

```
*A:Dut-C>tools>dump>filter>resources># cpm
```

```
=====
Number of ACL filters defined on CPM
=====
```

| Owner         | MAC | IP | IPv6 | Total |
|---------------|-----|----|------|-------|
| Configuration | 0   | 7  | 0    | 7     |
| BGP FlowSpec  | 0   | 2  | 2    | 4     |
| Host Common   | 0   | 2  | 0    | 2     |
| Tms           | 0   | 1  | 1    | 2     |
| Openflow      | 0   | 2  | 1    | 3     |
| Total         | 0   | 14 | 4    | 18    |

```
=====
Available filters (except openflow): 16369
Available openflow filters: 16381
=====
```

```
=====
Number of ACL filter entries / subentries defined on CPM
=====
```

| Inserted by        | MAC | IP | IPv6 | Total |
|--------------------|-----|----|------|-------|
| User configuration | 0   | 21 | 1    | 22    |
|                    | 0   | 21 | 1    | 22    |
| Radius             | 0   | 0  | 0    | 0     |
|                    | 0   | 0  | 0    | 0     |
| Credit Control     | 0   | 0  | 0    | 0     |
|                    | 0   | 0  | 0    | 0     |
| BGP FlowSpec       | 0   | 0  | 0    | 0     |
|                    | 0   | 0  | 0    | 0     |
| Embedded           | 0   | 0  | 0    | 0     |
|                    | 0   | 0  | 0    | 0     |
| Radius shared host | 0   | 2  | 0    | 2     |
|                    | 0   | 2  | 0    | 2     |
| Openflow           | 0   | 0  | 0    | 0     |
|                    | 0   | 0  | 0    | 0     |
| PCC-Rule           | 0   | 0  | 0    | 0     |
|                    | 0   | 0  | 0    | 0     |
| Other              | 0   | 0  | 0    | 0     |
|                    | 0   | 0  | 0    | 0     |
| Total              | 0   | 23 | 1    | 24    |
|                    | 0   | 23 | 1    | 24    |

```
=====
Available subentries (except openflow): 262120
Available openflow subentries: 262144
=====
```

```
=====
Filters utilizing most resources (ordered by CPM entries)
=====
```

| Type Id              | Entries | Subentries | TCAM entries<br>(per FlexPath) |
|----------------------|---------|------------|--------------------------------|
| No Mac filters found |         |            |                                |
| Ip 100               | 5       | 5          | 5                              |

```

Ip 65535 5 5 5
Ip 1 4 4 4
Ip 5:23 2 2 2
Ip 6:24 2 2 2

Ipv6 _tmnx_tms-ing-5/1-F 1 1 1
Ipv6 fSpec-0 0 0 0
Ipv6 fSpec-2345 0 0 0
Ipv6 _tmnx_ofs_system:1 0 0 0
No more Ipv6 filters
=====

Filters utilizing most resources (ordered by CPM subentries)
=====
Type Id Entries Subentries TCAM entries
 (per FlexPath)

No Mac filters found

Ip 100 5 5 5
Ip 65535 5 5 5
Ip 1 4 4 4
Ip 5:23 2 2 2
Ip 6:24 2 2 2

Ipv6 _tmnx_tms-ing-5/1-F 1 1 1
Ipv6 fSpec-0 0 0 0
Ipv6 fSpec-2345 0 0 0
Ipv6 _tmnx_ofs_system:1 0 0 0
No more Ipv6 filters
=====

```

## egress-pbr

|                    |                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>egress-pbr [detail]</b>                                                                                                            |
| <b>Context</b>     | tools>dump>filter>resources                                                                                                           |
| <b>Description</b> | This command displays the number of allocated unique egress PBR destinations.                                                         |
| <b>Parameters</b>  | <b>detail</b> — Displays number of allocated unique egress PBR destinations together with a list of destinations and their ref counts |

### Sample Output

```

*A:Dut-C>tools dump filter resources egress-pbr

=====
Egress PBR destinations
=====
Name Count

All destinations 8

```

```
Unique destinations 4
=====

*A:Dut-C# tools dump filter resources egress-pbr detail

=====
Unique egress PBR destinations
=====
Num Action Ref. count Parameters

 1 Esi L3 1 esi 00:00:00:00:00:00:00:00:01
 ip 5.5.1.5
 if VasToFromAccess
 rtr 123

 2 Esi L3 2 esi 00:00:00:00:00:00:00:00:02
 ip 5.5.0.5
 if VasToFromNetwork
 rtr 123

 3 Red-pol 3 name egress-pbr

 4 Red-pol 2 name ingress-pbr
=====
```

iom

|                    |                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>iom [&lt;slot-number&gt;]</b>                                                                                                                                                                                  |
| <b>Context</b>     | tools>dump>filter>resources                                                                                                                                                                                       |
| <b>Description</b> | This command shows information about filter resource utilization on all IOMs or a specified IOM. Resource utilization per filter type is available, as well as filters using most resources on a given line card. |
| <b>Parameters</b>  | <b>slot-number</b> — specifies filter resource utilization                                                                                                                                                        |
|                    | <b>Values</b>                                                                                                                                                                                                     |

Sample Output

```
*A:Dut-C>tools>dump>filter>resources># iom

=====
Number of ACL filter entries used / available on IOMs
=====
Slot Used Available

 1 11 65524
 2 5 65530
 3 5 65530
=====
```

```

=====
Number of ACL filters and filter entries used / available on FlexPaths
=====
Slot FlexPath Dir Filters Filters MAC/IP MAC/IP IPv6 IPv6
 used avail entries entries entries entries
 used avail used avail used avail

1 1 Ingr 2 2045 10 65526 2 28670
 Egr 2 2045 5 32763 2 16382
2 1 Ingr 4 2043 7 65529 2 28670
 Egr 0 2047 2 32766 2 16382
3 1 Ingr 0 2047 7 65529 2 28670
 Egr 0 2047 2 32766 2 16382
=====

```

```

=====
Filters utilizing most resources (ordered by TCAM entries per FlexPath)
Only filters present on any IOM are displayed
=====
Type Id Entries Subentries TCAM entries
 (per FlexPath)

No Mac filters found

Ip 100 5 5 5
Ip 5:23 2 2 2
Ip 6:24 2 2 2
Ip 3 1 1 1
Ip 4 1 1 1

Ipv6 _tmnx_tms-ing-5/1-F 1 1 1
Ipv6 fSpec-0 0 0 0
Ipv6 fSpec-2345 0 0 0
No more Ipv6 filters
=====

```

ip

|                    |                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip &lt;filter-id&gt;</b>                                                                                                                                                                    |
| <b>Context</b>     | tools>dump>filter>resources                                                                                                                                                                    |
| <b>Description</b> | This command displays information about the specified IP filter including resource utilization on CPM and IOM, the IOMs on which the filter is used, and the entries using the most resources. |
| <b>Parameters</b>  | <b>filter-id</b> — specifies filter resource utilization.<br><b>Values</b> 1 — 65535                                                                                                           |

**Sample Output**

```
*A:Dut-C>tools>dump>filter>resources># ip 100
```

```
=====
```

```
Resource utilization details for Ip filter 100
=====
CPM entries used : 5
CPM subentries used : 5
TCAM entries used (per FlexPath) : 5
Associated with IOMs : 1,2,3,4,5,6,7,8,9,10

Largest 5 entries

Entry ID Active TCAM entries
 (per FlexPath)

3 Yes 1
4 Yes 1
5 Yes 1
6 Yes 1
100 Yes 1

=====
```

## ipv6

|                    |                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ipv6 &lt;filter-id&gt;</b>                                                                                                                                                                    |
| <b>Context</b>     | tools>dump>filter>resources                                                                                                                                                                      |
| <b>Description</b> | This command displays information about the specified IPv6 filter including resource utilization on CPM and IOM, the IOMs on which the filter is used, and the entries using the most resources. |
| <b>Parameters</b>  | <b>filter-id</b> — specifies filter resource utilization.<br><b>Values</b> 1 — 65535                                                                                                             |

### Sample Output

```
*A:Dut-C>tools>dump>filter>resources># ipv6 "fSpec-0"

=====
Resource utilization details for Ipv6 filter fSpec-0
=====
CPM entries used : 0
CPM subentries used : 0
TCAM entries used (per FlexPath) : 0
Associated with IOMs : 2

Largest 5 entries

Entry ID Active TCAM entries
 (per FlexPath)

No Matching Entries

```

## mac

|                    |                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>mac &lt;filter-id&gt;</b>                                                                                                                                                                    |
| <b>Context</b>     | tools>dump>filter>resources                                                                                                                                                                     |
| <b>Description</b> | This command displays information about the specified MAC filter including resource utilization on CPM and IOM, the IOMs on which the filter is used, and the entries using the most resources. |
| <b>Parameters</b>  | <b>filter-id</b> — specifies filter resource utilization.                                                                                                                                       |
| <b>Values</b>      | 1 — 65535                                                                                                                                                                                       |

**Sample Output**

```
*A:Dut-C>tools>dump>filter>resources># mac 1

=====
Resource utilization details for Mac filter 1
=====
CPM entries used : 1
CPM subentries used : 1
TCAM entries used (per FlexPath) : 1
Associated with IOMs : 1

Largest 5 entries

Entry ID Active TCAM entries
 (per FlexPath)

1 Yes 1
No more entries defined

=====
```

## activate-best-dest

|                    |                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>activate-best-dest</b>                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | tools>perform>filter>redirect-policy                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command allows the operator to force a PBR switch to the best destination selected by the redirect policy when that destination is not currently active as result of sticky destination functionality being enabled for the specified redirect policy. If <b>hold-time-up</b> is running, the timer is also expired. |





---

## In This Chapter

This chapter provides information to configure Cflowd.

Topics in this chapter include:

- [Cflowd Overview on page 562](#)
  - [Operation on page 563](#)
  - [Cflowd Filter Matching on page 567](#)
- [Cflowd Configuration Process Overview on page 568](#)
- [Configuration Notes on page 569](#)

## 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.

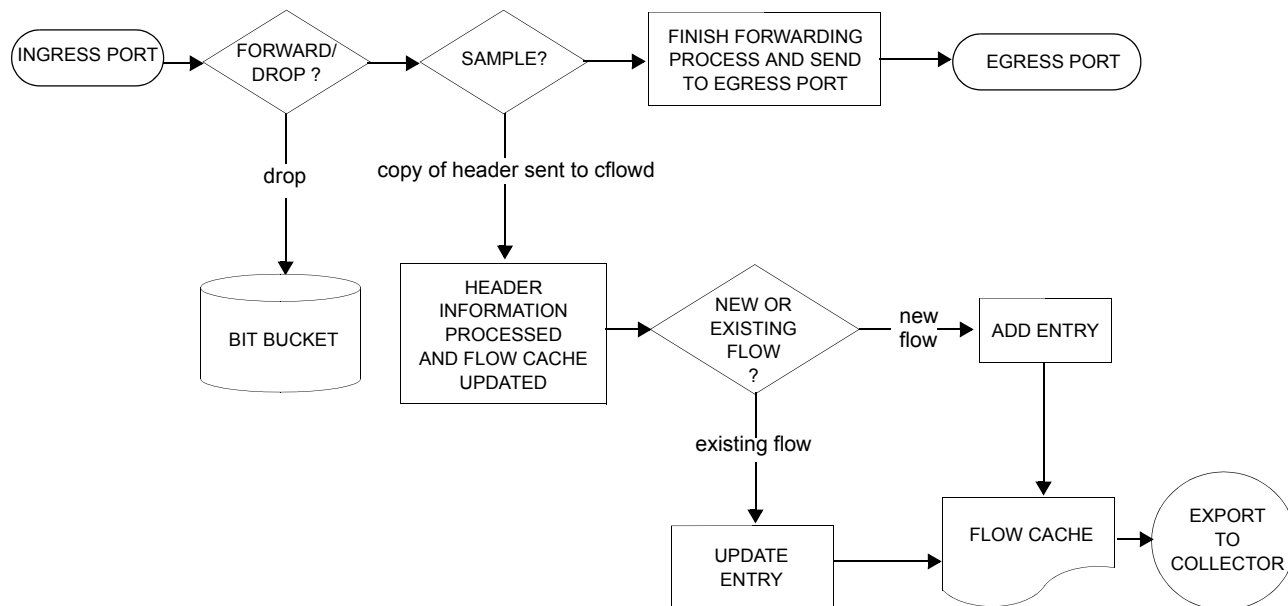
Cflowd is also useful for traffic engineering, network planning and analysis, network monitoring, developing user profiles, data warehousing and mining, as well as security-related investigations. Collected information can be viewed several ways such as in port, AS, or network matrices, and pure flow 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.

## Operation

Figure 26 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 26: Basic Cflowd Steps**

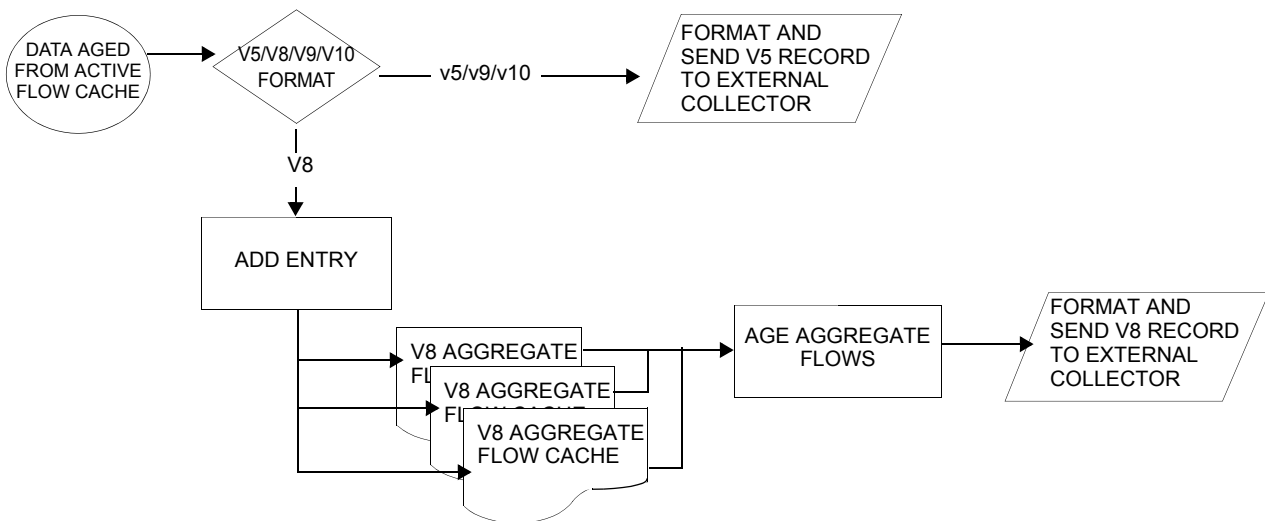
1. As a packet ingresses a port, a decision is made to forward or drop the packet.
2. If the packet is forwarded, it is then decided if the packet should be sampled for cflowd.
3. If a new flow is found, a new entry is added to the cache. If the flow already exists in the cache, the flow statistics are 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 than 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 27 depicts Version 5, Version 8, Version 9, and Version 10 flow processing.



**Figure 27: 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.

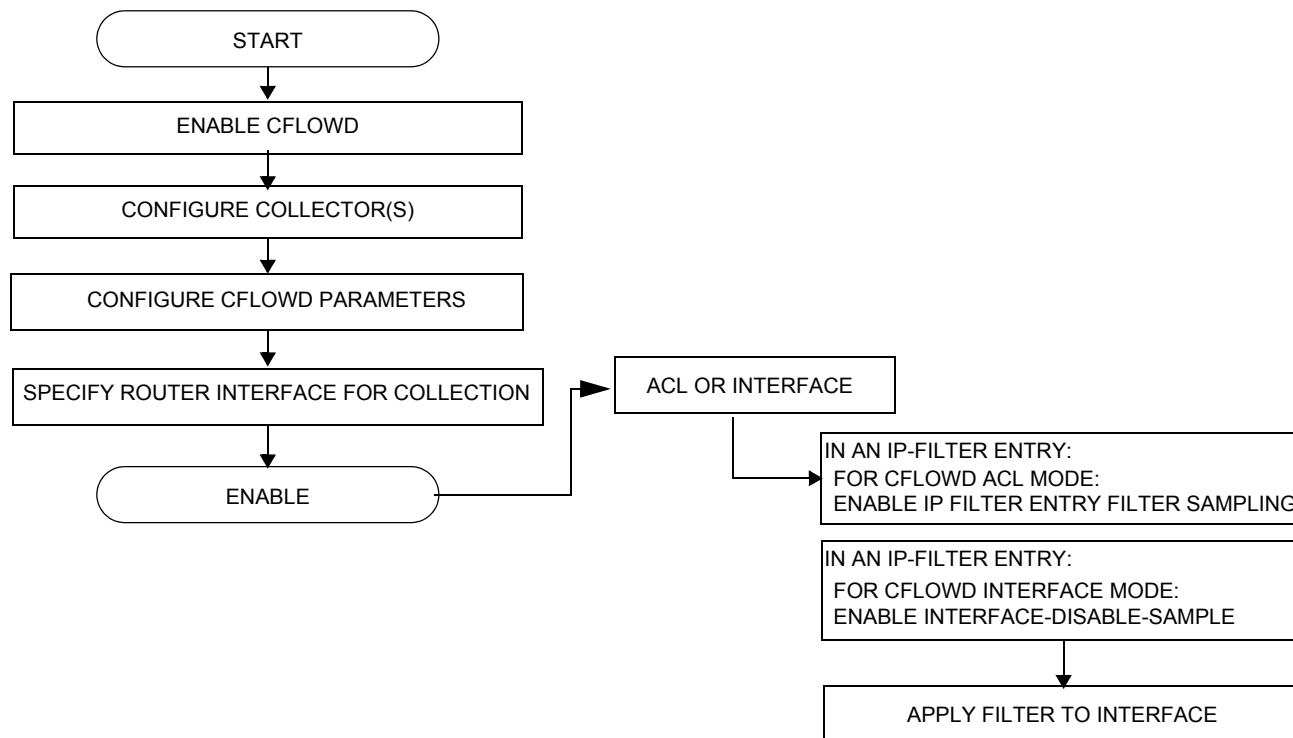
Version 10 is interoperable with RFC 5150 and 5102.

## 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 28 displays the process to configure Cflowd parameters.



**Figure 28: 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 on page 572](#)
  - [Traffic Sampling on page 572](#)
  - [Collectors on page 573](#)
  - [Aggregation on page 573](#)
- [Basic Cflowd Configuration on page 575](#)
- [Common Configuration Tasks on page 576](#)
  - [Enabling Cflowd on page 578](#)
  - [Configuring Global Cflowd Parameters on page 579](#)
  - [Configuring Cflowd Collectors on page 580](#)
  - [Dependencies on page 596](#)
  - [Enabling Cflowd on Interfaces and Filters on page 592](#)
  - [Specifying Cflowd Options on an IP Interface on page 593](#)
  - [Specifying Sampling Options in Filter Entries on page 595](#)
- [Cflowd Configuration Management Tasks on page 598](#)
  - [Modifying Global Cflowd Components on page 598](#)
  - [Modifying Cflowd Collector Parameters on page 599](#)

## Cflowd Configuration Overview

The 7950 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.

---

### 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
- Forwarding status
- 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
- Direction
- MPLS labels

The 7950 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 declared 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 578](#)
- [Configuring Global Cflowd Parameters on page 579](#)
- [Configuring Cflowd Collectors on page 580](#)
- [Enabling Cflowd on Interfaces and Filters on page 592](#)

---

**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 11](#) indicates the relationship between these values and the corresponding template used to export the flow data.

**Table 11: 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 12: 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 12: Basic IPv4 Template (Continued)**

|                                      |     |
|--------------------------------------|-----|
| Flow Start Milliseconds <sup>1</sup> | 152 |
| Flow End Milliseconds <sup>1</sup>   | 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 13: 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 13: MPLS-IPv4 Template (Continued)**

| Field Name                           | Field ID |
|--------------------------------------|----------|
| Packet Count                         | 2        |
| Byte Count                           | 1        |
| Start Time                           | 22       |
| End Time                             | 21       |
| Flow Start Milliseconds <sup>1</sup> | 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 13: 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 14: 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 <sup>1</sup> | 152      |
| Flow End Milliseconds <sup>1</sup>   | 153      |
| Src Port                             | 7        |
| Dest Port                            | 11       |
| Forwarding Status                    | 89       |
| TCP control Bits (Flags)             | 6        |



**Table 14: 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 15: 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 15: MPLS-IPv6 Template**

| Field Name                           | Field ID |
|--------------------------------------|----------|
| Byte Count                           | 1        |
| Start Time                           | 22       |
| End Time                             | 21       |
| Flow Start Milliseconds <sup>1</sup> | 152      |
| Flow End Milliseconds <sup>1</sup>   | 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_TOP_LABEL_TYPE                  | 46       |
| MPLS_TOP_LABEL_ADDR                  | 47       |
| MPLS Top Label Type                  | 46       |

**Table 15: MPLS-IPv6 Template**

| Field Name               | Field ID |
|--------------------------|----------|
| MPLS Top Label IPv6 Addr | 47       |
| MPLS Label 1             | 70       |
| MPLS Label 2             | 71       |
| MPLS Label 3             | 72       |
| MPLS Label 4             | 73       |
| MPLS Label 5             | 74       |
| MPLS Label 6             | 75       |
| MPLS_TOP_LABEL_TYPE      | 46       |
| MPLS_TOP_LABEL_ADDR      | 47       |

1. Only sent to collectors configured for v10 format

**Table 16: Basic MPLS Template**

| Field Name                           | Field ID |
|--------------------------------------|----------|
| Start Time                           | 22       |
| End Time                             | 21       |
| Flow Start Milliseconds <sup>1</sup> | 152      |
| Flow End Milliseconds <sup>1</sup>   | 153      |
| Ingress Interface                    | 10       |
| Egress Interface                     | 14       |
| Packet Count                         | 2        |
| Byte Count                           | 1        |
| Direction                            | 61       |

**Table 16: Basic MPLS Template**

| Field Name          | Field ID |
|---------------------|----------|
| MPLS_TOP_LABEL_TYPE | 46       |
| MPLS_TOP_LABEL_ADDR | 47       |
| 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 17: 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       |

**Table 17: MPLS-IP Template**

| Field Name                           | Field ID |
|--------------------------------------|----------|
| Flow Start Milliseconds <sup>1</sup> | 152      |
| Flow End Milliseconds <sup>1</sup>   | 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_ADDR                  | 47       |
| MPLS Top Label Type                  | 46       |
| MPLS Top Label IPv4 Addr             | 47       |
| 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 18: Ethernet (L2-IP) Flow Template<sup>1</sup>**

| 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        |
| 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       |

**Table 18: Ethernet (L2-IP) Flow Template<sup>1</sup>**

| Field Name     | Field ID |
|----------------|----------|
| TOS            | 5        |
| IP Version     | 60       |
| ICMP Type Code | 32       |

1. One 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 593](#)
  - [Interface Configurations on page 593](#)
  - [Service Interfaces on page 594](#)
- [Specifying Sampling Options in Filter Entries on page 595](#)
  - [Interface Configurations on page 593](#)
- [Dependencies on page 596](#)



## 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 19, Cflowd Configuration Dependencies, on page 597](#) 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 7950 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 filter 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 Interface Configuration) For configuration information, refer to the IP Router Configuration Overview section of the 7950 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 593](#)
- [Service Interfaces on page 594](#)
- [Filter Configurations on page 595](#)

Depending on the combination of interface and filter entry configurations determine if and when flow sampling occurs. [Table 19](#) displays the expected results when specific features are enabled and disabled.

**Table 19: Cflowd Configuration Dependencies**

| <b>Interface Setting</b>                                | <b>router&gt;interface<br/>cflowd [acl   interface]<br/>Setting</b> | <b>Command<br/>ip-filter entry</b> | <b>Expected Results</b>                                                                      |
|---------------------------------------------------------|---------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------------------------------------|
| 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<br>cflowd not enabled on<br>interface | ACL                                                                 | interface-<br>disable-sample       | Command is ignored. No sampling occurs.                                                      |
| Interface mode                                          | interface                                                           | interface-<br>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 598](#)
- [Modifying Cflowd Collector Parameters on page 599](#)

### 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#

```





# 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 602](#)

## 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 | <i>slot/mda/port[.channel]</i>  | 1/1/5                                                       |
| null    | <i>[port-id   lag-id]</i>       | <i>port-id:</i> 1/1/3<br><i>lag-id:</i> lag-3               |
| dot1q   | <i>[port-id   lag-id]:qtag1</i> | <i>port-id:qtag1:</i> 1/1/3:100<br><i>lag-id:lag-1:</i> 102 |

*qtag1*, *qtag2* — Specifies the encapsulation value used to identify the SAP on the port or sub-port. If this parameter is not specifically 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.<br>Note that a 0 qtag1 value also accepts untagged packets on the dot1q port. |

---

# 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
 — [no] use-vrtr-if-index

```

### Show Commands

```
show
 — cflowd
 — collector [ip-address[:port]] [detail]
 — interface [ip-int-name | ip-address]
 — status
```

### Tools Commands

```
tools
 — dump
 — cflowd
 — cache {all | aggregate {src-dst-proto | src-dst-proto-port}} family {ipv4 | ipv6}
 — packet-size [ipv4 | ipv6] [clear]
 — top-flows [ipv4 | ipv6 | mpls] [clear]
 — top-protocols [clear]
```

### Clear Commands

```
clear
 — cflowd
```

## Show Commands

### collector

|                    |                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>collector</b> [ <i>ip-addr[:port]</i> ] [ <b>detail</b> ]                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | show>cflowd                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | This command displays administrative and operational status of data collector configuration.                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <p><i>ip-addr</i> — Display only information about the specified collector IP address.</p> <p><b>Default</b> all collectors</p> <p><i>:port</i> — Display only information the collector on the specified UDP port.</p> <p><b>Default</b> all UDP ports</p> <p><b>Values</b> 1 — 65535</p> <p><b>detail</b> — Displays details about either all collectors or the specified collector.</p> |
| <b>Output</b>      | <b>cflowd Collector Output</b> — The following table describes the show cflowd collector output fields:                                                                                                                                                                                                                                                                                    |

**Table 20: 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      | <p>The style of AS reporting used in the exported flow data.</p> <p><i>origin</i> — Reflects the endpoints of the AS path which the flow is following.</p> <p><i>peer</i> — Reflects the AS of the previous and next hops for the flow.</p> |
| 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 21: 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 21: Show Cflowd Collector Detailed Output Fields (Continued)**

| Label            | Description (Continued)                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AS Type          | The style of AS reporting used in the exported flow data.<br><br>origin – Reflects the endpoints of the AS path which the flow is following.<br><br>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.<br><br>none – No data will be exported for this remote collector host.<br><br>raw – Flow data is exported without aggregation in version 5 format.<br><br>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 data 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
```

## Show Commands

```
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

|                    |                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>interface</b> [ <i>ip-addr</i>   <i>ip-int-name</i> ]                                                                                            |
| <b>Context</b>     | show>cflowd                                                                                                                                         |
| <b>Description</b> | Displays the administrative and operational status of the interfaces with cflowd enabled.                                                           |
| <b>Parameters</b>  | <i>ip-addr</i> — Display only information for the IP interface with the specified IP address.<br><b>Default</b> 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.<br>intf — Interface based sampling<br>acl — ACL based sampling<br>ingr — Ingress sampling<br>egr — Egress sampling<br>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      | <b>cflowd Status Output</b> — The following table describes the show cflowd status output fields:      |

Table 22: Cflowd Status Output

| Label                | Description                                                             |
|----------------------|-------------------------------------------------------------------------|
| Cflowd Admin Sta-tus | The desired administrative state for this Cflowd remote collector host. |
| Cflowd Oper Status   | The current operational status of this Cflowd remote collector host.    |

**Table 22: 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 Retransmit | 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.<br>one (1) – All packets are analyzed.<br>1000 (default) – Every 1000th packet is analyzed.                      |
| Active Flows        | The current number of active flows being collected.                                                                                                                                      |
| Total Pkts Rcvd     | The total number of packets 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.<br>disabled – Specifies that the aggregation type is disabled.                                                                 |
| Sent                | The number of packets with flow data 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       | Total number of flows dropped due to cache overflow events.                                                                                                                              |

**Sample Output**

```

sr1# show cflowd status
=====
Cflowd Status
=====

```

## Show Commands

```
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

### cache

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>cache {all   aggregate {src-dst-proto   src-dst-proto-port}} family {ipv4   ipv6}</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | tools>dump>cflowd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | This command displays the contents of the CFLOWD active cache. This information can be displayed either in raw form where every flow entry is displayed or in an aggregated form.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><b>all</b> — Display the raw active cache flow data with no aggregation.</p> <p><b>aggregate</b> — Display the aggregated active cache flow data.</p> <p><b>src-dst-proto</b> — Aggregates the active flow cache based on the source and destination IP address and the IP protocol value.</p> <p><b>src-dst-proto-port</b> — Aggregates the active flow cache based on the source and destination IP address, IP protocol value, and the source and destination port numbers.</p> <p><b>family</b> — Specifies which IP address family flow data should be displayed.</p> <p><b>ipv4</b> — Displays the IPv4 flow data.</p> <p><b>ipv6</b> — Displays the IPv6 flow data.</p> |
| <b>Output</b>      | <b>tools dump cflowd cache Output</b> — The following table describes the tools dump cflowd cache output fields:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

**Table 23: tools dump cflowd cache Output Fields**

| Label                         | Description                                                                                                 |
|-------------------------------|-------------------------------------------------------------------------------------------------------------|
| Proto/Protocol                | Displays the IPv4 or IPv6 protocol type.                                                                    |
| Source Address/<br>Src-IP     | Displays the source IP address of the flow (IPv4 or IPv6).                                                  |
| Destination<br>Address/Dst-IP | Displays the destination IP address of the flow (IPv4 or IPv6).                                             |
| Intf/Ingr                     | Displays the ingress interface associated with the sampled flow (only displayed with the raw (all) output). |
| Intf/Egr                      | Displays the egress interface associated with the sampled flow (only displayed with the raw (all) output).  |
| S-Port                        | Displays the source protocol port number.                                                                   |
| D-Port                        | Displays the destination protocol port number.                                                              |
| Pkt-Cnt                       | Displays the total number of packets sampled for the associated flow.                                       |

**Table 23: tools dump cflowd cache Output Fields**

| Label      | Description                                                                                                                                        |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Byte-Cnt   | Displays the total number of bytes of traffic sampled for the associated flow.                                                                     |
| Start-Time | Displays the system time when the first packet was sampled for the associated flow.                                                                |
| Flags      | Displays the IP flag value from the sampled IP flow header (only displayed with the raw (all) output).                                             |
| ToS        | Displays the ToS byte values from the sampled IP flow header (only displayed with the raw (all) output).                                           |
| (Src) Mask | Displays the IP route mask for the route to the flow source IP address associated with the flow (only displayed with the raw (all) output).        |
| (Dst) Mask | Displays the IP route mask for the route to the flow destination IP address associated with the flow (only displayed with the raw (all) output).   |
| (Src) AS   | Displays the ASN associated with the route to the flow source IP address associated with the flow (only displayed with the raw (all) output).      |
| (Dst) AS   | Displays the ASN associated with the route to the flow destination IP address associated with the flow (only displayed with the raw (all) output). |
| vRtr-ID    | Displays the Virtual Router ID associated with the reported IP flow (only displayed with the raw (all) output).                                    |

## packet-size

|                    |                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>packet-size [ipv4   ipv6] [clear]</b>                                                                                                                                                                       |
| <b>Context</b>     | tools>dump>cflowd                                                                                                                                                                                              |
| <b>Description</b> | 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
```

## top-flows

|                    |                                                                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>top-flows [ipv4   ipv6   mpls] [clear]</b>                                                                                                                                   |
| <b>Context</b>     | tools>dump>cflowd                                                                                                                                                               |
| <b>Description</b> | 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. |
| <b>Output</b>      | <b>Tools Dump Cflowd Top-Flows Output</b> — The following table describes the tools dump cflowd top-flows output fields:                                                        |

**Table 24: 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<br>Proto        | Displays the protocol type for flow.                                                                                                            |
| TOS                | Displays the Type of Service/DSCP butts 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.                                                                                            |
| S-Port<br>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<br>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.                                                                 |

**Table 24: Tools Dump Cflowd Top-flows Out put Fields**

| Label        | Description                                                                                                                                          |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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
1234567890123456789012345678901234567890123456789012345678901234567890
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
1234567890123456789012345678901234567890123456789012345678901234567890
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
1234567890123456789012345678901234567890123456789012345678901234567890
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

```

**top-protocols**

|                    |                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>top-protocols</b>                                                                                                                                                                                                                               |
| <b>Context</b>     | tools>dump>cflowd [clear]                                                                                                                                                                                                                          |
| <b>Description</b> | 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 25: Tools Dump Cflowd Top-protocols Output Fields**

| Label               | Description                                                                                                                                                                                         |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Protocol ID         | Displays the IPv4 or IPv6 protocol type.<br>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.<br>(Total flows / number of seconds since last clear)                                                               |
| Packets/Flow        | Displays the average number of packets per flow.<br>(Total number of packets / total flows)                                                                                                         |
| Bytes/Pkts          | Displays the average number of bytes per packet for the associated protocol type.<br>(Total number of bytes for the associated protocol / total number of packets seen for the associated protocol) |
| Packets/Sec         | Displays the average number of packets seen for the associated protocol type.<br>(Number of packets / time since last clear)                                                                        |
| Duration/Flow       | Displays the average lifetime of a flow for the associated protocol type.<br>(Number of seconds since last clear / total flows)                                                                     |
| Bandwidth Total (%) | Displays the percentage of bandwidth consumed by the associated protocol type.<br>(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<br>Flows | Flows<br>/Sec | Packets<br>/Flow | Bytes<br>/Pkt | Packets<br>/Sec | Duration<br>/Flow | % Total<br>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%                 |

---

## Clear Commands

### cflowd

|                    |                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>cflowd</b>                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | clear                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | 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. |

---

## Cflowd Configuration Commands

---

### Global Commands

---

#### cflowd

|                    |                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] cflowd</b>                                                                                                                                                                                                                                             |
| <b>Context</b>     | <b>config&gt;cflowd</b>                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>This command creates the context to configure cflowd.</p> <p>The <b>no</b> 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.</p> |
| <b>Default</b>     | no cflowd                                                                                                                                                                                                                                                      |

#### active-timeout

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>active-timeout <i>minutes</i></b><br><b>no active-timeout</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>cflowd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>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.</p> <p><b>Note:</b> 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.</p> <p>The <b>no</b> form of this command resets the inactive timeout back to the default value.</p> |
| <b>Default</b>     | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <p><i>minutes</i> — The value expressed in minutes before an active flow is exported.</p> <p><b>Values</b>      1 — 600</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## cache-size

|                    |                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>cache-size</b> <i>num-entries</i><br><b>no cache-size</b>                                                                                                                                                       |
| <b>Context</b>     | config>cflowd                                                                                                                                                                                                      |
| <b>Description</b> | This command specifies the maximum number of active flows to maintain in the flow cache table.<br>The <b>no</b> form of this command resets the number of active entries back to the default value.                |
| <b>Default</b>     | <b>65536</b> (64K)                                                                                                                                                                                                 |
| <b>Parameters</b>  | <i>num-entries</i> — The maximum number of entries maintained in the cflowd cache. It depends on the CPM version.<br><br><b>Values</b> 1000 - 128k (SF/CPM1, SF/CPM2)<br>1000 — 250000 (cfm-xp, SF/CPM3 or higher) |

## collector

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Syntax      | <b>collector</b> <i>ip-address[:port]</i> { <b>version</b> [ 5   8   9   10]}                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|             | <b>no collector</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Context     | config>cflowd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Description | <p>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.</p> <p>The <b>no</b> 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.</p> |
| Default     | none                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Parameters  | <p><i>ip-address</i> — Specifies the address of a remote Cflowd collector host to receive the exported Cflowd data.</p> <p><b>Values</b>      &lt;ip-address[:port]&gt; : ip-address - a.b.c.d[:port]      (IPv4)<br/>                     x:x:x:x:x:x:x      (IPv6)<br/>                     [x:x:x:x:x:x]:port (IPv6)<br/>                     x - [0..FFFF]H</p> <p><i>port</i> — Specifies the UDP port number on the remote Cflowd collector host to receive the exported Cflowd data.</p> <p><b>Values</b>      1— 65535</p> <p><b>Default</b>     2055</p>                                                                                            |

**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

|                    |                                                                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] protocol-port</b>                                                                                                                                                                                                                      |
| <b>Context</b>     | config>cflowd>collector>aggregation                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command specifies that flows be aggregated based on the IP protocol, source port number, and destination port number.</p> <p>The <b>no</b> form of this command removes this type of aggregation from the collector configuration.</p> |
| <b>Default</b>     | none                                                                                                                                                                                                                                           |

## raw

|                    |                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] raw</b>                                                                                                                                                                                   |
| <b>Context</b>     | config>cflowd>collector>aggregation                                                                                                                                                               |
| <b>Description</b> | <p>This command configures raw (unaggregated) flow data to be sent in Version 5.</p> <p>The <b>no</b> form of this command removes this type of aggregation from the collector configuration.</p> |
| <b>Default</b>     | none                                                                                                                                                                                              |

## source-destination-prefix

|                    |                                                                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] source-destination-prefix</b>                                                                                                                                                                    |
| <b>Context</b>     | config>cflowd>collector>aggregation                                                                                                                                                                      |
| <b>Description</b> | <p>This command configures cflowd aggregation based on source and destination prefixes.</p> <p>The <b>no</b> form of this command removes this type of aggregation from the collector configuration.</p> |
| <b>Default</b>     | none                                                                                                                                                                                                     |

## source-prefix

|                    |                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] source-prefix</b>                                                                                                                                                                          |
| <b>Context</b>     | config>cflowd>collector>aggregation                                                                                                                                                                |
| <b>Description</b> | <p>This command configures cflowd aggregation based on source prefix information.</p> <p>The <b>no</b> form of this command removes this type of aggregation from the collector configuration.</p> |
| <b>Default</b>     | none                                                                                                                                                                                               |

## autonomous-system-type

|                    |                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>autonomous-system-type</b> { <b>origin</b>   <b>peer</b> }<br><b>no autonomous-system-type</b>                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>cflowd>collector                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | 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.<br><br>This option is only allowed if the collector is configured as Version 5 or Version 8.<br><br>The <b>no</b> form of this command resets the AS type to the default value. |
| <b>Default</b>     | <b>autonomous-system-type origin</b>                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <b>origin</b> — Specifies that the AS information included in the flow data is based on the originating AS.<br><b>peer</b> — Specifies that the AS information included in the flow data is based on the peer AS.                                                                                                                               |

## description

|                    |                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>description</b> <i>description-string</i><br><b>no description</b>                                                                                                                                                                                                                         |
| <b>Context</b>     | config>cflowd>collector                                                                                                                                                                                                                                                                       |
| <b>Description</b> | This command creates a text description stored in the configuration file for a configuration context.<br><br>The <b>no</b> form of this command removes the description string from the context.                                                                                              |
| <b>Default</b>     | No description is associated with the configuration context.                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <i>description-string</i> — 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] shutdown</b>                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>cflowd<br>config>cflowd>collector                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | This command administratively disables an entity. When disabled, an entity does not change, reset, or remove any configuration settings or statistics.<br><br>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.<br><br>The <b>no</b> 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

|                    |                                                                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>template-set {basic   mpls-ip   l2-ip}</b>                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>cflowd>collector                                                                                                                                                                                                                                                                               |
| <b>Description</b> | This command specifies the set of templates sent to the collector when using cflowd Version 9 or Version 10.                                                                                                                                                                                          |
| <b>Default</b>     | <b>basic</b>                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <b>basic</b> — Basic flow data is sent.<br><b>mpls-ip</b> — Extended flow data is sent that includes IP and MPLS flow information.<br><b>l2-ip</b> — 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

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>export-type [automatic   manual]</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>cflowd                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | 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. |
| <b>Default</b>     | export-mode automatic                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <b>automatic</b> — Cflowd flow data is automatically generated.<br><b>manual</b> — Cflowd flow data is exported only when manual triggered.                                                                                                                                                                                                                                                                                                                        |

## inactive-timeout

|                    |                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>inactive-timeout <i>seconds</i></b><br><b>no inactive-timeout</b>                                                                                      |
| <b>Context</b>     | config>cflowd                                                                                                                                             |
| <b>Description</b> | 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.

|                   |                                                                                                                                                               |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | <b>15</b>                                                                                                                                                     |
| <b>Parameters</b> | <i>seconds</i> — 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. |
| <b>Values</b>     | 10 — 600                                                                                                                                                      |

## overflow

|                    |                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>overflow percent</b><br><b>no overflow</b>                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>cflowd                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | <p>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.</p> <p>The <b>no</b> form of this command resets the number of entries cleared from the flow cache on overflow to the default value.</p> |
| <b>Default</b>     | <b>1 %</b>                                                                                                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <i>percent</i> — Specifies the percentage of the flow cache entries removed when the maximum number of entries is exceeded.                                                                                                                                                                                                                                        |
| <b>Values</b>      | 1 — 50 percent                                                                                                                                                                                                                                                                                                                                                     |

## rate

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>rate sample-rate</b><br><b>no rate</b>                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>cflowd                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>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 <i>sample-rate</i> is configured as 1, then all packets are sent to the cache. When <i>sample-rate</i> is configured as 100, then every 100th packet is sent to the cache.</p> <p>The <b>no</b> form of this command resets the sample rate to the default value.</p> |
| <b>Default</b>     | <b>1000</b>                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <i>sample-rate</i> — Specifies the rate at which traffic is sampled.                                                                                                                                                                                                                                                                                                                                                        |
| <b>Values</b>      | 1 — 10000                                                                                                                                                                                                                                                                                                                                                                                                                   |

## template-retransmit

|                    |                                                                                      |
|--------------------|--------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>template-retransmit</b> <i>seconds</i><br><b>no template-retransmit</b>           |
| <b>Context</b>     | config>cflowd                                                                        |
| <b>Description</b> | This command specifies the interval for sending template definitions.                |
| <b>Default</b>     | 600                                                                                  |
| <b>Parameters</b>  | <i>seconds</i> — The value expressed in seconds before sending template definitions. |
|                    | <b>Values</b> 10 — 600                                                               |

## use-vrtr-if-index

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] use-vrtr-if-index</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>cflowd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command is used to export flow data using interface indexes (ifIndex values), which can be used directly as the index into the IF-MIB tables for retrieving interface statistics. Specifically, if the this command is enabled, then the ingressInterface (ID=10) and egressInterface (ID= 14) fields in IP flow templates used to export the flow data to Cflowd version 9 and version 10 collectors will be populated with the IF-MIB ifIndex of that interface. In addition, for version 10 templates, two fields are available in the IP flow templates to present the Virtual Router ID associated with the ingress and egress interfaces.</p> <p>The <b>no</b> form of this command removes the command from the active configuration and causes cflowd to return to the default behavior of populating the ingress and egress interface ID with the global IF index IDs.</p> |
| <b>Default</b>     | no use-vrtr-if-index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

# Standards and Protocol Support



**Note:** The information presented is subject to change without notice.

Alcatel-Lucent assumes no responsibility for inaccuracies contained herein.

## ANCP/L2CP

RFC 5851, *Framework and Requirements for an Access Node Control Mechanism in Broadband Multi-Service Networks*

draft-ietf-ancp-protocol-02, *Protocol for Access Node Control Mechanism in Broadband Networks*

## ATM

AF-ILMI-0065.000, *Integrated Local Management Interface (ILMI) Version 4.0*

AF-PHY-0086.001, *Inverse Multiplexing for ATM (IMA) Specification Version 1.1*

AF-TM-0121.000, *Traffic Management Specification Version 4.1*

AF-TM-0150.00, *Addendum to Traffic Management v4.1 optional minimum desired cell rate indication for UBR*

GR-1113-CORE, *Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements, Issue 1*

GR-1248-CORE, *Generic Requirements for Operations of ATM Network Elements (NEs), Issue 3*

ITU-T I.432.1, *B-ISDN user-network interface - Physical layer specification: General characteristics (02/99)*

ITU-T I.610, *B-ISDN operation and maintenance principles and functions (11/95)*

RFC 1626, *Default IP MTU for use over ATM AAL5*

RFC 2684, *Multiprotocol Encapsulation over ATM Adaptation Layer 5*

## BGP

RFC 1772, *Application of the Border Gateway Protocol in the Internet*

RFC 1997, *BGP Communities Attribute*

RFC 2385, *Protection of BGP Sessions via the TCP MD5 Signature Option*

RFC 2439, *BGP Route Flap Damping*

RFC 2545, *Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing*

RFC 2858, *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 BGP-4*

RFC 4271, *A Border Gateway Protocol 4 (BGP-4)*

RFC 4360, *BGP Extended Communities Attribute*

RFC 4364, *BGP/MPLS IP Virtual Private Networks (VPNs)*

RFC 4456, *BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)*

RFC 4486, *Subcodes for BGP Cease Notification Message*

RFC 4659, *BGP/MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN*

## Standards and Protocol Support

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 (Helper Mode)*

RFC 4760, *Multiprotocol Extensions for BGP-4*

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, *Autonomous System Confederations for BGP*

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-04, *Advertisement of Multiple Paths in BGP*

draft-ietf-idr-best-external-03, *Advertisement of the best external route in BGP*

## Circuit Emulation

MEF-8, *Implementation Agreement for the Emulation of PDH Circuits over Metro Ethernet Networks, October 2004*

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)*

RFC 5287, *Control Protocol Extensions for the Setup of Time-Division Multiplexing (TDM) Pseudowires in MPLS Networks*

## Ethernet

IEEE 802.1AB, *Station and Media Access Control Connectivity Discovery*

IEEE 802.1ad, *Provider Bridges*

IEEE 802.1ag, *Connectivity Fault Management*

IEEE 802.1ah, *Provider Backbone Bridges*

IEEE 802.1ak, *Multiple Registration Protocol*

IEEE 802.1aq, *Shortest Path Bridging*

IEEE 802.1ax, *Link Aggregation*

IEEE 802.1D, *MAC Bridges*

IEEE 802.1p, *Traffic Class Expediting*

IEEE 802.1Q, *Virtual LANs*

IEEE 802.1s, *Multiple Spanning Trees*

IEEE 802.1w, *Rapid Reconfiguration of Spanning Tree*

IEEE 802.1X, *Port Based Network Access Control*

IEEE 802.3ab, *1000BASE-T*

IEEE 802.3ac, *VLAN Tag*

IEEE 802.3ad, *Link Aggregation*

IEEE 802.3ae, *10 Gb/s Ethernet*

IEEE 802.3ah, *Ethernet in the First Mile*

IEEE 802.3ba, *40 Gb/s and 100 Gb/s Ethernet*

IEEE 802.3i, *Ethernet*

IEEE 802.3u, *Fast Ethernet*

IEEE 802.3x, *Ethernet Flow Control*

IEEE 802.3z, *Gigabit Ethernet*

ITU-T G.8031, *Ethernet Linear Protection Switching*

ITU-T G.8032, *Ethernet Ring Protection Switching*

ITU-T Y.1731, *OAM functions and mechanisms for Ethernet based networks*

## EVPN

RFC7432, *BGP MPLS-Based Ethernet VPN*

draft-ietf-bess-evpn-overlay-01, *A Network Virtualization Overlay Solution using EVPN*

draft-ietf-bess-evpn-prefix-advertisement-01, *IP Prefix Advertisement in EVPN*

draft-ietf-bess-evpn-vpls-seamless-integ-00, *(PBB-)EVPN Seamless Integration with (PBB-)VPLS*  
 draft-ietf-l2vpn-pbb-evpn-10, *Provider Backbone Bridging Combined with Ethernet VPN (PBB-EVPN)*  
 draft-snr-bess-evpn-proxy-arp-nd-00, *Proxy-ARP/ND function in EVPN networks*

## Fast Reroute

RFC 5286, *Basic Specification for IP Fast Reroute: Loop-Free Alternates*  
 RFC 7490, *Remote Loop-Free Alternate (LFA) Fast Reroute (FRR)*  
 draft-ietf-rtgwg-lfa-manageability-08, *Operational management of Loop Free Alternates*  
 draft-katran-mofrr-02, *Multicast only Fast Re-Route*

## Frame Relay

ANSI T1.617 Annex D, *DSSI - Signalling Specification For Frame Relay Bearer Service*  
 FRF.1.2, *PVC User-to-Network Interface (UNI) Implementation Agreement*  
 FRF.12, *Frame Relay Fragmentation Implementation Agreement*  
 FRF.16.1, *Multilink Frame Relay UNI/NNI Implementation Agreement*  
 FRF.5, *Frame Relay/ATM PVC Network Interworking Implementation*  
 FRF2.2, *PVC Network-to-Network Interface (NNI) Implementation Agreement*  
 ITU-T Q.933 Annex A, *Additional procedures for Permanent Virtual Connection (PVC) status management*

## IP — General

RFC 768, *User Datagram Protocol*  
 RFC 793, *Transmission Control Protocol*  
 RFC 854, *TELNET Protocol Specifications*

RFC 951, *Bootstrap Protocol (BOOTP)*  
 RFC 1034, *Domain Names - Concepts and Facilities*  
 RFC 1035, *Domain Names - Implementation and Specification*  
 RFC 1350, *The TFTP Protocol (revision 2)*  
 RFC 1534, *Interoperation between DHCP and BOOTP*  
 RFC 1542, *Clarifications and Extensions for the Bootstrap Protocol*  
 RFC 2131, *Dynamic Host Configuration Protocol*  
 RFC 2347, *TFTP Option Extension*  
 RFC 2348, *TFTP Blocksize Option*  
 RFC 2349, *TFTP Timeout Interval and Transfer Size Options*  
 RFC 2428, *FTP Extensions for IPv6 and NATs*  
 RFC 2865, *Remote Authentication Dial In User Service (RADIUS)*  
 RFC 2866, *RADIUS Accounting*  
 RFC 2868, *RADIUS Attributes for Tunnel Protocol Support*  
 RFC 3046, *DHCP Relay Agent Information Option (Option 82)*  
 RFC 3315, *Dynamic Host Configuration Protocol for IPv6 (DHCPv6)*  
 RFC 3596, *DNS Extensions to Support IP version 6*  
 RFC 3768, *Virtual Router Redundancy Protocol (VRRP)*  
 RFC 4250, *The Secure Shell (SSH) Protocol Assigned Numbers*  
 RFC 4251, *The Secure Shell (SSH) Protocol Architecture*  
 RFC 4254, *The Secure Shell (SSH) Connection Protocol*  
 RFC 5880, *Bidirectional Forwarding Detection (BFD)*  
 RFC 5881, *Bidirectional Forwarding Detection (BFD) IPv4 and IPv6 (Single Hop)*  
 RFC 5883, *Bidirectional Forwarding Detection (BFD) for Multihop Paths*  
 RFC 7130, *Bidirectional Forwarding Detection (BFD) on Link Aggregation Group (LAG) Interfaces*  
 draft-grant-tacacs-02, *The TACACS+ Protocol*

draft-ietf-vrrp-unified-spec-02, *Virtual Router Redundancy Protocol Version 3 for IPv4 and IPv6*

### IP — Multicast

RFC 1112, *Host Extensions for IP Multicasting*

RFC 2236, *Internet Group Management Protocol, Version 2*

RFC 2375, *IPv6 Multicast Address Assignments*

RFC 2710, *Multicast Listener Discovery (MLD) for IPv6*

RFC 3306, *Unicast-Prefix-based IPv6 Multicast Addresses*

RFC 3376, *Internet Group Management Protocol, Version 3*

RFC 3446, *Anycast Rendezvous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP)*

RFC 3590, *Source Address Selection for the Multicast Listener Discovery (MLD) Protocol*

RFC 3618, *Multicast Source Discovery Protocol (MSDP)*

RFC 3810, *Multicast Listener Discovery Version 2 (MLDv2) for IPv6*

RFC 3956, *Embedding the Rendezvous Point (RP) Address in an IPv6 Multicast Address*

RFC 4601, *Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)*

RFC 4604, *Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (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)*

RFC 5059, *Bootstrap Router (BSR) Mechanism for Protocol Independent Multicast (PIM)*

RFC 5384, *The Protocol Independent Multicast (PIM) Join Attribute Format*

RFC 5496, *The Reverse Path Forwarding (RPF) Vector TLV*

RFC 6037, *Cisco Systems' Solution for Multicast in MPLS/BGP IP VPNs*

RFC 6513, *Multicast in MPLS/BGP IP VPNs*

RFC 6514, *BGP Encodings and Procedures for Multicast in MPLS/IP VPNs*

RFC 6515, *IPv4 and IPv6 Infrastructure Addresses in BGP Updates for Multicast VPNs*

RFC 6516, *IPv6 Multicast VPN (MVPN) Support Using PIM Control Plane and Selective Provider Multicast Service Interface (S-PMSI) Join Messages*

RFC 6625, *Wildcards in Multicast VPN Auto-Discover Routes*

RFC 6826, *Multipoint LDP In-Band Signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Path*

RFC 7246, *Multipoint Label Distribution Protocol In-Band Signaling in a Virtual Routing and Forwarding (VRF) Table Context*

RFC 7385, *IANA Registry for P-Multicast Service Interface (PMSI) Tunnel Type Code Points*

draft-dolganow-l3vpn-mvpn-expl-track-00, *Explicit tracking in MPLS/BGP IP VPNs*

### IP — Version 4

RFC 791, *Internet Protocol*

RFC 792, *Internet Control Message Protocol*

RFC 826, *An Ethernet Address Resolution Protocol*

RFC 1519, *Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy*

RFC 1812, *Requirements for IPv4 Routers*

RFC 2401, *Security Architecture for Internet Protocol*

RFC 3021, *Using 31-Bit Prefixes on IPv4 Point-to-Point Links*

## IP — Version 6

RFC 1981, *Path MTU Discovery for IP version 6*  
 RFC 2460, *Internet Protocol, Version 6 (IPv6) Specification*  
 RFC 2464, *Transmission of IPv6 Packets over Ethernet Networks*  
 RFC 2529, *Transmission of IPv6 over IPv4 Domains without Explicit Tunnels*  
 RFC 3587, *IPv6 Global Unicast Address Format*  
 RFC 3633, *IPv6 Prefix Options for Dynamic Host Configuration Protocol (DHCP) version 6*  
 RFC 3646, *DNS Configuration options for Dynamic Host Configuration Protocol for IPv6 (DHCPv6)*  
 RFC 3736, *Stateless Dynamic Host Configuration Protocol (DHCP) Service for IPv6*  
 RFC 3971, *SEcure Neighbor Discovery (SEND)*  
 RFC 3972, *Cryptographically Generated Addresses (CGA)*  
 RFC 4007, *IPv6 Scoped Address Architecture*  
 RFC 4193, *Unique Local IPv6 Unicast Addresses*  
 RFC 4291, *Internet Protocol Version 6 (IPv6) Addressing Architecture*  
 RFC 4443, *Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification*  
 RFC 4861, *Neighbor Discovery for IP version 6 (IPv6)*  
 RFC 4862, *IPv6 Stateless Address Autoconfiguration (Router Only)*  
 RFC 4941, *Privacy Extensions for Stateless Address Autoconfiguration in IPv6*  
 RFC 5007, *DHCPv6 Leasequery*  
 RFC 5095, *Deprecation of Type 0 Routing Headers in IPv6*  
 RFC 5952, *A Recommendation for IPv6 Address Text Representation*  
 RFC 6106, *IPv6 Router Advertisement Options for DNS Configuration*  
 RFC 6164, *Using 127-Bit IPv6 Prefixes on Inter-Router Links*

## 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, *A Traffic-Based Method of Detecting Dead Internet Key Exchange (IKE) Peers*  
 RFC 3947, *Negotiation of NAT-Traversal in the IKE*  
 RFC 3948, *UDP Encapsulation of IPsec ESP Packets*  
 RFC 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-mode-cfg-05, *The ISAKMP Configuration Method*  
 draft-ietf-ipsec-isakmp-xauth-06, *Extended Authentication within ISAKMP/Oakley (XAUTH)*

## IS-IS

ISO/IEC 10589:2002, Second Edition, Nov. 2002, *Intermediate system to Intermediate system intra-domain routeing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode Network Service (ISO 8473)*  
 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*

## Standards and Protocol Support

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 5130, *A Policy Control Mechanism in IS-IS Using Administrative Tags*

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 (Helper Mode)*

RFC 5307, *IS-IS Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)*

RFC 5308, *Routing IPv6 with IS-IS*

RFC 5309, *Point-to-Point Operation over LAN in Link State Routing Protocols*

RFC 5310, *IS-IS Generic Cryptographic Authentication*

RFC 6213, *IS-IS BFD-Enabled TLV*

RFC 6232, *Purge Originator Identification TLV for IS-IS*

RFC 6233, *IS-IS Registry Extension for Purges*

RFC 6329, *IS-IS Extensions Supporting IEEE 802.1aq Shortest Path Bridging*

draft-ietf-isis-mi-02, *IS-IS Multi-Instance*

draft-ietf-isis-segment-routing-extensions-04, *IS-IS Extensions for Segment Routing*

draft-kaplan-isis-ext-eth-02, *Extended Ethernet Frame Size Support*

## Management

ianaaddressfamilynumbers-mib, *IANA-ADDRESS-FAMILY-NUMBERS-MIB*

ianagmplstc-mib, *IANA-GMPLS-TC-MIB*

ianaiftype-mib, *IANAifType-MIB*

ianaiprouteprotocol-mib, *IANA-RTPROTO-MIB*

IEEE8021-CFM-MIB, *IEEE P802.1ag(TM) CFM MIB*

IEEE8021-PAE-MIB, *IEEE 802.1X MIB*

IEEE8023-LAG-MIB, *IEEE 802.3ad MIB*

LLDP-MIB, *IEEE P802.1AB(TM) LLDP MIB*

SFLOW-MIB, *sFlow MIB Version 1.3 (Draft 5)*

RFC 1157, *A Simple Network Management Protocol (SNMP)*

RFC 1215, *A Convention for Defining Traps for use with the SNMP*

RFC 1724, *RIP Version 2 MIB Extension*

RFC 2021, *Remote Network Monitoring Management Information Base Version 2 using SMIPv2*

RFC 2115, *Management Information Base for Frame Relay DTEs Using SMIPv2*

RFC 2138, *Remote Authentication Dial In User Service (RADIUS)*

RFC 2206, *RSVP Management Information Base using SMIPv2*

RFC 2213, *Integrated Services Management Information Base using SMIPv2*

RFC 2494, *Definitions of Managed Objects for the DS0 and DS0 Bundle Interface Type*

RFC 2514, *Definitions of Textual Conventions and OBJECT-IDENTITIES for ATM Management*

RFC 2515, *Definitions of Managed Objects for ATM Management*

RFC 2571, *An Architecture for Describing SNMP Management Frameworks*

RFC 2572, *Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)*

RFC 2573, *SNMP Applications*



- RFC 2574, *User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)*
- RFC 2575, *View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)*
- RFC 2578, *Structure of Management Information Version 2 (SMIv2)*
- RFC 2579, *Textual Conventions for SMIv2*
- RFC 2787, *Definitions of Managed Objects for the Virtual Router Redundancy Protocol*
- RFC 2819, *Remote Network Monitoring Management Information Base*
- RFC 2856, *Textual Conventions for Additional High Capacity Data Types*
- RFC 2863, *The Interfaces Group MIB*
- RFC 2864, *The Inverted Stack Table Extension to the Interfaces Group MIB*
- RFC 2933, *Internet Group Management Protocol MIB*
- RFC 3014, *Notification Log MIB*
- RFC 3164, *The BSD syslog Protocol*
- RFC 3165, *Definitions of Managed Objects for the Delegation of Management Scripts*
- RFC 3231, *Definitions of Managed Objects for Scheduling Management Operations*
- RFC 3273, *Remote Network Monitoring Management Information Base for High Capacity Networks*
- RFC 3419, *Textual Conventions for Transport Addresses*
- RFC 3498, *Definitions of Managed Objects for Synchronous Optical Network (SONET) Linear Automatic Protection Switching (APS) Architectures*
- RFC 3584, *Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework*
- RFC 3592, *Definitions of Managed Objects for the Synchronous Optical Network/Synchronous Digital Hierarchy (SONET/SDH) Interface Type*
- RFC 3593, *Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals*
- RFC 3635, *Definitions of Managed Objects for the Ethernet-like Interface Types*
- RFC 3637, *Definitions of Managed Objects for the Ethernet WAN Interface Sublayer*
- RFC 3826, *The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model*
- RFC 3877, *Alarm Management Information Base (MIB)*
- RFC 3895, *Definitions of Managed Objects for the DS1, E1, DS2, and E2 Interface Types*
- RFC 3896, *Definitions of Managed Objects for the DS3/E3 Interface Type*
- RFC 4001, *Textual Conventions for Internet Network Addresses*
- RFC 4022, *Management Information Base for the Transmission Control Protocol (TCP)*
- RFC 4113, *Management Information Base for the User Datagram Protocol (UDP)*
- RFC 4220, *Traffic Engineering Link Management Information Base*
- RFC 4292, *IP Forwarding Table MIB*
- RFC 4293, *Management Information Base for the Internet Protocol (IP)*
- RFC 4631, *Link Management Protocol (LMP) Management Information Base (MIB)*
- RFC 4878, *Definitions and Managed Objects for Operations, Administration, and Maintenance (OAM) Functions on Ethernet-Like Interfaces*
- RFC 5101, *Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information*
- RFC 6241, *Network Configuration Protocol (NETCONF)*
- RFC 6242, *Using the NETCONF Protocol over Secure Shell (SSH)*

## Standards and Protocol Support

draft-ietf-snmpv3-update-mib-05, *Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)*

draft-ietf-idr-bgp4-mib-05, *Definitions of Managed Objects for the Fourth Version of Border Gateway Protocol (BGP-4)*

draft-ietf-isis-wg-mib-06, *Management Information Base for Intermediate System to Intermediate System (IS-IS)*

draft-ietf-mboned-msdp-mib-01, *Multicast Source Discovery protocol MIB*

draft-ietf-mppls-ldp-mib-07, *Definitions of Managed Objects for the Multiprotocol Label Switching, Label Distribution Protocol (LDP)*

draft-ietf-mppls-lsr-mib-06, *Multiprotocol Label Switching (MPLS) Label Switching Router (LSR) Management Information Base Using SMIV2*

draft-ietf-mppls-te-mib-04, *Multiprotocol Label Switching (MPLS) Traffic Engineering Management Information Base*

draft-ietf-ospf-mib-update-08, *OSPF Version 2 Management Information Base*

### MPLS — General

RFC 3031, *Multiprotocol Label Switching Architecture*

RFC 3032, *MPLS Label Stack Encoding*

RFC 3443, *Time To Live (TTL) Processing in Multiprotocol Label Switching (MPLS) Networks*

RFC 4023, *Encapsulating MPLS in IP or Generic Routing Encapsulation (GRE)*

RFC 4182, *Removing a Restriction on the use of MPLS Explicit NULL*

RFC 5332, *MPLS Multicast Encapsulations*

### MPLS — GMPLS

RFC 3471, *Generalized Multi-Protocol Label Switching (GMPLS) Signaling Functional Description*

RFC 3473, *Generalized Multi-Protocol Label Switching (GMPLS) Signaling Resource ReserVation Protocol-Traffic Engineering (RSVP-TE) Extensions*

RFC 4204, *Link Management Protocol (LMP)*

RFC 4208, *Generalized Multiprotocol Label Switching (GMPLS) User-Network Interface (UNI): Resource ReserVation Protocol-Traffic Engineering (RSVP-TE) Support for the Overlay Model*

RFC 4872, *RSVP-TE Extensions in Support of End-to-End Generalized Multi-Protocol Label Switching (GMPLS) Recovery*

draft-ietf-ccamp-rsvp-te-srlg-collect-04, *RSVP-TE Extensions for Collecting SRLG Information*

### MPLS — LDP

RFC 3037, *LDP Applicability*

RFC 3478, *Graceful Restart Mechanism for Label Distribution Protocol (Helper Mode)*

RFC 5036, *LDP Specification*

RFC 5283, *LDP Extension for Inter-Area Label Switched Paths (LSPs)*

RFC 5443, *LDP IGP Synchronization*

RFC 5561, *LDP Capabilities*

RFC 6388, *Label Distribution Protocol Extensions for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths*

RFC 6826, *Multipoint LDP in-band signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths*

draft-ietf-mppls-ldp-ip-pw-capability-09, *Controlling State Advertisements Of Non-negotiated LDP Applications*

draft-ietf-mppls-ldp-ipv6-15, *Updates to LDP for IPv6*

draft-pdutta-mppls-ldp-adj-capability-00, *LDP Adjacency Capabilities*

draft-pdutta-mppls-ldp-v2-00, *LDP Version 2*

draft-pdutta-mppls-multi-ldp-instance-00, *Multiple LDP Instances*

draft-pdutta-mpls-tldp-hello-reduce-04, *Targeted LDP Hello Reduction*

## **MPLS — MPLS-TP**

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 Transport Profile (MPLS-TP) Identifiers*  
 RFC 6378, *MPLS Transport Profile (MPLS-TP) Linear Protection*  
 RFC 6426, *MPLS On-Demand Connectivity and Route Tracing*  
 RFC 6428, *Proactive Connectivity Verification, Continuity Check and Remote Defect indication for MPLS Transport Profile*  
 RFC 6478, *Pseudowire Status for Static Pseudowires*  
 RFC 7213, *MPLS Transport Profile (MPLS-TP) Next-Hop Ethernet Addressing*

## **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 — RSVP-TE**

RFC 2702, *Requirements for Traffic Engineering over MPLS*  
 RFC 2747, *RSVP Cryptographic Authentication*  
 RFC 2961, *RSVP Refresh Overhead Reduction Extensions*  
 RFC 3097, *RSVP Cryptographic Authentication -- Updated Message Type Value*

RFC 3209, *RSVP-TE: Extensions to RSVP for LSP Tunnels*  
 RFC 3473, *Generalized Multi-Protocol Label Switching (GMPLS) Signaling Resource Reservation Protocol-Traffic Engineering (RSVP-TE) Extensions (IF\_ID RSVP\_HOP Object With Unnumbered Interfaces and RSVP-TE Graceful Restart Helper Procedures)*  
 RFC 3477, *Signalling Unnumbered Links in Resource Reservation Protocol - Traffic Engineering (RSVP-TE)*  
 RFC 3564, *Requirements for Support of Differentiated Services-aware MPLS Traffic Engineering*  
 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 Record Route Object (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 4950, *ICMP Extensions for Multiprotocol Label Switching*  
 RFC 5151, *Inter-Domain MPLS and GMPLS Traffic Engineering -- Resource Reservation Protocol-Traffic Engineering (RSVP-TE) Extensions*  
 RFC 5712, *MPLS Traffic Engineering Soft Preemption*  
 RFC 5817, *Graceful Shutdown in MPLS and Generalized MPLS Traffic Engineering Networks*

## Standards and Protocol Support

draft-newton-mpls-te-dynamic-overbooking-00, *A Diffserv-TE Implementation Model to dynamically change booking factors during failure events*

### NAT

RFC 5382, *NAT Behavioral Requirements for TCP*  
RFC 5508, *NAT Behavioral Requirements for ICMP*  
RFC 6146, *Stateful NAT64: Network Address and Protocol Translation from IPv6 Clients to IPv4 Servers*  
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)*

### OpenFlow

ONF *OpenFlow Switch Specification Version 1.3.1* (OpenFlow-hybrid switches)

### OSPF

RFC 1586, *Guidelines for Running OSPF Over Frame Relay Networks*  
RFC 1765, *OSPF Database Overflow*  
RFC 2328, *OSPF Version 2*  
RFC 3101, *The OSPF Not-So-Stubby Area (NSSA) Option*  
RFC 3509, *Alternative Implementations of OSPF Area Border Routers*  
RFC 3623, *Graceful OSPF Restart Graceful OSPF Restart (Helper Mode)*  
RFC 3630, *Traffic Engineering (TE) Extensions to OSPF Version 2*  
RFC 4203, *OSPF Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)*  
RFC 4222, *Prioritized Treatment of Specific OSPF Version 2 Packets and Congestion Avoidance*

RFC 4552, *Authentication/Confidentiality for OSPFv3*  
RFC 4576, *Using a Link State Advertisement (LSA) Options Bit to Prevent Looping in BGP/MPLS IP Virtual Private Networks (VPNs)*  
RFC 4577, *OSPF as the Provider/Customer Edge Protocol for BGP/MPLS IP Virtual Private Networks (VPNs)*  
RFC 4970, *Extensions to OSPF for Advertising Optional Router Capabilities*  
RFC 5185, *OSPF Multi-Area Adjacency*  
RFC 5187, *OSPFv3 Graceful Restart (Helper Mode)*  
RFC 5243, *OSPF Database Exchange Summary List Optimization*  
RFC 5250, *The OSPF Opaque LSA Option*  
RFC 5309, *Point-to-Point Operation over LAN in Link State Routing Protocols*  
RFC 5340, *OSPF for IPv6*  
RFC 5709, *OSPFv2 HMAC-SHA Cryptographic Authentication*  
RFC 5838, *Support of Address Families in OSPFv3*  
RFC 6987, *OSPF Stub Router Advertisement*  
draft-ietf-ospf-prefix-link-attr-06, *OSPFv2 Prefix/Link Attribute Advertisement*  
draft-ietf-ospf-segment-routing-extensions-04, *OSPF Extensions for Segment Routing*

### Policy Management and Credit Control

3GPP TS 29.212, *Policy and Charging Control (PCC) over Gx/Sd Reference Point (Release 11 and Release 12) Gx support as it applies to wireline environment (BNG)*  
RFC 3588, *Diameter Base Protocol*  
RFC 4006, *Diameter Credit-Control Application*

### PPP

RFC 1332, *The PPP Internet Protocol Control Protocol (IPCP)*

RFC 1377, *The PPP OSI Network Layer Control Protocol (OSINLCP)*  
 RFC 1661, *The Point-to-Point Protocol (PPP)*  
 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 2153, *PPP Vendor Extensions*  
 RFC 2516, *A Method for Transmitting PPP Over Ethernet (PPPoE)*  
 RFC 2615, *PPP over SONET/SDH*  
 RFC 2661, *Layer Two Tunneling Protocol "L2TP"*  
 RFC 2686, *The Multi-Class Extension to Multi-Link PPP*  
 RFC 2878, *PPP Bridging Control Protocol (BCP)*  
 RFC 4951, *Fail Over Extensions for Layer 2 Tunneling Protocol (L2TP) "failover"*  
 RFC 5072, *IP Version 6 over PPP*

## Pseudowire

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*  
 RFC 3916, *Requirements for Pseudo- Wire Emulation Edge-to-Edge (PWE3)*  
 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 4446, *IANA Allocations for Pseudowire Edge to Edge Emulation (PWE3)*  
 RFC 4447, *Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP)*  
 RFC 4448, *Encapsulation Methods for Transport of Ethernet over MPLS Networks*  
 RFC 4619, *Encapsulation Methods for Transport of Frame Relay over Multiprotocol Label Switching (MPLS) Networks*  
 RFC 4717, *Encapsulation Methods for Transport Asynchronous Transfer Mode (ATM) over MPLS Networks*  
 RFC 4816, *Pseudowire Emulation Edge-to-Edge (PWE3) Asynchronous Transfer Mode (ATM) Transparent Cell Transport Service*  
 RFC 5085, *Pseudowire Virtual Circuit Connectivity Verification (VCCV): A Control Channel for Pseudowires*  
 RFC 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 6073, *Segmented Pseudowire*  
 RFC 6310, *Pseudowire (PW) Operations, Administration, and Maintenance (OAM) Message Mapping*  
 RFC 6391, *Flow-Aware Transport of Pseudowires over an MPLS Packet Switched Network*  
 RFC 6575, *Address Resolution Protocol (ARP) Mediation for IP Interworking of Layer 2 VPNs*  
 RFC 6718, *Pseudowire Redundancy*  
 RFC 6829, *Label Switched Path (LSP) Ping for Pseudowire Forwarding Equivalence Classes (FECs) Advertised over IPv6*  
 RFC 6870, *Pseudowire Preferential Forwarding Status bit*  
 RFC 7023, *MPLS and Ethernet Operations, Administration, and Maintenance (OAM) Interworking*

## Standards and Protocol Support

RFC 7267, *Dynamic Placement of Multi-Segment Pseudowires*  
draft-ietf-l2vpn-vpws-iw-oam-04, *OAM Procedures for VPWS Interworking*

### Quality of Service

RFC 2430, *A Provider Architecture for Differentiated Services and Traffic Engineering (PASTE)*  
RFC 2474, *Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers*  
RFC 3260, *New Terminology and Clarifications for Diffserv*  
RFC 2598, *An Expedited Forwarding PHB*  
RFC 3140, *Per Hop Behavior Identification Codes*

### RIP

RFC 1058, *Routing Information Protocol*  
RFC 2080, *RIPng for IPv6*  
RFC 2082, *RIP-2 MD5 Authentication*  
RFC 2453, *RIP Version 2*

### SONET/SDH

ITU-G.841, *Types and Characteristics of SDH Networks Protection Architecture*, issued in October 1998 and as augmented by *Corrigendum 1*, issued in July 2002

### Timing

GR-1244-CORE, *Clocks for the Synchronized Network: Common Generic Criteria, Issue 3*, May 2005  
GR-253-CORE, *SONET Transport Systems: Common Generic Criteria. Issue 3*, September 2000  
ITU-T G.781, *Synchronization layer functions*, issued 09/2008  
ITU-T G.813, *Timing characteristics of SDH equipment slave clocks (SEC)*, issued 03/2003

ITU-T G.8261, *Timing and synchronization aspects in packet networks*, issued 04/2008

ITU-T G.8262, *Timing characteristics of synchronous Ethernet equipment slave clock (EEC)*, issued 08/2007

ITU-T G.8264, *Distribution of timing information through packet networks*, issued 10/2008

ITU-T G.8265.1, *Precision time protocol telecom profile for frequency synchronization*, issued 10/2010

ITU-T G.8275.1, *Precision time protocol telecom profile for phase/time synchronization with full timing support from the network*, issued 07/2014

RFC 5905, *Network Time Protocol Version 4: Protocol and Algorithms Specification*

### Voice and Video Performance

ETSI TS 101 329-5 Annex E, *QoS Measurement for VoIP - Method for determining an Equipment Impairment Factor using Passive Monitoring*

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*

ITU-T G.107, *The E Model - A computational model for use in planning*

ITU-T P.564, *Conformance testing for voice over IP transmission quality assessment models*

RFC 3550 Appendix A.8, *RTP: A Transport Protocol for Real-Time Applications* (Estimating the Interarrival Jitter)

### VPLS

RFC 4761, *Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling*

RFC 4762, *Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling*

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)*

RFC 7041, *Extensions to the Virtual Private LAN Service (VPLS) Provider Edge (PE) Model for Provider Backbone Bridging*

RFC 7117, *Multicast in Virtual Private LAN Service (VPLS)*





# Customer Documentation and Product Support



## Customer Documentation

<http://documentation.alcatel-lucent.com>



## Technical Support

<http://support.alcatel-lucent.com>



## Documentation Feedback

[documentation.feedback@alcatel-lucent.com](mailto:documentation.feedback@alcatel-lucent.com)

