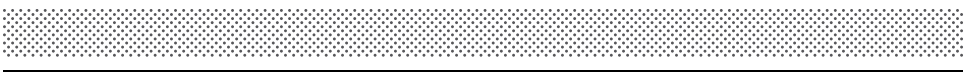
JUNIPER NETWORKS

Junos® OS

Multitopology Routing Feature Guide for Routing Devices

Release
13.2



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Juniper Networks, Inc.
1194 North Mathilda Avenue
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

Junos® OS Multitopology Routing Feature Guide for Routing Devices
13.2

The information in this document is current as of the date on the title page.

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About the Documentation

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If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

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Supported Platforms

For the features described in this document, the following platforms are supported:

- T Series
- MX Series
- M Series

Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   system {
     scripts {
       commit {
         file ex-script.xsl;
       }
     }
   }
   interfaces {
     fxp0 {
       disable;
       unit 0 {
         family inet {
           address 10.0.0.1/24;
         }
       }
     }
   }
   ```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

   ```
   [edit]
   user@host# load merge /var/tmp/ex-script.conf
   load complete
   ```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   commit {
     file ex-script-snippet.xsl; }
   ```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see the *CLI User Guide*.

Documentation Conventions

Table 1 on page xi defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.

Table 2 on page xi defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the**configure** command: user@host> **configure**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`

Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
Italic text like this	• Introduces or emphasizes important new terms. • Identifies book names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS System Basics Configuration Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Enclose optional keywords or variables.	**stub <default-metric** ***metric*****>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Enclose a variable for which you can substitute one or more values.	**community name members [** ***community-ids*** **]**

Indention and braces ({ })	Identify a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  retain;
		  }
		  }
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can send your comments to techpubs-comments@juniper.net, or fill out the documentation feedback form at https://www.juniper.net/cgi-bin/docbugreport/ . If you are using e-mail, be sure to include the following information with your comments:

- Document or topic name
- URL or page number
- Software release version (if applicable)

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- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
- Product warranties—For product warranty information, visit http://www.juniper.net/support/warranty/.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

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- Find product documentation: http://www.juniper.net/techpubs/
- Find solutions and answer questions using our Knowledge Base: http://kb.juniper.net/
- Download the latest versions of software and review release notes: http://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: https://www.juniper.net/alerts/

- Join and participate in the Juniper Networks Community Forum: http://www.juniper.net/company/communities/
- Open a case online in the CSC Case Management tool: http://www.juniper.net/cm/

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: https://tools.juniper.net/SerialNumberEntitlementSearch/

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at http://www.juniper.net/cm/.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see http://www.juniper.net/support/requesting-support.html.

PART 1

Overview

CHAPTER 1

Introduction to Multitopology Routing

Multitopology Routing Overview

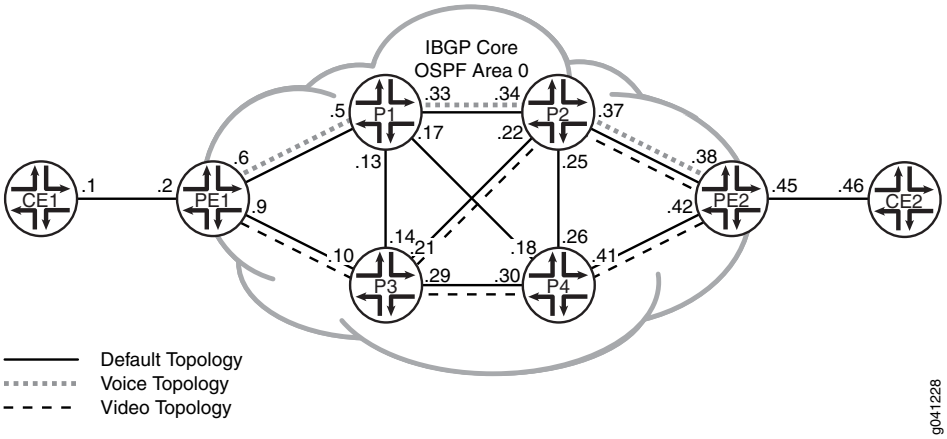
Service providers and enterprises can use multitopology routing (MTR) to engineer traffic flow across a network. MTR can be used with direct and static routes, OSPF, and BGP. MTR can be configured for unicast and multicast IP, using the Junos® operating system (Junos OS). With basic unicast IP, an IBGP core runs on top of OSPF to direct traffic based on application types, such as voice or video. For multicast, Protocol Independent Multicast (PIM) is used, in conjunction with multitopology OSPF and BGP, to direct multicast traffic over particular paths based on traffic characteristics.

In a network carrying multiple traffic types, you often need to direct different types of application traffic over multiple links depending on their link characteristics. For example, voice traffic requires links that are less likely to incur latency, jitter, or packet loss. File traffic, on the other hand, requires links that have large amounts of available bandwidth. MTR is a way to direct traffic to follow specified paths. You can use MTR to extend a traditional MPLS network into a segment where only IP forwarding is supported. With MTR, each traffic type is handled in its own conceptually incongruent topology, and yet runs on top of the same underlying network. You can configure separate topologies to share the same network links as needed. MTR uses a combination of control plane (routing) and forwarding plane (firewall filters). Each topology uses the unified control plane to make routing decisions for traffic associated with that topology. In addition, each topology has a separate forwarding table and, in effect, a dedicated forwarding plane for each topology. This forwarding plane not only directs traffic using its own forwarding table, but also simultaneously handles sophisticated functionality, such as queuing for class of service (CoS), that can be applied to a topology. As traffic enters the router, fields within a packet determine to which topology the traffic belongs.

Multitopology routing enables you to configure class-based forwarding for different types of traffic, such as voice, video, and data. Each type of traffic is defined by a topology that is used to create a new routing table for that topology. MTR provides the ability to generate forwarding tables based on the resolved entries in the routing tables for the custom topologies you create. In this way, packets of different classes can be routed independently from one another.

One way to manage traffic flow is to group links into specific routing topologies based on application requirements. Each routing topology can be thought of as of a set of contiguous links. MTR provides a way for you to manage each set of links uniquely by directing traffic types to flow over specified links. This solution uses a combination of routing (control plane) and firewall filtering (forwarding plane) configurations. Figure 1 on page 5 shows a network with two topologies configured: voice (dotted lines) and video (dashed lines). Note there is also a default routing topology (solid line).

Figure 1: Voice and Video Routing Topologies Enabled on a Subset of Links



You can configure MTR for BGP, OSPF, and static routes. When a routing topology is created, it has its own forwarding table.

Packet forwarding uses firewall filters to examine packets as they enter the router over an interface. These filters determine whether a specific topology or the default forwarding table should be used to make packet forwarding decisions. If applicable, firewall filters evaluate packet attributes, such as destination IP address, Differentiated Services code points (DSCPs), or next-level protocol headers, to determine which topology to use. In fact, any item in a packet that is recognized by a firewall filter can be used to direct the packet next-hop lookup to use a particular topology. Once the packet is directed to use a topology, the destination IP address must be in the topology forwarding table. Otherwise, the packet is dropped.

The following topics provide background information about multitopology routing:

- Routing Table Naming Conventions for Multitopology Routing on page 6
- Filter-Based Forwarding Support on page 7

Routing Table Naming Conventions for Multitopology Routing

Routing topologies have their own routing tables, similar to any other routing table created by default or by a **rib-group** configuration with a few differences. The routing table name indicates that the routing table is associated with a topology by prepending a colon (**:**) to the name. For example, a routing topology named voice has a routing table named **:voice.inet.0**. When routing topologies are configured under **routing-options**, a new routing table for each topology is created.

Each routing protocol creates a routing table based on the topology name, the instance name, and the purpose of the table. A routing table for each topology uses the following format:

logical-system-name/routing-instance-name*:*topology-name*.*protocol*.*identifier

The routing instance string is included only if the instance is not the master. The logical system string is included only if the logical system identifier has a value other than 0 (zero). Each routing table for a topology includes a colon (:) before the topology name that also separates the routing-instance name from the topology name. ***protocol*** is the

protocol family, which can be **inet** or **inet6**. ***identifier*** is a positive integer that specifies the instance of the routing table. Table 3 on page 7 shows specific examples of routing tables for various topologies.

Table 3: Examples of Routing Tables for Custom Topologies

Name of Routing Table	Description
:voice.inet.0	Master instance, voice topology, unicast IPv4 routes
:voice.inet6.0	Master instance, voice topology, unicast IPv6 routes
:voice.inet.3	Master instance, voice topology, ingress label-switched paths (LSPs)
private_1/:voice.inet.0	Logical system private, voice topology, unicast IPv4 routes
customer-A:voice.inet.0	Virtual-router customer-A, voice topology, unicast IPv4 routes
customer-B:voice.inet.3	Virtual-router customer-B, voice topology, ingress LSPs
customer-A:voice.mpls.0	Virtual-router customer-A, voice topology, unicast carrier-of-carriers IPv4 routes

To run multitopology routing (MTR), you must configure IP routing. MTR supports OSPF version 2 (OSPFv2), static routes, and BGP. You must configure an interior gateway protocol (IGP), such as OSPFv2 or static routing. Configure BGP to add routes learned through BGP to the appropriate custom topologies.

MTR is also supported on logical systems and the virtual router routing instance. No other routing instance type is supported on MTR.

Filter-Based Forwarding Support

By default, the ingress interface forwards traffic to the default topology for each configured routing instance. MTR supports filter-based forwarding, which enables you to match traffic on the ingress interface with a specific type of forwarding class and then forward that traffic to the specified topology. You can further define how traffic is handled for each forwarding class by configuring additional firewall filters that match traffic for such values as the IP precedence field or the Differentiated Services code point (DSCP).

Related Documentation

- Example: Configuring Multitopology Routing Based on Applications on page 13
- Example: Configuring Multitopology Routing Based on a Multicast Source on page 39

CHAPTER 2

Multitopology Routing Standards

Multitopology Routing Standards

Multitopology routing is defined in the following document:

- RFC 4915, *Multi-Topology (MT) Routing in OSPF*

PART 2

Configuration

CHAPTER 3

Multitopology Routing

Example: Configuring Multitopology Routing Based on Applications

Understanding Multitopology Routing Based on Applications

Multitopology routing (MTR) enables you to configure class-based forwarding for different types of traffic, such as voice, video, and data. Each type of traffic is defined by a topology that is used to create a new routing table for that topology. MTR provides the ability to generate forwarding tables based on the resolved entries in the routing tables for the custom topologies you create. In this way, packets of different classes can be routed independently from one another.

To run MTR, you must configure IP routing. MTR supports OSPFv2, static routes, and BGP. You must configure an interior gateway protocol (IGP), such as OSPFv2 or static routing, Configure BGP to add routes learned through BGP to the appropriate custom topologies. MTR also supports filter-based forwarding, which enables you to match traffic on the ingress interface with a specific type of forwarding class and then forward that traffic to the specified topology.

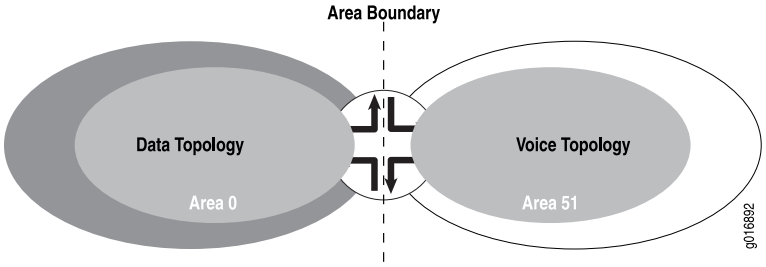
OSPF in MTR

OSPF in MTR uses a single instance of OSPF to carry connectivity and IP reachability information for different topologies. That information is used to calculate shortest-path-first (SPF) trees and routing tables. OSPF for MTR supports protocol extensions that include metrics that correspond to different topologies for link and prefix reachabilty information. The type-of-service (TOS) metric field is used to advertise the topology-specific metric for links and prefixes belonging to that topology. The TOS field is redefined as MT-ID in the payload of router, summary, and Type 5 and Type 7 AS-external link-state advertisements (LSAs).

Under MTR, each OSPF interface continues to belong to a single area. Therefore, by default, all topologies share the same area boundaries. As a result, attributes of an area, such as stubbiness, are independent of the topology. By default, all topologies configured

for OSPF are enabled on all interfaces. However, you can disable one or more configured topologies on an interface. You can thus allocate an interface for a specific topology. In Figure 2 on page 14, Area 51 includes an interface that is uniquely allocated to voice traffic, and Area 0 includes an interface that is uniquely allocated to data traffic. Each topology thus corresponds to a different OSPF area that shares a boundary.

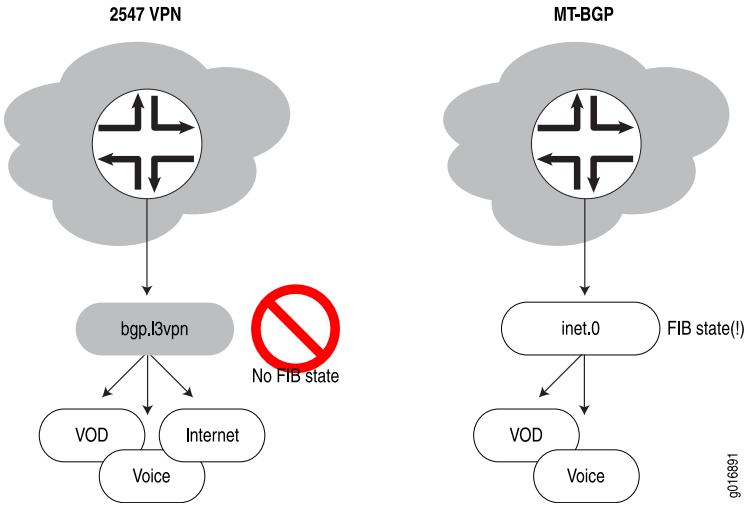
Figure 2: MTR-OSPF Area Boundary



BGP in MTR

BGP in MTR provides the ability to resolve BGP routes against configured topologies. An inbound policy is used to select routes for inclusion in the appropriate routing tables for the topologies. The default behavior for virtual private networks (VPNs) that use MPLS for forwarding packets over the backbone and that use BGP for distributing routes over the backbone is to place BGP route updates in the **bgp.l3vpn** routing table. Figure 3 on page 14 shows a BGP peer operating in an environment that conforms with the requirements in RFC 2547, *BGP/MPLS VPNs*. The figure shows how a BGP peer configured for MTR performs secondary route resolution.

Figure 3: BGP Route Resolution

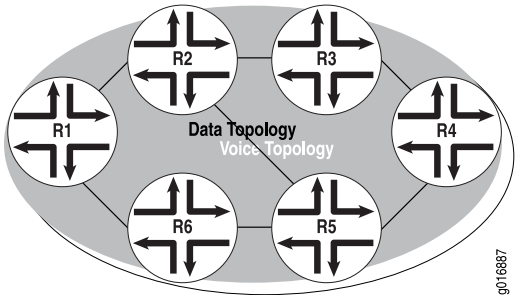


The BGP peer in a standard VPN topology places prefixes for routes it learns in the **bgp.l3vpn** routing table, which does not result in automatic updates to the forwarding table. Under BGP in MTR, when BGP receives a route from a peer, it attempts to resolve that route against a route in the **inet.0** routing table. If the route is resolved, it is placed in that table, which generates a forwarding state. If you have configured a community

target identifier that matches the import policy for the topology, routing and forwarding states are added to the tables for the topology.

Because MTR provides support for BGP to perform secondary route resolution, as Figure 4 on page 15 shows, MTR is able to create two distinct network paths for each type of traffic. Each router advertises BGP routes that need to be resolved against the IGP routes for each topology. Based on the IGP metrics configured for each topology, for all routes that originate from Router 4 (R4), the upper path between R1 and R4, which traverses R2 and R3, is selected for voice traffic, whereas the lower path between R1 and R4, which traverses R5 and R6, is selected for data traffic.

Figure 4: Route Resolution for MTR



Example: Configuring Multitopology Routing Based on Applications

This example shows how to use multitopology routing (MTR) to choose a topology path based on an application, either voice or video.

Requirements

This example requires that Junos OS Release 9.0 or later is running on the provider core devices.

Overview

In this example, the network is running OSPF and internal BGP (IBGP) in the core, but not MPLS. Even without traffic engineering, voice traffic uses one set of links, and video traffic uses a different set of links. This traffic might or might not be destined for the same IP address. In some cases, both applications traverse the same link. The solution uses MTR-based OSPF and BGP, along with firewall filters to direct different traffic types over designated links. The routers use a fairly similar set of configurations, which reduces complexity and improves network management.

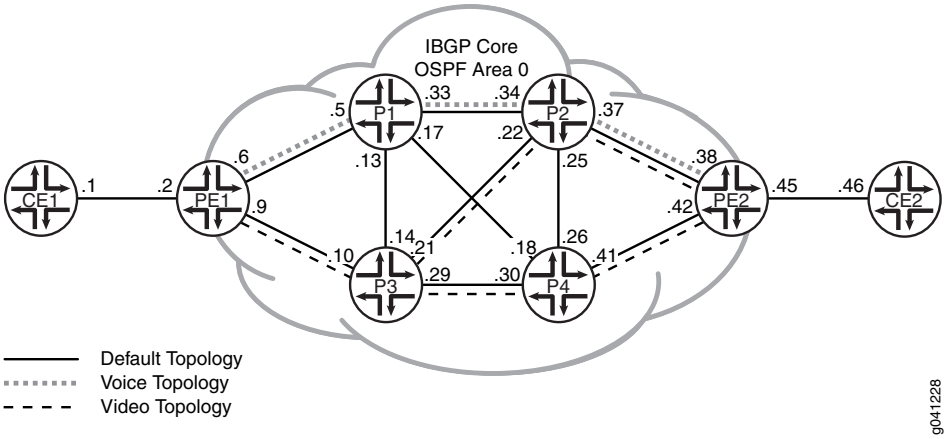
The OSPF topologies are defined to support each service offering over the OSPF area. The links of a topology must be contiguous, consistent with a typical OSPF area. IBGP routes in each routing topology automatically use the associated OSPF topology routing table for protocol next-hop route resolution. No special route resolution configurations

are required. In this solution, multiple topologies can be configured over the same link. However, traffic in each application service class cannot traverse links unless they are configured for the topology designated for that service. Figure 5 on page 16 shows a diagram of this case. Contiguous paths for routing the voice topology are shown with dotted lines, and paths for routing the video topology are shown with dashed lines.

For a complete set of configurations for all of the devices in the topology, see "CLI Quick Configuration" on page 16. The remainder of the example focuses on Device CE1 and Device PE1.

Figure 5 on page 16 shows the sample topology.

Figure 5: Multitopology OSPF and IBGP for Designating Links Belonging to Voice and Video Services



Configuration

- Configuring Device CE1 on page 23
- Configuring Device PE1 on page 26

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Device CE1

```
set interfaces fe-0/1/0 fastether-options loopback
set interfaces fe-0/1/0 unit 0 family inet address 11.19.130.1/24
set interfaces fe-0/1/0 unit 0 family inet address 11.19.131.1/24
set interfaces fe-0/1/0 unit 0 family inet address 11.19.132.1/24
set interfaces fe-1/2/0 unit 1 description to-PE1
set interfaces fe-1/2/0 unit 1 family inet address 10.0.0.1/30
set interfaces lo0 unit 97 family inet address 10.255.165.97/32 primary
set protocols bgp group ebgp type external
set protocols bgp group ebgp local-address 10.0.0.1
set protocols bgp group ebgp export set_community
set protocols bgp group ebgp export inject_directs
set protocols bgp group ebgp peer-as 100
set protocols bgp group ebgp neighbor 10.0.0.2
set policy-options policy-statement inject_directs term a from protocol direct
```

```
set policy-options policy-statement inject_directs term a from interface fe-0/1/0.0
set policy-options policy-statement inject_directs term a then next policy
set policy-options policy-statement inject_directs term a then accept
set policy-options policy-statement inject_directs term b then reject
set policy-options policy-statement set_community term a from route-filter 11.19.130.0/24
  exact
set policy-options policy-statement set_community term a from route-filter 11.19.131.0/24
  exact
set policy-options policy-statement set_community term a then community add voice
set policy-options policy-statement set_community term a then accept
set policy-options policy-statement set_community term b from route-filter 11.19.132.0/24
  exact
set policy-options policy-statement set_community term b from route-filter 11.19.133.0/24
  exact
set policy-options policy-statement set_community term b then community add video
set policy-options policy-statement set_community term b then accept
set policy-options policy-statement set_community term default then accept
set policy-options community video members target:50:50
set policy-options community voice members target:40:40
set routing-options autonomous-system 101
```

Device CE2

```
set interfaces fe-0/1/1 fastether-options loopback
set interfaces fe-0/1/1 unit 0 family inet address 11.19.140.1/24
set interfaces fe-0/1/1 unit 0 family inet address 11.19.141.1/24
set interfaces fe-0/1/1 unit 0 family inet address 11.19.142.1/24
set interfaces fe-1/2/0 unit 46 description to-PE2
set interfaces fe-1/2/0 unit 46 family inet address 10.0.0.46/30
set interfaces lo0 unit 20 family inet address 10.255.165.20/32 primary
set protocols bgp group ebgp type external
set protocols bgp group ebgp local-address 10.0.0.46
set protocols bgp group ebgp export set_community
set protocols bgp group ebgp export inject_directs
set protocols bgp group ebgp peer-as 100
set protocols bgp group ebgp neighbor 10.0.0.45
set policy-options policy-statement inject_directs term a from protocol direct
set policy-options policy-statement inject_directs term a from interface fe-0/1/1.0
set policy-options policy-statement inject_directs term a then next policy
set policy-options policy-statement inject_directs term a then accept
set policy-options policy-statement inject_directs term b then reject
set policy-options policy-statement set_community term a from route-filter 11.19.140.0/24
  exact
set policy-options policy-statement set_community term a from route-filter 11.19.141.0/24
  exact
set policy-options policy-statement set_community term a then community add voice
set policy-options policy-statement set_community term a then accept
set policy-options policy-statement set_community term b from route-filter 11.19.142.0/24
  exact
set policy-options policy-statement set_community term b from route-filter 11.19.143.0/24
  exact
set policy-options policy-statement set_community term b then community add video
set policy-options policy-statement set_community term b then accept
set policy-options policy-statement set_community term default then accept
set policy-options community video members target:50:50
set policy-options community voice members target:40:40
set routing-options autonomous-system 102
```

Device PE1

```
set interfaces fe-1/2/0 unit 2 description to-CE1
set interfaces fe-1/2/0 unit 2 family inet filter input ef_path
set interfaces fe-1/2/0 unit 2 family inet address 10.0.0.2/30
set interfaces fe-1/2/1 unit 6 description to-P1
set interfaces fe-1/2/1 unit 6 family inet filter input ef_path
set interfaces fe-1/2/1 unit 6 family inet address 10.0.0.6/30
set interfaces fe-1/2/2 unit 9 description to-P3
set interfaces fe-1/2/2 unit 9 family inet filter input ef_path
set interfaces fe-1/2/2 unit 9 family inet address 10.0.0.9/30
set interfaces lo0 unit 93 family inet address 10.255.165.93/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.93
set protocols bgp group ibgp family inet unicast topology voice community target:40:40
set protocols bgp group ibgp family inet unicast topology video community target:50:50
set protocols bgp group ibgp export nhs
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols bgp group ebgp type external
set protocols bgp group ebgp local-address 10.0.0.2
set protocols bgp group ebgp family inet unicast topology voice community target:40:40
set protocols bgp group ebgp family inet unicast topology video community target:50:50
set protocols bgp group ebgp peer-as 101
set protocols bgp group ebgp neighbor 10.0.0.1
set protocols ospf topology voice topology-id 126
set protocols ospf topology video topology-id 52
set protocols ospf area 0.0.0.0 interface fe-1/2/1.6 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/1.6 topology video disable
set protocols ospf area 0.0.0.0 interface fe-1/2/1.6 topology voice
set protocols ospf area 0.0.0.0 interface fe-1/2/2.9 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/2.9 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/2.9 topology video
set protocols ospf area 0.0.0.0 interface lo0.93 passive
set policy-options policy-statement nhs then next-hop self
set routing-options autonomous-system 100
set routing-options topologies family inet topology voice
set routing-options topologies family inet topology video
set firewall family inet filter ef_path term ef from forwarding-class expedited-forwarding
set firewall family inet filter ef_path term ef then topology voice
set firewall family inet filter ef_path term video from source-address 11.19.132.0/24
set firewall family inet filter ef_path term video from source-address 11.19.133.0/24
set firewall family inet filter ef_path term video from source-address 11.19.142.0/24
set firewall family inet filter ef_path term video from source-address 11.19.144.0/24
set firewall family inet filter ef_path term video then topology video
set firewall family inet filter ef_path term default then accept
set class-of-service interfaces fe-1/2/0 unit 2 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/1 unit 6 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/2 unit 9 classifiers inet-precedence default
```

Device PE2

```
set interfaces fe-1/2/0 unit 38 description to-P2
set interfaces fe-1/2/0 unit 38 family inet filter input ef_path
set interfaces fe-1/2/0 unit 38 family inet address 10.0.0.38/30
set interfaces fe-1/2/1 unit 42 description to-P4
```

```
set interfaces fe-1/2/1 unit 42 family inet filter input ef_path
set interfaces fe-1/2/1 unit 42 family inet address 10.0.0.42/30
set interfaces fe-1/2/2 unit 45 description to-CE2
set interfaces fe-1/2/2 unit 45 family inet filter input ef_path
set interfaces fe-1/2/2 unit 45 family inet address 10.0.0.45/30
set interfaces lo0 unit 203 family inet address 10.255.165.203/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.203
set protocols bgp group ibgp family inet unicast topology voice community target:40:40
set protocols bgp group ibgp family inet unicast topology video community target:50:50
set protocols bgp group ibgp export nhs
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.93
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols bgp group ebgp type external
set protocols bgp group ebgp local-address 10.0.0.45
set protocols bgp group ebgp family inet unicast topology voice community target:40:40
set protocols bgp group ebgp family inet unicast topology video community target:50:50
set protocols bgp group ebgp peer-as 102
set protocols bgp group ebgp neighbor 10.0.0.46
set protocols ospf topology voice topology-id 126
set protocols ospf topology video topology-id 52
set protocols ospf area 0.0.0.0 interface fe-1/2/0.38 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/0.38 topology video metric 200
set protocols ospf area 0.0.0.0 interface fe-1/2/0.38 topology voice
set protocols ospf area 0.0.0.0 interface fe-1/2/1.42 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/1.42 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/1.42 topology video
set protocols ospf area 0.0.0.0 interface lo0.203 passive
set policy-options policy-statement nhs then next-hop self
set routing-options autonomous-system 100
set routing-options topologies family inet topology voice
set routing-options topologies family inet topology video
set firewall family inet filter ef_path term ef from forwarding-class expedited-forwarding
set firewall family inet filter ef_path term ef then topology voice
set firewall family inet filter ef_path term video from source-address 11.19.132.0/24
set firewall family inet filter ef_path term video from source-address 11.19.133.0/24
set firewall family inet filter ef_path term video from source-address 11.19.142.0/24
set firewall family inet filter ef_path term video from source-address 11.19.144.0/24
set firewall family inet filter ef_path term video then topology video
set firewall family inet filter ef_path term default then accept
set class-of-service interfaces fe-1/2/0 unit 38 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/1 unit 42 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/2 unit 45 classifiers inet-precedence default
```

Device P1

```
set interfaces fe-1/2/0 unit 5 description to-PE1
set interfaces fe-1/2/0 unit 5 family inet filter input ef_path
set interfaces fe-1/2/0 unit 5 family inet address 10.0.0.5/30
set interfaces fe-1/2/1 unit 13 description to-P3
set interfaces fe-1/2/1 unit 13 family inet filter input ef_path
set interfaces fe-1/2/1 unit 13 family inet address 10.0.0.13/30
set interfaces fe-1/2/2 unit 17 description to-P4
set interfaces fe-1/2/2 unit 17 family inet filter input ef_path
set interfaces fe-1/2/2 unit 17 family inet address 10.0.0.17/30
```

```
set interfaces fe-1/2/3 unit 33 description to-P2
set interfaces fe-1/2/3 unit 33 family inet filter input ef_path
set interfaces fe-1/2/3 unit 33 family inet address 10.0.0.33/30
set interfaces lo0 unit 99 family inet address 10.255.165.99/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.99
set protocols bgp group ibgp family inet unicast topology voice community target:40:40
set protocols bgp group ibgp family inet unicast topology video community target:50:50
set protocols bgp group ibgp neighbor 10.255.165.93
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols ospf topology voice topology-id 126
set protocols ospf topology video topology-id 52
set protocols ospf area 0.0.0.0 interface fe-1/2/3.33 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/3.33 topology voice
set protocols ospf area 0.0.0.0 interface fe-1/2/3.33 topology video disable
set protocols ospf area 0.0.0.0 interface fe-1/2/2.17 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/2.17 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/2.17 topology video disable
set protocols ospf area 0.0.0.0 interface fe-1/2/1.13 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/1.13 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/1.13 topology video disable
set protocols ospf area 0.0.0.0 interface fe-1/2/0.5 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/0.5 topology voice
set protocols ospf area 0.0.0.0 interface fe-1/2/0.5 topology video disable
set protocols ospf area 0.0.0.0 interface lo0.99 passive
set routing-options autonomous-system 100
set routing-options topologies family inet topology voice
set routing-options topologies family inet topology video
set firewall family inet filter ef_path term ef from forwarding-class expedited-forwarding
set firewall family inet filter ef_path term ef then topology voice
set firewall family inet filter ef_path term video from source-address 11.19.132.0/24
set firewall family inet filter ef_path term video from source-address 11.19.133.0/24
set firewall family inet filter ef_path term video from source-address 11.19.142.0/24
set firewall family inet filter ef_path term video from source-address 11.19.144.0/24
set firewall family inet filter ef_path term video then topology video
set firewall family inet filter ef_path term default then accept
set class-of-service interfaces fe-1/2/0 unit 5 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/1 unit 13 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/2 unit 17 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/3 unit 33 classifiers inet-precedence default
```

Device P2

```
set interfaces fe-1/2/0 unit 22 description to-P3
set interfaces fe-1/2/0 unit 22 family inet filter input ef_path
set interfaces fe-1/2/0 unit 22 family inet address 10.0.0.22/30
set interfaces fe-1/2/1 unit 25 description to-P4
set interfaces fe-1/2/1 unit 25 family inet filter input ef_path
set interfaces fe-1/2/1 unit 25 family inet address 10.0.0.25/30
set interfaces fe-1/2/2 unit 34 description to-P1
set interfaces fe-1/2/2 unit 34 family inet filter input ef_path
set interfaces fe-1/2/2 unit 34 family inet address 10.0.0.34/30
set interfaces fe-1/2/3 unit 37 description to-PE2
set interfaces fe-1/2/3 unit 37 family inet filter input ef_path
set interfaces fe-1/2/3 unit 37 family inet address 10.0.0.37/30
```



```
set interfaces lo0 unit 113 family inet address 10.255.165.113/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.113
set protocols bgp group ibgp family inet unicast topology voice community target:40:40
set protocols bgp group ibgp family inet unicast topology video community target:50:50
set protocols bgp group ibgp neighbor 10.255.165.93
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols ospf topology voice topology-id 126
set protocols ospf topology video topology-id 52
set protocols ospf area 0.0.0.0 interface fe-1/2/2.34 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/2.34 topology voice
set protocols ospf area 0.0.0.0 interface fe-1/2/2.34 topology video disable
set protocols ospf area 0.0.0.0 interface fe-1/2/0.22 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/0.22 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/0.22 topology video metric 20
set protocols ospf area 0.0.0.0 interface fe-1/2/1.25 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/1.25 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/1.25 topology video disable
set protocols ospf area 0.0.0.0 interface fe-1/2/3.37 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/3.37 topology voice
set protocols ospf area 0.0.0.0 interface fe-1/2/3.37 topology video metric 200
set protocols ospf area 0.0.0.0 interface lo0.113 passive
set routing-options autonomous-system 100
set routing-options topologies family inet topology voice
set routing-options topologies family inet topology video
set firewall family inet filter ef_path term ef from forwarding-class expedited-forwarding
set firewall family inet filter ef_path term ef then topology voice
set firewall family inet filter ef_path term video from source-address 11.19.132.0/24
set firewall family inet filter ef_path term video from source-address 11.19.133.0/24
set firewall family inet filter ef_path term video from source-address 11.19.142.0/24
set firewall family inet filter ef_path term video from source-address 11.19.144.0/24
set firewall family inet filter ef_path term video then topology video
set firewall family inet filter ef_path term default then accept
set class-of-service interfaces fe-1/2/0 unit 22 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/1 unit 25 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/2 unit 34 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/3 unit 37 classifiers inet-precedence default
```

Device P3

```
set interfaces fe-1/2/0 unit 10 description to-PE1
set interfaces fe-1/2/0 unit 10 family inet filter input ef_path
set interfaces fe-1/2/0 unit 10 family inet address 10.0.0.10/30
set interfaces fe-1/2/1 unit 14 description to-P1
set interfaces fe-1/2/1 unit 14 family inet filter input ef_path
set interfaces fe-1/2/1 unit 14 family inet address 10.0.0.14/30
set interfaces fe-1/2/2 unit 21 description to-P2
set interfaces fe-1/2/2 unit 21 family inet filter input ef_path
set interfaces fe-1/2/2 unit 21 family inet address 10.0.0.21/30
set interfaces fe-1/2/3 unit 29 description to-P4
set interfaces fe-1/2/3 unit 29 family inet filter input ef_path
set interfaces fe-1/2/3 unit 29 family inet address 10.0.0.29/30
set interfaces lo0 unit 111 family inet address 10.255.165.111/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.111
```

```
set protocols bgp group ibgp family inet unicast topology voice community target:40:40
set protocols bgp group ibgp family inet unicast topology video community target:50:50
set protocols bgp group ibgp neighbor 10.255.165.93
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols ospf topology voice topology-id 126
set protocols ospf topology video topology-id 52
set protocols ospf area 0.0.0.0 interface fe-1/2/3.29 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/3.29 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/3.29 topology video
set protocols ospf area 0.0.0.0 interface fe-1/2/2.21 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/2.21 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/2.21 topology video metric 20
set protocols ospf area 0.0.0.0 interface fe-1/2/1.14 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/1.14 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/1.14 topology video disable
set protocols ospf area 0.0.0.0 interface fe-1/2/0.10 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/0.10 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/0.10 topology video
set protocols ospf area 0.0.0.0 interface lo0.111 passive
set routing-options autonomous-system 100
set routing-options topologies family inet topology voice
set routing-options topologies family inet topology video
set firewall family inet filter ef_path term ef from forwarding-class expedited-forwarding
set firewall family inet filter ef_path term ef then topology voice
set firewall family inet filter ef_path term video from source-address 11.19.132.0/24
set firewall family inet filter ef_path term video from source-address 11.19.133.0/24
set firewall family inet filter ef_path term video from source-address 11.19.142.0/24
set firewall family inet filter ef_path term video from source-address 11.19.144.0/24
set firewall family inet filter ef_path term video then topology video
set firewall family inet filter ef_path term default then accept
set class-of-service interfaces fe-1/2/0 unit 10 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/1 unit 14 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/2 unit 21 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/3 unit 29 classifiers inet-precedence default
```

Device P4

```
set interfaces fe-1/2/0 unit 18 description to-P1
set interfaces fe-1/2/0 unit 18 family inet filter input ef_path
set interfaces fe-1/2/0 unit 18 family inet address 10.0.0.18/30
set interfaces fe-1/2/1 unit 26 description to-P2
set interfaces fe-1/2/1 unit 26 family inet filter input ef_path
set interfaces fe-1/2/1 unit 26 family inet address 10.0.0.26/30
set interfaces fe-1/2/2 unit 30 description to-P3
set interfaces fe-1/2/2 unit 30 family inet filter input ef_path
set interfaces fe-1/2/2 unit 30 family inet address 10.0.0.30/30
set interfaces fe-1/2/3 unit 41 description to-PE2
set interfaces fe-1/2/3 unit 41 family inet filter input ef_path
set interfaces fe-1/2/3 unit 41 family inet address 10.0.0.41/30
set interfaces lo0 unit 95 family inet address 10.255.165.95/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.95
set protocols bgp group ibgp family inet unicast topology voice community target:40:40
set protocols bgp group ibgp family inet unicast topology video community target:50:50
set protocols bgp group ibgp neighbor 10.255.165.93
```

```
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols ospf topology voice topology-id 126
set protocols ospf topology video topology-id 52
set protocols ospf area 0.0.0.0 interface fe-1/2/2.30 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/2.30 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/2.30 topology video
set protocols ospf area 0.0.0.0 interface fe-1/2/0.18 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/0.18 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/0.18 topology video disable
set protocols ospf area 0.0.0.0 interface fe-1/2/0.18 topology video metric 20
set protocols ospf area 0.0.0.0 interface fe-1/2/1.26 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/1.26 topology voice disable
set protocols ospf area 0.0.0.0 interface fe-1/2/1.26 topology video disable
set protocols ospf area 0.0.0.0 interface fe-1/2/3.41 metric 10
set protocols ospf area 0.0.0.0 interface fe-1/2/3.41 topology voice
set protocols ospf area 0.0.0.0 interface fe-1/2/3.41 topology video
set protocols ospf area 0.0.0.0 interface lo0.95 passive
set routing-options autonomous-system 100
set routing-options topologies family inet topology voice
set routing-options topologies family inet topology video
set firewall family inet filter ef_path term ef from forwarding-class expedited-forwarding
set firewall family inet filter ef_path term ef then topology voice
set firewall family inet filter ef_path term video from source-address 11.19.132.0/24
set firewall family inet filter ef_path term video from source-address 11.19.133.0/24
set firewall family inet filter ef_path term video from source-address 11.19.142.0/24
set firewall family inet filter ef_path term video from source-address 11.19.144.0/24
set firewall family inet filter ef_path term video then topology video
set firewall family inet filter ef_path term default then accept
set class-of-service interfaces fe-1/2/0 unit 18 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/1 unit 26 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/2 unit 30 classifiers inet-precedence default
set class-of-service interfaces fe-1/2/3 unit 41 classifiers inet-precedence default
```

Configuring Device CE1

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure Device CE1:

1. Configure the interfaces.

   For demonstration purposes, the example places an Ethernet interface into loopback mode and configures several addresses on this loopback interface. The addresses are then announced to the network.

   ```
   [edit interfaces]
   user@CE1# set fe-0/1/0 fastether-options loopback
   user@CE1# set fe-0/1/0 unit 0 family inet address 11.19.130.1/24
   user@CE1# set fe-0/1/0 unit 0 family inet address 11.19.131.1/24
   user@CE1# set fe-0/1/0 unit 0 family inet address 11.19.132.1/24
   ```

```
user@CE1# set fe-1/2/0 unit 1 description to-PE1
user@CE1# set fe-1/2/0 unit 1 family inet address 10.0.0.1/30


user@CE1# set lo0 unit 97 family inet address 10.255.165.97/32 primary
```

2. Configure the external BGP (EBGP) connection to Device PE1.

```
[edit protocols bgp group ebgp]
user@CE1# set type external
user@CE1# set local-address 10.0.0.1
user@CE1# set peer-as 100
user@CE1# set neighbor 10.0.0.2
```

3. Configure the routing policy that announces the addresses that are configured on interface fe-0/1/0.

```
[edit policy-options policy-statement inject_directs]
user@CE1# set term a from protocol direct
user@CE1# set term a from interface fe-0/1/0.0
user@CE1# set term a then next policy
user@CE1# set term a then accept
user@CE1# set term b then reject
```

4. Configure the routing policy that tags voice routes with the video community attribute, and video routes with the voice community attribute.

```
[edit policy-options policy-statement set_community]
user@CE1# set term a from route-filter 11.19.130.0/24 exact
user@CE1# set term a from route-filter 11.19.131.0/24 exact
user@CE1# set term a then community add voice
user@CE1# set term a then accept

user@CE1# set term b from route-filter 11.19.132.0/24 exact
user@CE1# set term b from route-filter 11.19.133.0/24 exact
user@CE1# set term b then community add video
user@CE1# set term b then accept

user@CE1# set term default then accept

[edit policy-options community]
user@CE1# set video members target:50:50
user@CE1# set voice members target:40:40
```

5. Apply the **set_community** export policy so that direct routes are exported from the routing table into BGP.

   Apply the **inject_directs** export policy to announce the addresses that are configured on interface fe-0/1/0.

```
[edit protocols bgp group ebgp]
user@CE1# set export set_community
user@CE1# set export inject_directs
```

6. Configure the autonomous system (AS) number.

```
[edit routing-options]
user@CE1# set autonomous-system 101
```


Results From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, **show policy-options**, and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@CE1# show interfaces
fe-0/1/0 {
    fastether-options {
        loopback;
    }
    unit 0 {
        family inet {
            address 11.19.130.1/24;
            address 11.19.131.1/24;
            address 11.19.132.1/24;
        }
    }
}
fe-1/2/0 {
    unit 1 {
        description to-PE1;
        family inet {
            address 10.0.0.1/30;
        }
    }
}
lo0 {
    unit 97 {
        family inet {
            address 10.255.165.97/32 {
                primary;
            }
        }
    }
}
```

```
user@CE1# show protocols
bgp {
    group ebgp {
        type external;
        local-address 10.0.0.1;
        export [ set_community inject_directs ];
        peer-as 100;
        neighbor 10.0.0.2;
    }
}
```

```
user@CE1# show policy-options
policy-statement inject_directs {
    term a {
        from {
            protocol direct;
            interface fe-0/1/0.0;
        }
        then {
            next policy;
```

```
        accept;
      }
    }
    term b {
      then reject;
    }
  }
  policy-statement set_community {
    term a {
      from {
        route-filter 11.19.130.0/24 exact;
        route-filter 11.19.131.0/24 exact;
      }
      then {
        community add voice;
        accept;
      }
    }
    term b {
      from {
        route-filter 11.19.132.0/24 exact;
        route-filter 11.19.133.0/24 exact;
      }
      then {
        community add video;
        accept;
      }
    }
    term default {
      then accept;
    }
  }
  community video members target:50:50;
  community voice members target:40:40;

  user@CE1# show routing-options
  autonomous-system 101;
```

If you are done configuring the device, enter **commit** from configuration mode.

Configuring Device PE1

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure Device PE1:

1. Configure the interfaces.

   The forwarding plane uses a firewall filter to indicate which topology forwarding table traffic should use. In this case, you must configure a firewall filter on all interfaces related to routing topologies. In general, all multitopology OSPF interfaces in the core where topologies are configured have input firewall filters. In addition, the ingress interfaces, where traffic from a CE device enters a PE device toward the core, have firewall filters configured. This configuration on Device PE1 shows a

firewall filter applied to the ingress interface (connected to the CE device) and to the two core-facing interfaces (connected to Device P1 and Device P3).

```
[edit interfaces]
user@PE1# set fe-1/2/0 unit 2 description to-CE1
user@PE1# set fe-1/2/0 unit 2 family inet filter input ef_path
user@PE1# set fe-1/2/0 unit 2 family inet address 10.0.0.2/30

user@PE1# set fe-1/2/1 unit 6 description to-P1
user@PE1# set fe-1/2/1 unit 6 family inet filter input ef_path
user@PE1# set fe-1/2/1 unit 6 family inet address 10.0.0.6/30

user@PE1# set fe-1/2/2 unit 9 description to-P3
user@PE1# set fe-1/2/2 unit 9 family inet filter input ef_path
user@PE1# set fe-1/2/2 unit 9 family inet address 10.0.0.9/30

user@PE1# set lo0 unit 93 family inet address 10.255.165.93/32 primary
```

2. Configure the autonomous system (AS) number.

```
[edit routing-options]
user@PE1# set autonomous-system 100
```

3. Configure BGP.

```
[edit protocols bgp group ibgp]
user@PE1# set type internal
user@PE1# set local-address 10.255.165.93
user@PE1# set neighbor 10.255.165.111
user@PE1# set neighbor 10.255.165.203
user@PE1# set neighbor 10.255.165.113
user@PE1# set neighbor 10.255.165.95
user@PE1# set neighbor 10.255.165.99

[edit protocols bgp group ebgp]
user@PE1# set type external
user@PE1# set local-address 10.0.0.2
user@PE1# set peer-as 101
user@PE1# set neighbor 10.0.0.1
```

4. Configure a next-hop self routing policy to ensure that the IBGP devices use the loopback address on Device PE1 as the next-hop address on all IBGP route advertisements.

   This way, Device PE1 serves as the gateway router for EBGP routes.

```
[edit policy-options policy-statement nhs]
user@PE1# set then next-hop self
```

5. Apply the next-hop self policy to the IBGP sessions.

```
[edit protocols bgp group ibgp]
user@PE1# set export nhs
```

6. Configure the voice and video topologies, which enable you to use these topologies with OSPF and BGP.

The names **voice** and **video** are local to the router. The names are not propagated beyond this router. However, for management purposes, a consistent naming scheme across routers in a multitopology environment is convenient.

```
[edit routing-options topologies family inet]
user@PE1# set topology voice
user@PE1# set topology video
```

7. Apply the community tags to identify the voice and video topologies by configuring a routing topology name and BGP community value.

   In Junos OS, multitopology support for BGP is based on the community value in a BGP route. This configuration determines the association between a topology and one or more community values and populates the topology routing tables. Arriving BGP updates that have a matching community value are replicated in the associated topology routing table. You decide which BGP community values are associated with a given topology.

   This configuration causes BGP updates that are received with community value **target:40:40** to be added into topology routing table **:voice.inet.0** (in addition to the default routing table **inet.0**). Updates that are received with community value **target:50:50** are added into topology routing table **:video.inet.0** (in addition to the default routing table **inet.0**).

   ```
   [edit protocols bgp group ibgp family inet unicast]
   user@PE1# set topology voice community target:40:40
   user@PE1# set topology video community target:50:50

   [edit protocols bgp group ebgp family inet unicast]
   user@PE1# set topology voice community target:40:40
   user@PE1# set topology video community target:50:50
   ```

8. Enable and disable multitopology OSPF on particular interfaces.

   Enable multitopology OSPF designations only on desired interfaces, as shown in Figure 5 on page 16. On interface fe-1/2/1.6 facing Device P1, enable the voice topology, and disable the video topology. On interface fe-1/2/2.9 facing Device P3, enable the video topology, and disable the voice topology.

   When a topology ID is configured under OSPF, the topology is automatically enabled on all interfaces under OSPF. To disable a topology or to add a metric, you must add an explicit configuration.

   For readability purposes, each topology is configured under each desired OSPF interface even though this default behavior occurs when the topology ID is configured. Configure higher metric values on a link to make the link less preferred than another available link.

   ```
   [edit protocols ospf ]
   user@PE1# set topology voice topology-id 126
   user@PE1# set topology video topology-id 52

   [edit protocols ospf area 0.0.0.0]
   user@PE1# set interface fe-1/2/1.6 metric 10
   user@PE1# set interface fe-1/2/1.6 topology video disable
   user@PE1# set interface fe-1/2/1.6 topology voice
   ```



```
user@PE1# set interface fe-1/2/2.9 metric 10
user@PE1# set interface fe-1/2/2.9 topology voice disable
user@PE1# set interface fe-1/2/2.9 topology video


user@PE1# set interface lo0.93 passive
```

9. Configure the firewall filter.

   After routing topologies are configured, traffic must go through a firewall filter to make use of routing topology forwarding tables. For basic routing topologies, where traffic is first entering the core network, apply an input firewall filter to the ingress interface. Additionally, add firewall filters to interfaces where multitopology OSPF is configured. All routers must use the same firewall filter to associate packets with a topology to ensure consistent forwarding and to avoid routing loops or packet loss.

   The forwarding plane handles traffic as it enters the router and exits out a particular interface. To inspect traffic and use a specified topology forwarding table to perform next-hop lookups, configure an input firewall filter on each interface where routing topology support is desired. Use a regular firewall filter to identify packet characteristics.

   In general, for application-level differentiation, it is convenient to use DiffServ code points (DSCPs). When there is a firewall filter match, the firewall instructs the route lookup to use a particular topology forwarding table. Packet attributes are identified in the **from** clause, followed by a **then** clause indicating the topology forwarding table for use in forwarding next-hop lookups. This configuration notifies the router which traffic uses a routing topology forwarding table and which traffic uses the default forwarding table. The last term, which is named **default**, specifies the use of the default forwarding table.

   These firewall configurations show source addresses and DSCPs used to sort voice, video, and default traffic. DSCPs are practical because you can set them at or near a CE device and because the information is intact across the network. For instance, here class of service (CoS) is configured for expedited traffic. DSCPs are also practical when the same IP address is used for different applications.

```
[edit firewall family inet filter ef_path]
user@PE1# set term ef from forwarding-class expedited-forwarding
user@PE1# set term ef then topology voice


user@PE1# set term video from source-address 11.19.132.0/24
user@PE1# set term video from source-address 11.19.133.0/24
user@PE1# set term video from source-address 11.19.142.0/24
user@PE1# set term video from source-address 11.19.144.0/24
user@PE1# set term video then topology video


user@PE1# set term default then accept
```

10. Enable CoS on the interfaces.

```
[edit class-of-service interfaces]
user@PE1# set fe-1/2/0 unit 2 classifiers inet-precedence default
user@PE1# set fe-1/2/1 unit 6 classifiers inet-precedence default
```

```
user@PE1# set fe-1/2/2 unit 9 classifiers inet-precedence default
```

Results From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, **show policy-options**, **show routing-options**, **show firewall**, and **show class-of-service** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@PE1# show interfaces
fe-1/2/0 {
    unit 2 {
        description to-CE1;
        family inet {
            filter {
                input ef_path;
            }
            address 10.0.0.2/30;
        }
    }
}
fe-1/2/1 {
    unit 6 {
        description to-P1;
        family inet {
            filter {
                input ef_path;
            }
            address 10.0.0.6/30;
        }
    }
}
fe-1/2/2 {
    unit 9 {
        description to-P3;
        family inet {
            filter {
                input ef_path;
            }
            address 10.0.0.9/30;
        }
    }
}
lo0 {
    unit 93 {
        family inet {
            address 10.255.165.93/32 {
                primary;
            }
        }
    }
}
```

```
user@PE1# show protocols
bgp {
    group ibgp {
        type internal;
```



```
        local-address 10.255.165.93;
        family inet {
          unicast {
            topology voice {
              community target:40:40;
            }
            topology video {
              community target:50:50;
            }
          }
        }
        export nhs;
        neighbor 10.255.165.111;
        neighbor 10.255.165.203;
        neighbor 10.255.165.113;
        neighbor 10.255.165.95;
        neighbor 10.255.165.99;
      }
      group ebgp {
        type external;
        local-address 10.0.0.2;
        family inet {
          unicast {
            topology voice {
              community target:40:40;
            }
            topology video {
              community target:50:50;
            }
          }
        }
        peer-as 101;
        neighbor 10.0.0.1;
      }
    }
    ospf {
      topology voice topology-id 126;
      topology video topology-id 52;
      area 0.0.0.0 {
        interface fe-1/2/1.6 {
          metric 10;
          topology video disable;
          topology voice;
        }
        interface fe-1/2/2.9 {
          metric 10;
          topology voice disable;
          topology video;
        }
        interface lo0.93 {
          passive;
        }
      }
    }
```

user@PE1# **show policy-options**

```
policy-statement nhs {
  then {
    next-hop self;
  }
}
```

```
user@PE1# show routing-options
autonomous-system 100;
topologies {
  family inet {
    topology voice;
    topology video;
  }
}
```

```
user@PE1# show firewall
family inet {
  filter ef_path {
    term ef {
      from {
        forwarding-class expedited-forwarding;
      }
      then topology voice;
    }
    term video {
      from {
        source-address {
          11.19.132.0/24;
          11.19.133.0/24;
          11.19.142.0/24;
          11.19.144.0/24;
        }
      }
      then topology video;
    }
    term default {
      then accept;
    }
  }
}
```

```
user@PE1# show class-of-service
interfaces {
  fe-1/2/0 {
    unit 2 {
      classifiers {
        inet-precedence default;
      }
    }
    unit 6 {
      classifiers {
        inet-precedence default;
      }
    }
    unit 9 {
      classifiers {
        inet-precedence default;
```

```
        }
      }
    }
  }
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

Verifying the OSPF Interfaces

Purpose Verify that the OSPF interfaces are configured to belong to one or more topologies.

Action From operational mode, enter the **show (ospf | ospf3) interface** ***interface-name*** **detail** command.

```
user@PE1> show ospf interface fe-1/2/1.6 detail
Interface           State   Area            DR ID           BDR ID          Nbrs
fe-1/2/1.6          DR      0.0.0.0         10.255.165.93   10.255.165.99      1

  Type: LAN, Address: 10.0.0.6, Mask: 255.255.255.252, MTU: 1500, Cost: 10
  DR addr: 10.0.0.6, BDR addr: 10.0.0.5, Priority: 128
  Adj count: 1
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Protection type: None
  Topology default (ID 0) -> Cost: 10
  Topology video (ID 52) -> Disabled, Cost: 10
  Topology voice (ID 126) -> Cost: 10
```

Meaning This output shows that the voice topology was added to the fe-1/2/1.6 interface on Device PE1. The topology name is voice, and the MT-ID is 126. The video topology is disabled on this interface. The cost of the interface is 10.

The Router-LSA originated and flooded by the router includes all relevant topology information for specific interfaces, such as MT-ID and metric. If MTR is not configured on an OSPF interface, then the Router-LSA does not include any topology information for that interface. OSPF neighbors might or might not support multitopology OSPF. That is, a particular link is not used to calculate OSPF routes for a topology unless routers at both ends of the link announce that link as part of the topology. If multitopology OSPF is not supported in neighboring OSPF routers or is not configured to do so, then topology information in LSAs received by the neighbor is ignored.

Verifying the Routes

Purpose Make sure that the routes are in the expected routing tables and that the expected communities are attached to the routes.

Action From operational mode, enter the show route detail command on Device PE1.

```
user@PE1> show route 11.19.130.0/24 detail

inet.0: 29 destinations, 30 routes (29 active, 0 holddown, 0 hidden)
11.19.130.0/24 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next hop type: Router, Next hop index: 812
                Address: 0xb9f064c
                Next-hop reference count: 22
                Source: 10.0.0.1
                Next hop: 10.0.0.1 via fe-1/2/0.2, selected
                Session Id: 0x600004
                State: <Active Ext>
                Local AS:   100 Peer AS:   101
                Age: 3d 21:44:07
                Task: BGP_101.10.0.0.1+51873
                Announcement bits (3): 0-KRT 3-BGP_RT_Background 4-Resolve tree
3
                AS path: 101 I
                Communities: target:40:40
                Accepted
                Localpref: 100
                Router ID: 10.255.165.97
                Secondary Tables: :voice.inet.0

:voice.inet.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)

11.19.130.0/24 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next hop type: Router, Next hop index: 812
                Address: 0xb9f064c
                Next-hop reference count: 22
                Source: 10.0.0.1
                Next hop: 10.0.0.1 via fe-1/2/0.2, selected
                Session Id: 0x600004
                State: <Secondary Active IndepResolution Ext>
                Local AS:   100 Peer AS:   101
                Age: 3d 21:44:07
                Task: BGP_101.10.0.0.1+51873
                Announcement bits (2): 0-KRT 1-Resolve tree 1
                AS path: 101 I
                Communities: target:40:40
                Accepted
                Localpref: 100
                Router ID: 10.255.165.97
                Primary Routing Table inet.0
```

Meaning This output shows BGP route 11.19.130.0/24 with community value target:40:40. Because the route matches the criteria for the voice topology, it is added to both the default and voice topology routing tables (**inet.0** and **:voice.inet.0**). Device PE1 learns the route from Device CE1 through EBGP and then injects the route into IBGP.

Checking the Resolving BGP Next Hops

Purpose Check the protocol next hop and forwarding next hop.

Action From operational mode, enter the show route detail command on Device PE2.

```
user@PE2> show route 11.19.130.0/24 detail
inet.0: 29 destinations, 30 routes (29 active, 0 holddown, 0 hidden)
11.19.130.0/24 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next hop type: Indirect
                Address: 0xb9f0e04
                Next-hop reference count: 12
                Source: 10.255.165.93
                Next hop type: Router, Next hop index: 262153
                Next hop: 10.0.0.37 via fe-1/2/0.38
                Session Id: 0x700004
                Next hop: 10.0.0.41 via fe-1/2/1.42, selected
                Session Id: 0x700005
                Protocol next hop: 10.255.165.93
                Indirect next hop: bb8c000 262154 INH Session ID: 0x700007
                State: <Active Int Ext>
                Local AS:   100 Peer AS:   100
                Age: 3d 4:27:40         Metric2: 30
                Task: BGP_100.10.255.165.93+179
                Announcement bits (3): 0-KRT 3-BGP_RT_Background 4-Resolve tree
3
                AS path: 101 I
                Communities: target:40:40
                Accepted
                Localpref: 100
                Router ID: 10.255.165.93
                Secondary Tables: :voice.inet.0

:voice.inet.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)

11.19.130.0/24 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next hop type: Indirect
                Address: 0xb9f0f34
                Next-hop reference count: 6
                Source: 10.255.165.93
                Next hop type: Router, Next hop index: 1188
                Next hop: 10.0.0.37 via fe-1/2/0.38, selected
                Session Id: 0x700004
                Protocol next hop: 10.255.165.93
                Indirect next hop: bb8c1d8 262177 INH Session ID: 0x700007
                State: <Secondary Active IndepResolution Int Ext>
                Local AS:   100 Peer AS:   100
                Age: 3d 2:00:20         Metric2: 30
                Task: BGP_100.10.255.165.93+179
                Announcement bits (2): 0-KRT 1-Resolve tree 1
                AS path: 101 I
                Communities: target:40:40
                Accepted
                Localpref: 100
                Router ID: 10.255.165.93
                Primary Routing Table inet.0
```

Meaning A typical IBGP core has BGP routes with protocol next hops that resolve using the underlying IGP routes. IBGP routes in a topology routing table have protocol next-hop IP addresses. By default, the same topology routing table is used to look up and resolve the protocol next-hop IP address to a forwarding next hop. This output from Device PE2 shows the same BGP route as seen in the previous example: 11.19.130.0/24. The route is being shown from a different perspective, that is, from Device PE2 as an IBGP route. Similarly, this IBGP route is added to both **inet.0** and **:voice.inet.0** on Device PE2. However, while each route has the same protocol next hop, each route has a different forwarding next hop (ge-0/0/3.0 instead of ge-0/1/4.0). The reason for this difference is when the protocol next-hop IP address 10.255.165.93 is resolved, it uses the corresponding routing table (**inet.0** or **:voice.inet.0**) to look up the protocol next hop.

Examining the Protocol Next Hop

Purpose Check the protocol next hop and forwarding next hop.

Action From operational mode, enter the show route command on Device PE2.

```
user@PE2> show route 10.255.165.93
inet.0: 29 destinations, 30 routes (29 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.255.165.93/32   *[OSPF/10] 3d 04:37:26, metric 30
                    > to 10.0.0.37 via fe-1/2/0.38
                      to 10.0.0.41 via fe-1/2/1.42

:voice.inet.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.255.165.93/32   *[OSPF/10] 3d 02:10:04, metric 30
                    > to 10.0.0.37 via fe-1/2/0.38

:video.inet.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.255.165.93/32   *[OSPF/10] 3d 02:03:16, metric 30
                    > to 10.0.0.41 via fe-1/2/1.42
```

Meaning This output from Device PE2 shows the protocol next hop of 11.19.130.0/24, which is IP address 10.255.165.93, thus further demonstrating how IBGP route 11.19.130.0/24 resolves its protocol next hop. The forwarding next hops of 10.255.165.93 match the IBGP forwarding next hops of route 11.19.130/24 as shown in the previous example. Observe here that the IP address 10.255.165.93 is also in routing table **:video.inet.0**. This address is the loopback address of Device PE1, and as such, resides in all three routing tables. This example also shows how traffic entering Device PE2 destined to 11.19.130.0/24 exits out different interfaces depending on its associated topology. The actual traffic is marked in such a way that a firewall filter can direct the traffic to use a particular topology routing table.

Verifying the OSPF Neighbor

Purpose Make sure that the expected topologies are enabled on the OSPF neighbor.

Action From operational mode, enter the **show ospf neighbor 10.0.0.21 extensive** command on Device P2.

```
user@P2> show ospf neighbor 10.0.0.21 extensive
Address          Interface              State     ID               Pri  Dead
10.0.0.21        fe-1/2/0.22            Full      10.255.165.111   128    39
  Area 0.0.0.0, opt 0x52, DR 10.0.0.22, BDR 10.0.0.21
  Up 3d 06:09:50, adjacent 3d 06:09:50
   Topology default (ID 0) -> Bidirectional
   Topology video (ID 52) -> Bidirectional
```

Meaning This Device P2 output shows OSPF neighbor PE2 (10.0.0.21), where multitopology OSPF default and video are multitopology OSPF participants. The **Bidirectional** flag shows that the neighbor is configured using the same multitopology OSPF ID.

Checking the Router LSA

Purpose Check the links where video and voice topologies are enabled.

Action From operational mode, enter the show ospf database **lsa-id 10.255.165.203 extensive** command on Device P2.

```
user@P2> show ospf database lsa-id 10.255.165.203 extensive

    OSPF database, Area 0.0.0.0
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.165.203   10.255.165.203   0x80000063  1552  0x22 0xdff3  80
  bits 0x0, link count 3
  id 10.255.165.203, data 255.255.255.255, Type Stub (3)
    Topology count: 2, Default metric: 0
    Topology video (ID 52) -> Metric: 0
    Topology voice (ID 126) -> Metric: 0
  id 10.0.0.38, data 10.0.0.38, Type Transit (2)
    Topology count: 2, Default metric: 10
    Topology video (ID 52) -> Metric: 200
    Topology voice (ID 126) -> Metric: 10
  id 10.0.0.42, data 10.0.0.42, Type Transit (2)
    Topology count: 1, Default metric: 10
    Topology video (ID 52) -> Metric: 10
  Topology default (ID 0)
    Type: Transit, Node ID: 10.0.0.42
      Metric: 10, Bidirectional
    Type: Transit, Node ID: 10.0.0.38
      Metric: 10, Bidirectional
  Topology video (ID 52)
    Type: Transit, Node ID: 10.0.0.42
      Metric: 10, Bidirectional
    Type: Transit, Node ID: 10.0.0.38
      Metric: 200, Bidirectional
  Topology voice (ID 126)
    Type: Transit, Node ID: 10.0.0.38
      Metric: 10, Bidirectional
  Aging timer 00:34:08
  Installed 00:25:49 ago, expires in 00:34:08, sent 00:25:47 ago
  Last changed 3d 01:45:51 ago, Change count: 10
```

Meaning This Device P2 output shows the Router-LSA originated by Device PE2. The LSA shows links where video and voice topologies are enabled (in addition to the default topology).

Checking How Traffic Traverses the Network

Purpose Make sure that the expected paths are used.

Action From operational mode, enter the traceroute command on Device CE1.

The first example output shows a traceroute over the voice topology goes from Device CE1 to Device CE2 where DSCPs are set. The routes are resolved over **:voice.inet.0**. This traceroute path follows the voice path CE1-PE1-P1-P2-PE2-CE2

```
user@CE1> traceroute 11.19.140.1 source 11.19.130.1 tos 160


traceroute to 11.19.140.1 (11.19.140.1) from 11.19.130.1, 30 hops max, 40 byte
packets
 1  10.0.0.2 (10.0.0.2)  2.015 ms  1.924 ms  1.770 ms
 2  10.0.0.5 (10.0.0.5)  1.890 ms  1.010 ms  0.974 ms
 3  10.0.0.34 (10.0.0.34)  0.986 ms  1.031 ms  0.973 ms
 4  10.0.0.38 (10.0.0.38)  1.213 ms  1.065 ms  1.154 ms
 5  11.19.140.1 (11.19.140.1)  1.696 ms  4.286 ms  1.332 ms
```

This output shows a traceroute from Device CE1 to Device CE2 for voice where no DSCPs are set. The routes are resolved over **inet.0**, and the resulting path is different from the previous case where the DSCPs are set. This traceroute path follows the default path CE1-PE1-P4-PE2-CE2.

```
user@CE1> traceroute 11.19.140.1 source 11.19.130.1

traceroute to 11.19.140.1 (11.19.140.1) from 11.19.130.1, 30 hops max, 40 byte
packets
 1  10.0.0.2 (10.0.0.2)  1.654 ms  1.710 ms  1.703 ms
 2  10.0.0.5 (10.0.0.5)  1.790 ms  1.045 ms  0.975 ms
 3  10.0.0.18 (10.0.0.18)  0.989 ms  1.041 ms  0.983 ms
 4  10.0.0.42 (10.0.0.42)  0.994 ms  1.036 ms  1.002 ms
 5  11.19.140.1 (11.19.140.1)  1.329 ms  2.248 ms  2.225 ms
```

This output shows a traceroute from Device CE1 to Device CE2 for video traffic where the firewall filter is based on the destination address. The routes are resolved over **:video.inet.0** . This traceroute follows the video path CE1-PE1-P3-P4-PE2-CE2.

```
user@CE1> traceroute 11.19.142.1 source 11.19.132.1

traceroute to 11.19.142.1 (11.19.142.1) from 11.19.132.1, 30 hops max, 40 byte
packets
 1  10.0.0.2 (10.0.0.2)  1.126 ms  1.300 ms  0.995 ms
 2  10.0.0.10 (10.0.0.10)  0.981 ms  1.018 ms  0.991 ms
 3  10.0.0.30 (10.0.0.30)  0.997 ms  1.886 ms  1.952 ms
 4  10.0.0.42 (10.0.0.42)  1.800 ms  1.038 ms  0.980 ms
 5  11.19.142.1 (11.19.142.1)  1.367 ms  1.352 ms  1.328 ms
```

This output shows a traceroute from Device CE1 to Device CE2 for video where DSCPs are set. The DSCP bits are directing Device PE1 to use the topology table **:voice.inet.0**. Because there is no entry in the voice routing table for video routes, traffic is dropped.

```
user@CE1> traceroute 11.19.142.1 source 11.19.132.1 tos 160

traceroute to 11.19.142.1 (11.19.142.1) from 11.19.132.1, 30 hops max, 40 byte
```



```
packets
 1  10.0.0.2 (10.0.0.2)  1.135 ms !N  1.007 ms !N  0.954 ms !N
```

Related Documentation

- Example: Configuring Multitopology Routing Based on a Multicast Source on page 39

Example: Configuring Multitopology Routing Based on a Multicast Source

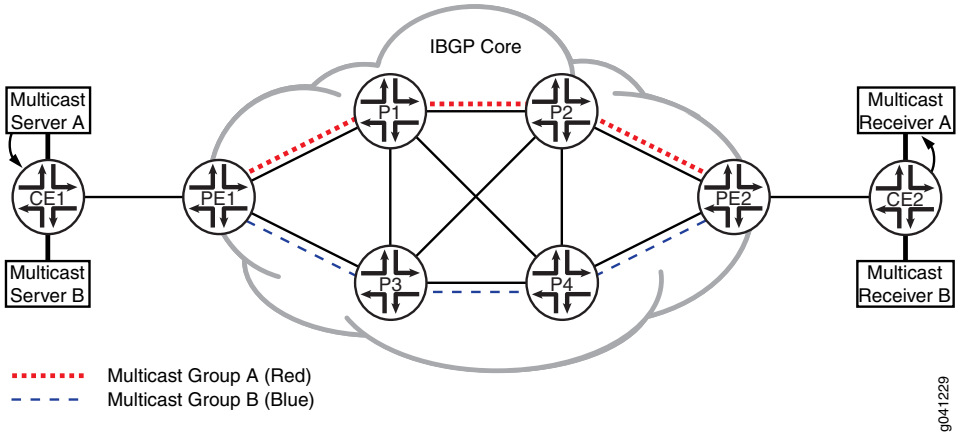
Understanding Multitopology Routing Based on a Multicast Source

Protocol Independent Multicast (PIM), in conjunction with multitopology routing extensions to OSPF (multitopology OSPF) and BGP, can direct multicast traffic over particular paths based on traffic characteristics.

Junos OS provides a mechanism whereby multicast traffic traverses user-specified topology paths based on the sender's source address. Multitopology routing (MTR) is used for OSPF, BGP, and route resolution over the specified topology routing tables. OSPF and BGP independently populate the routing table used by PIM. Firewall filters are not required because the multicast forwarding plane uses the multicast tree after it has been built.

Figure 6 on page 39 shows a diagram of routing topology paths, where the dashed lines are associated with multicast group A (topology red), and the dotted lines are associated with multicastgroup B (topology blue).

Figure 6: Core Links Configured to Prefer Specified Routing Topologies



Two copies of the same stream enter Device PE1 and then traverse separate paths over the internal BGP (IBGP) core.

This solution leverages Junos OS features that allow particular routing tables to perform route resolution using specified routing tables.

The configuration includes a combination of the following features:

- BGP communities
- Separate IBGP next hops belonging to user-specified OSPF routing topologies
- Route resolution over user-specified topology routing tables
- A separate routing table (**inet.2**) for multicast protocols

Commonly, networks use a separate routing table for multicast. In Junos OS, the multicast routing table is **inet.2**. Routing topologies are grouped based on BGP communities. Each group represents a set of IP addresses associated with multicast servers and receivers. Primarily, the group must be related to the set of servers because the multicast receivers initiate tree creation toward these servers. Multicast traffic directed downstream toward receivers uses the previously created PIM tree, and therefore the forwarding plane does not need to know about routing topologies.

PIM uses the **inet.2** routing table for lookups of multicast source addresses. These IP addresses used for tree creation are IP unicast addresses. The customer edge (CE) routers, nearest to the multicast servers, announce the multicast source IP addresses to the provider edge (PE) routers using external BGP (EBGP). They are announced with both **family inet** unicast and **family inet multicast**, thus causing the BGP route to be added to the default routing table **inet.0** and to **inet.2**.

Both versions of the route are injected by the PE router into IBGP. Each BGP route injected into IBGP has a specific protocol next hop. Junos OS provides the flexibility to set the protocol next hop when exporting the route into IBGP. For instance, a next-hop self can be set with an export policy configuration. You can also set the protocol next hop to a route associated with a specified topology routing table.

Keeping in mind that an EBGP route can have a community associated with a routing topology, you can conveniently configure a policy to use this community to designate which protocol next hop should be set when exporting the IBGP route into **inet.2**. As such, a specific protocol next-hop IP address is required for each topology on each router injecting IBGP routes. You can configure multiple secondary loopback IP addresses on a router to be used as protocol next-hop addresses.

A group of BGP routes associated with a routing topology use the same unique protocol next hop. For instance, if you configure a PE router to handle two routing topologies, you would also configure two unique nonprimary addresses under loopback interface lo0. Next, associate each nonprimary loopback IP address with a topology for inclusion in the associated topology routing table. Configure the loopback IP address and topology under an OSPF interface statement. You must specifically disable all other topologies known to OSPF for two reasons. First, the loopback address specific to a topology must reside in only one topology routing table. Second, once the topology is added to OSPF, the topology defaults to being enabled on all subsequent interfaces under OSPF.

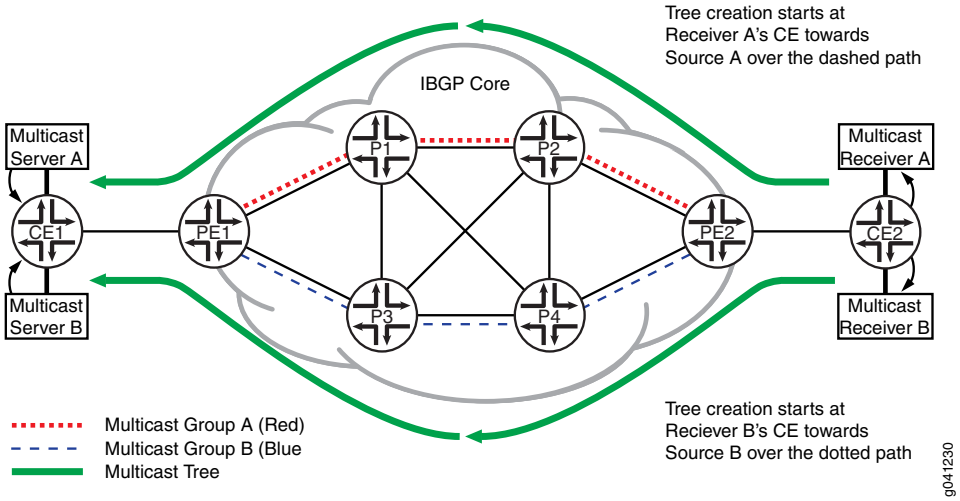
You can specify up to two routing tables in the resolution configuration. A key element to this solution is that the protocol next-hop address resides in only one topology table. That is, the protocol next hop belongs to a remote PE secondary loopback address and is injected into only one topology table. The route resolution scheme first checks the

topology table for the protocol next-hop address. If the address is found, it uses this entry. If it is not found, the resolution scheme then checks the second topology table. Hence, only one topology table is used for each protocol nexthop address.

Links can support all routing topologies to provide a backup path should a primary multicast path fail. You can configure specific OSPF link metrics on topologies to identify paths and build trees to different servers. When a multicast tree gets built with PIM join messages directed toward the source, it follows the most preferred path. A multicast tree to a different multicast source (in a different routing topology) can create another tree along a different path.

Figure 7 on page 41 shows an example of two trees using different paths over different topologies. It shows Server A using the multicast tree with the dashed line as its path and Server B using the multicast tree with the dotted line as its path.

Figure 7: Core Links Configured to Prefer Specified Routing Topologies



Example: Configuring Multitopology Routing Based on a Multicast Source

This example shows how to use multitopology routing (MTR) to provide redundancy for multicast traffic over separate network paths. That is, two multicast sources send the same multicast stream, yet for redundancy purposes in the case of link failure, the two streams use disjoint paths.

NOTE: Note there is no standard defined at this time for using MTR extensions to PIM.

- Requirements on page 42
- Overview on page 42
- Configuration on page 42
- Verification on page 60

Requirements

This example requires that Junos OS Release 9.0 or later is running on the provider core devices.

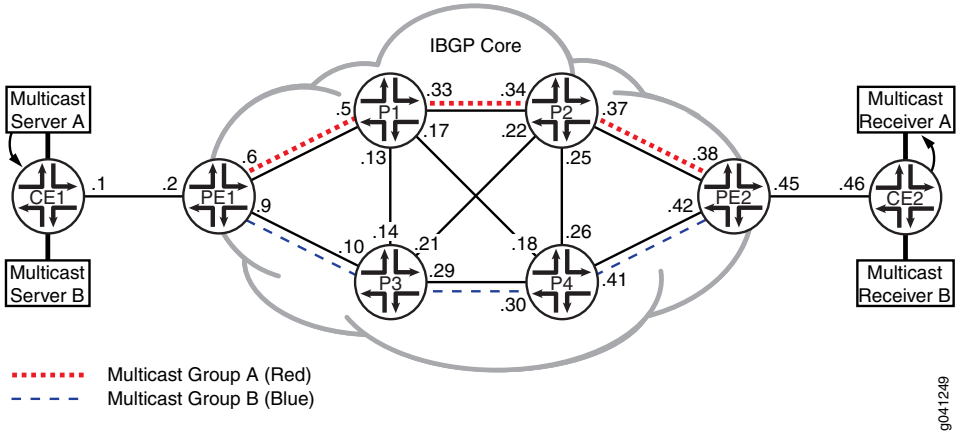
Overview

Assume that each source providing redundant multicast streams, S1 and S2, have different IP subnet addresses. Each source sends multicast traffic using different groups: G1 and G2. Further, assume that S1 and S2 are attached to the same customer edge (CE) device and use BGP to announce routes to the provider edge (PE) router.

For a complete set of configurations for all of the devices in the topology, see "CLI Quick Configuration" on page 42. The remainder of the example focuses on Device CE1 and Device PE1.

Figure 8 on page 42 shows the sample topology.

Figure 8: Multi-topology OSPF and BGP for Designating Links Belonging to Voice and Video Services



Configuration

- Configuring Device CE1 on page 49
- Configuring Device PE1 on page 53

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Device CE1

```
set interfaces fe-0/1/0 fastether-options loopback
set interfaces fe-0/1/0 unit 0 family inet address 11.19.130.1/24
set interfaces fe-0/1/0 unit 0 family inet address 11.19.131.1/24
set interfaces fe-0/1/0 unit 0 family inet address 11.19.132.1/24
set interfaces ge-1/2/0 unit 1 description to-PE1
set interfaces ge-1/2/0 unit 1 family inet address 10.0.0.1/30
set interfaces lo0 unit 97 family inet address 10.255.165.97/32 primary
set protocols bgp group ebgp type external
```

```
set protocols bgp group ebgp local-address 10.0.0.1
set protocols bgp group ebgp family inet unicast
set protocols bgp group ebgp family inet multicast
set protocols bgp group ebgp export set_community
set protocols bgp group ebgp export inject_directs
set protocols bgp group ebgp peer-as 100
set protocols bgp group ebgp neighbor 10.0.0.2
set protocols pim interface fe-0/1/0.0 mode sparse
set protocols pim interface ge-1/2/0.1 mode sparse
set policy-options policy-statement inject_directs term a from protocol direct
set policy-options policy-statement inject_directs term a from interface fe-0/1/0.0
set policy-options policy-statement inject_directs term a then next policy
set policy-options policy-statement inject_directs term a then accept
set policy-options policy-statement inject_directs term b then reject
set policy-options policy-statement set_community term a from route-filter 11.19.130.0/24
  exact
set policy-options policy-statement set_community term a from route-filter 11.19.131.0/24
  exact
set policy-options policy-statement set_community term a then community add red
set policy-options policy-statement set_community term a then accept
set policy-options policy-statement set_community term b from route-filter 11.19.132.0/24
  exact
set policy-options policy-statement set_community term b from route-filter 11.19.133.0/24
  exact
set policy-options policy-statement set_community term b then community add blue
set policy-options policy-statement set_community term b then accept
set policy-options policy-statement set_community term default then accept
set policy-options community blue members target:50:50
set policy-options community red members target:40:40
set routing-options interface-routes rib-group inet if-rib
set routing-options static route 10.0.0.0/16 next-hop 10.0.0.2
set routing-options rib-groups inet.2 import-rib inet.0
set routing-options rib-groups if-rib import-rib inet.0
set routing-options rib-groups if-rib import-rib inet.2
set routing-options rib-groups if-rib import-policy inject_directs
set routing-options autonomous-system 101
```

Device CE2

```
set interfaces fe-0/1/1 unit 0
set interfaces ge-1/2/0 unit 46 description to-PE2
set interfaces ge-1/2/0 unit 46 family inet address 10.0.0.46/30
set interfaces lo0 unit 20 family inet address 10.255.165.20/32 primary
set protocols bgp group ebgp type external
set protocols bgp group ebgp local-address 10.0.0.46
set protocols bgp group ebgp peer-as 100
set protocols bgp group ebgp neighbor 10.0.0.45
set routing-options autonomous-system 102
```

Device PE1

```
set interfaces ge-1/2/0 unit 2 description to-CE1
set interfaces ge-1/2/0 unit 2 family inet address 10.0.0.2/30
set interfaces ge-1/2/1 unit 6 description to-P1
set interfaces ge-1/2/1 unit 6 family inet address 10.0.0.6/30
set interfaces ge-1/2/2 unit 9 description to-P3
set interfaces ge-1/2/2 unit 9 family inet address 10.0.0.9/30
set interfaces lo0 unit 93 family inet address 10.255.165.93/32 primary
set interfaces lo0 unit 93 family inet address 1.1.1.30/32
```

```
set interfaces lo0 unit 93 family inet address 2.2.2.30/32
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.93
set protocols bgp group ibgp family inet unicast
set protocols bgp group ibgp family inet multicast
set protocols bgp group ibgp export nhs_test
set protocols bgp group ibgp export nhs_inet0_self
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols bgp group ebgp type external
set protocols bgp group ebgp local-address 10.0.0.2
set protocols bgp group ebgp family inet unicast
set protocols bgp group ebgp family inet multicast
set protocols bgp group ebgp peer-as 101
set protocols bgp group ebgp neighbor 10.0.0.1
set protocols ospf topology red topology-id 126
set protocols ospf topology blue topology-id 52
set protocols ospf area 0.0.0.0 interface ge-1/2/1.6 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/1.6 topology blue metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/1.6 topology red
set protocols ospf area 0.0.0.0 interface ge-1/2/2.9 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/2.9 topology red metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/2.9 topology blue
set protocols ospf area 0.0.0.0 interface lo0.93 passive
set protocols ospf area 0.0.0.0 interface 1.1.1.30 topology red
set protocols ospf area 0.0.0.0 interface 1.1.1.30 topology blue disable
set protocols ospf area 0.0.0.0 interface 2.2.2.30 topology blue
set protocols ospf area 0.0.0.0 interface 2.2.2.30 topology red disable
set protocols pim rib-group inet mcast-rib
set protocols pim interface ge-1/2/0.2 mode sparse
set protocols pim interface ge-1/2/1.6 mode sparse
set protocols pim interface ge-1/2/2.9 mode sparse
set policy-options policy-statement nhs_inet0_self term a from protocol bgp
set policy-options policy-statement nhs_inet0_self term a from rib inet.0
set policy-options policy-statement nhs_inet0_self term a then next-hop self
set policy-options policy-statement nhs_test term a from protocol bgp
set policy-options policy-statement nhs_test term a from community red
set policy-options policy-statement nhs_test term a then next-hop 1.1.1.30
set policy-options policy-statement nhs_test term a then next policy
set policy-options policy-statement nhs_test term a then accept
set policy-options policy-statement nhs_test term b from protocol bgp
set policy-options policy-statement nhs_test term b from community blue
set policy-options policy-statement nhs_test term b then next-hop 2.2.2.30
set policy-options policy-statement nhs_test term b then next policy
set policy-options policy-statement nhs_test term b then accept
set policy-options policy-statement nhs_test term c then next-hop self
set policy-options community blue members target:50:50
set policy-options community red members target:40:40
set routing-options rib-groups mcast-rib import-rib inet.2
set routing-options autonomous-system 100
set routing-options resolution rib inet.2 resolution-ribs :red.inet.0
set routing-options resolution rib inet.2 resolution-ribs :blue.inet.0
set routing-options topologies family inet topology red
```

```
set routing-options topologies family inet topology blue
```

Device PE2

```
set interfaces ge-1/2/0 unit 38 description to-P2
set interfaces ge-1/2/0 unit 38 family inet address 10.0.0.38/30
set interfaces ge-1/2/1 unit 42 description to-P4
set interfaces ge-1/2/1 unit 42 family inet address 10.0.0.42/30
set interfaces ge-1/2/2 unit 45 description to-CE2
set interfaces ge-1/2/2 unit 45 family inet address 10.0.0.45/30
set interfaces lo0 unit 203 family inet address 10.255.165.203/32 primary
set interfaces lo0 unit 203 family inet address 1.1.1.40/32
set interfaces lo0 unit 203 family inet address 2.2.2.40/32
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.203
set protocols bgp group ibgp family inet unicast
set protocols bgp group ibgp family inet multicast
set protocols bgp group ibgp export nhs_test
set protocols bgp group ibgp export nhs_inet0_self
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.93
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols bgp group ebgp type external
set protocols bgp group ebgp local-address 10.0.0.45
set protocols bgp group ebgp family inet unicast
set protocols bgp group ebgp family inet multicast
set protocols bgp group ebgp peer-as 102
set protocols bgp group ebgp neighbor 10.0.0.46
set protocols ospf topology red topology-id 126
set protocols ospf topology blue topology-id 52
set protocols ospf area 0.0.0.0 interface ge-1/2/0.38 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/0.38 topology blue metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/0.38 topology red
set protocols ospf area 0.0.0.0 interface ge-1/2/1.42 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/1.42 topology red metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/1.42 topology blue
set protocols ospf area 0.0.0.0 interface lo0.203 passive
set protocols ospf area 0.0.0.0 interface 1.1.1.40 topology red
set protocols ospf area 0.0.0.0 interface 1.1.1.40 topology blue disable
set protocols ospf area 0.0.0.0 interface 2.2.2.40 topology red disable
set protocols ospf area 0.0.0.0 interface 2.2.2.40 topology blue
set protocols pim rib-group inet mcast-rib
set protocols pim interface ge-1/2/0.38 mode sparse
set protocols pim interface ge-1/2/1.42 mode sparse
set protocols pim interface ge-1/2/2.45 mode sparse
set policy-options policy-statement nhs then next-hop self
set policy-options policy-statement nhs_inet0_self term a from protocol bgp
set policy-options policy-statement nhs_inet0_self term a from rib inet.0
set policy-options policy-statement nhs_inet0_self term a then next-hop self
set policy-options policy-statement nhs_test term a from protocol bgp
set policy-options policy-statement nhs_test term a from community red
set policy-options policy-statement nhs_test term a then next-hop 1.1.1.40
set policy-options policy-statement nhs_test term a then next policy
set policy-options policy-statement nhs_test term a then accept
set policy-options policy-statement nhs_test term b from protocol bgp
set policy-options policy-statement nhs_test term b from community blue
```

```
set policy-options policy-statement nhs_test term b then next-hop 2.2.2.40
set policy-options policy-statement nhs_test term b then next policy
set policy-options policy-statement nhs_test term b then accept
set policy-options policy-statement nhs_test term c then next-hop self
set policy-options community blue members target:50:50
set policy-options community red members target:40:40
set routing-options rib-groups mcast-rib import-rib inet.2
set routing-options autonomous-system 100
set routing-options resolution rib inet.2 resolution-ribs :red.inet.0
set routing-options resolution rib inet.2 resolution-ribs :blue.inet.0
set routing-options topologies family inet topology red
set routing-options topologies family inet topology blue
```

Device P1

```
set interfaces ge-1/2/0 unit 5 description to-PE1
set interfaces ge-1/2/0 unit 5 family inet address 10.0.0.5/30
set interfaces ge-1/2/1 unit 13 description to-P3
set interfaces ge-1/2/1 unit 13 family inet address 10.0.0.13/30
set interfaces ge-1/2/2 unit 17 description to-P4
set interfaces ge-1/2/2 unit 17 family inet address 10.0.0.17/30
set interfaces ge-1/2/3 unit 33 description to-P2
set interfaces ge-1/2/3 unit 33 family inet address 10.0.0.33/30
set interfaces lo0 unit 99 family inet address 10.255.165.99/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.99
set protocols bgp group ibgp family inet unicast
set protocols bgp group ibgp family inet multicast
set protocols bgp group ibgp neighbor 10.255.165.93
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols ospf topology red topology-id 126
set protocols ospf topology blue topology-id 52
set protocols ospf area 0.0.0.0 interface ge-1/2/3.33 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/3.33 topology red
set protocols ospf area 0.0.0.0 interface ge-1/2/3.33 topology blue metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/2.17
set protocols ospf area 0.0.0.0 interface ge-1/2/1.13
set protocols ospf area 0.0.0.0 interface ge-1/2/0.5 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/0.5 topology red
set protocols ospf area 0.0.0.0 interface ge-1/2/0.5 topology blue metric 1
set protocols ospf area 0.0.0.0 interface lo0.99 passive
set protocols pim rib-group inet mcast-rib
set protocols pim interface ge-1/2/3.33 mode sparse
set protocols pim interface ge-1/2/2.17 mode sparse
set protocols pim interface ge-1/2/1.13 mode sparse
set protocols pim interface ge-1/2/0.5 mode sparse
set routing-options rib-groups mcast-rib import-rib inet.2
set routing-options autonomous-system 100
set routing-options topologies family inet topology red
set routing-options topologies family inet topology blue
```

Device P2

```
set interfaces ge-1/2/0 unit 22 description to-P3
set interfaces ge-1/2/0 unit 22 family inet address 10.0.0.22/30
set interfaces ge-1/2/1 unit 25 description to-P4
```

```
set interfaces ge-1/2/1 unit 25 family inet address 10.0.0.25/30
set interfaces ge-1/2/2 unit 34 description to-P1
set interfaces ge-1/2/2 unit 34 family inet address 10.0.0.34/30
set interfaces ge-1/2/3 unit 37 description to-PE2
set interfaces ge-1/2/3 unit 37 family inet address 10.0.0.37/30
set interfaces lo0 unit 113 family inet address 10.255.165.113/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.113
set protocols bgp group ibgp family inet unicast
set protocols bgp group ibgp family inet multicast
set protocols bgp group ibgp neighbor 10.255.165.93
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols ospf topology red topology-id 126
set protocols ospf topology blue topology-id 52
set protocols ospf area 0.0.0.0 interface ge-1/2/2.34 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/2.34 topology red
set protocols ospf area 0.0.0.0 interface ge-1/2/2.34 topology blue metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/0.22
set protocols ospf area 0.0.0.0 interface ge-1/2/1.25
set protocols ospf area 0.0.0.0 interface ge-1/2/3.37 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/3.37 topology red
set protocols ospf area 0.0.0.0 interface ge-1/2/3.37 topology blue metric 1
set protocols ospf area 0.0.0.0 interface lo0.113 passive
set protocols pim rib-group inet mcast-rib
set protocols pim interface ge-1/2/2.34 mode sparse
set protocols pim interface ge-1/2/0.22 mode sparse
set protocols pim interface ge-1/2/1.25 mode sparse
set protocols pim interface ge-1/2/3.37 mode sparse
set routing-options rib-groups mcast-rib import-rib inet.2
set routing-options autonomous-system 100
set routing-options topologies family inet topology red
set routing-options topologies family inet topology blue
```

Device P3

```
set interfaces ge-1/2/0 unit 10 description to-PE1
set interfaces ge-1/2/0 unit 10 family inet address 10.0.0.10/30
set interfaces ge-1/2/1 unit 14 description to-P1
set interfaces ge-1/2/1 unit 14 family inet address 10.0.0.14/30
set interfaces ge-1/2/2 unit 21 description to-P2
set interfaces ge-1/2/2 unit 21 family inet address 10.0.0.21/30
set interfaces ge-1/2/3 unit 29 description to-P4
set interfaces ge-1/2/3 unit 29 family inet address 10.0.0.29/30
set interfaces lo0 unit 111 family inet address 10.255.165.111/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.111
set protocols bgp group ibgp family inet unicast
set protocols bgp group ibgp family inet multicast
set protocols bgp group ibgp neighbor 10.255.165.93
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.95
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols ospf topology red topology-id 126
set protocols ospf topology blue topology-id 52
```

```
set protocols ospf area 0.0.0.0 interface ge-1/2/3.29 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/3.29 topology red metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/3.29 topology blue
set protocols ospf area 0.0.0.0 interface ge-1/2/2.21
set protocols ospf area 0.0.0.0 interface ge-1/2/1.14
set protocols ospf area 0.0.0.0 interface ge-1/2/0.10 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/0.10 topology red metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/0.10 topology blue
set protocols ospf area 0.0.0.0 interface lo0.111 passive
set protocols pim rib-group inet mcast-rib
set protocols pim interface ge-1/2/3.29 mode sparse
set protocols pim interface ge-1/2/2.21 mode sparse
set protocols pim interface ge-1/2/1.14 mode sparse
set protocols pim interface ge-1/2/0.10 mode sparse
set routing-options rib-groups mcast-rib import-rib inet.2
set routing-options autonomous-system 100
set routing-options topologies family inet topology red
set routing-options topologies family inet topology blue
```

Device P4

```
set interfaces ge-1/2/0 unit 18 description to-P1
set interfaces ge-1/2/0 unit 18 family inet address 10.0.0.18/30
set interfaces ge-1/2/1 unit 26 description to-P2
set interfaces ge-1/2/1 unit 26 family inet address 10.0.0.26/30
set interfaces ge-1/2/2 unit 30 description to-P3
set interfaces ge-1/2/2 unit 30 family inet address 10.0.0.30/30
set interfaces ge-1/2/3 unit 41 description to-PE2
set interfaces ge-1/2/3 unit 41 family inet address 10.0.0.41/30
set interfaces lo0 unit 95 family inet address 10.255.165.95/32 primary
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10.255.165.95
set protocols bgp group ibgp family inet unicast
set protocols bgp group ibgp family inet multicast
set protocols bgp group ibgp neighbor 10.255.165.93
set protocols bgp group ibgp neighbor 10.255.165.113
set protocols bgp group ibgp neighbor 10.255.165.203
set protocols bgp group ibgp neighbor 10.255.165.111
set protocols bgp group ibgp neighbor 10.255.165.99
set protocols ospf topology red topology-id 126
set protocols ospf topology blue topology-id 52
set protocols ospf area 0.0.0.0 interface ge-1/2/2.30 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/2.30 topology red metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/2.30 topology blue
set protocols ospf area 0.0.0.0 interface ge-1/2/0.18
set protocols ospf area 0.0.0.0 interface ge-1/2/1.26
set protocols ospf area 0.0.0.0 interface ge-1/2/3.41 metric 10
set protocols ospf area 0.0.0.0 interface ge-1/2/3.41 topology red metric 1
set protocols ospf area 0.0.0.0 interface ge-1/2/3.41 topology blue
set protocols ospf area 0.0.0.0 interface lo0.95 passive
set protocols pim rib-group inet mcast-rib
set protocols pim interface ge-1/2/2.30 mode sparse
set protocols pim interface ge-1/2/0.18 mode sparse
set protocols pim interface ge-1/2/1.26 mode sparse
set protocols pim interface ge-1/2/3.41 mode sparse
set routing-options rib-groups mcast-rib import-rib inet.2
set routing-options autonomous-system 100
set routing-options topologies family inet topology red
```

```
set routing-options topologies family inet topology blue
```

Configuring Device CE1

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure Device CE1:

1. Configure the interfaces.

   For demonstration purposes, the example places an Ethernet interface into loopback mode and configures several addresses on this loopback interface. The addresses are then announced to the network as direct routes. These routes simulate a group of BGP routes with communities attached.

   ```
   [edit interfaces]
   user@CE1# set fe-0/1/0 fastether-options loopback
   user@CE1# set fe-0/1/0 unit 0 family inet address 11.19.130.1/24
   user@CE1# set fe-0/1/0 unit 0 family inet address 11.19.131.1/24
   user@CE1# set fe-0/1/0 unit 0 family inet address 11.19.132.1/24

   user@CE1# set ge-1/2/0 unit 1 description to-PE1
   user@CE1# set ge-1/2/0 unit 1 family inet address 10.0.0.1/30

   user@CE1# set lo0 unit 97 family inet address 10.255.165.97/32 primary
   ```

2. Configure the external BGP (EBGP) connection to Device PE1.

   The CE router nearest to the multicast servers announces the multicast source IP addresses to the PE routers using EBGP. The source addresses are announced with both **family inet unicast** and **family inet multicast**, thus causing the BGP route to be added to the default routing table, **inet.0**, and to the multicast routing table, **inet.2**. Both sets of routes are injected by the PE router into IBGP.

   ```
   [edit protocols bgp group ebgp]
   user@CE1# set type external
   user@CE1# set local-address 10.0.0.1
   user@CE1# set family inet unicast
   user@CE1# set family inet multicast
   user@CE1# set peer-as 100
   user@CE1# set neighbor 10.0.0.2
   ```

3. Configure PIM on the interfaces.

   ```
   [edit protocols pim]
   user@CE1# set interface fe-0/1/0.0 mode sparse
   user@CE1# set interface ge-1/2/0.1 mode sparse
   ```

4. Configure the routing policy that announces the addresses that are configured on interface fe-0/1/0.

   ```
   [edit policy-options policy-statement inject_directs]
   user@CE1# set term a from protocol direct
   user@CE1# set term a from interface fe-0/1/0.0
   user@CE1# set term a then next policy
   ```

```
user@CE1# set term a then accept
user@CE1# set term b then reject
```

5. Configure the routing policy that tags some routes with the red community attribute and other routes with the blue community attribute.

   The CE router advertises routes through EBGP to the PE router. These routes are advertised as BGP **family inet multicast** routes with communities set for two different groups. Policies identify the two groups of BGP routes.

```
[edit policy-options policy-statement set_community term a]
user@CE1# set from route-filter 11.19.130.0/24 exact
user@CE1# set from route-filter 11.19.131.0/24 exact
user@CE1# set then community add red
user@CE1# set then accept

[edit policy-options policy-statement set_community term b]
user@CE1# set from route-filter 11.19.132.0/24 exact
user@CE1# set from route-filter 11.19.133.0/24 exact
user@CE1# set then community add blue
user@CE1# set then accept

[edit policy-options policy-statement set_community term default]
user@CE1# set then accept

[edit policy-options]
user@CE1# set community blue members target:50:50
user@CE1# set community red members target:40:40
```

6. Apply the **set_community** export policy so that the direct routes are exported into BGP.

   Apply the **inject_directs** export policy to announce the addresses that are configured on interface fe-0/1/0.

```
[edit protocols bgp group ebgp]
user@CE1# set export set_community
user@CE1# set export inject_directs
```

7. Use **rib-groups** to simulate a group of BGP routes with communities attached and announced as multicast routes.

   This configuration creates a multicast routing table and causes PIM to use the multicast routing table **inet.2**.

```
[edit routing-options]
user@CE1# set interface-routes rib-group inet if-rib

user@CE1# set static route 10.0.0.0/16 next-hop 10.0.0.2

[edit routing-options rib-groups]
user@CE1# set inet.2 import-rib inet.0
user@CE1# set if-rib import-rib inet.0
user@CE1# set if-rib import-rib inet.2
user@CE1# set if-rib import-policy inject_directs
```


8. Configure the autonomous system (AS) number.

```
[edit routing-options]
user@CE1# set autonomous-system 101
```

Results From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, **show policy-options**, and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@CE1# show interfaces
fe-0/1/0 {
    fastether-options {
        loopback;
    }
    unit 0 {
        family inet {
            address 11.19.130.1/24;
            address 11.19.131.1/24;
            address 11.19.132.1/24;
        }
    }
}
ge-1/2/0 {
    unit 1 {
        description to-PE1;
        family inet {
            address 10.0.0.1/30;
        }
    }
}
lo0 {
    unit 97 {
        family inet {
            address 10.255.165.97/32 {
                primary;
            }
        }
    }
}
```

```
user@CE1# show protocols
bgp {
    group ebgp {
        type external;
        local-address 10.0.0.1;
        family inet {
            unicast;
            multicast;
        }
        export [ set_community inject_directs ];
        peer-as 100;
        neighbor 10.0.0.2;
    }
}
pim {
```

```
    interface fe-0/1/0.0 {
        mode sparse;
    }
    interface ge-1/2/0.1 {
        mode sparse;
    }
}

user@CE1# show policy-options
policy-statement inject_directs {
    term a {
        from {
            protocol direct;
            interface fe-0/1/0.0;
        }
        then {
            next policy;
            accept;
        }
    }
    term b {
        then reject;
    }
}
policy-statement set_community {
    term a {
        from {
            route-filter 11.19.130.0/24 exact;
            route-filter 11.19.131.0/24 exact;
        }
        then {
            community add red;
            accept;
        }
    }
    term b {
        from {
            route-filter 11.19.132.0/24 exact;
            route-filter 11.19.133.0/24 exact;
        }
        then {
            community add blue;
            accept;
        }
    }
    term default {
        then accept;
    }
}
community blue members target:50:50;
community red members target:40:40;

user@CE1# show routing-options
interface-routes {
    rib-group inet if-rib;
}
static {
```

```
    route 10.0.0.0/16 next-hop 10.0.0.2;
  }
  rib-groups {
    inet.2 {
      import-rib inet.0;
    }
    if-rib {
      import-rib [ inet.0 inet.2 ];
      import-policy inject_directs;
    }
  }
  autonomous-system 101;
```

If you are done configuring the device, enter **commit** from configuration mode.

Configuring Device PE1

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure Device PE1:

1. Configure the interfaces.

   ```
   [edit interfaces]
   user@PE1# set ge-1/2/0 unit 2 description to-CE1
   user@PE1# set ge-1/2/0 unit 2 family inet address 10.0.0.2/30

   user@PE1# set ge-1/2/1 unit 6 description to-P1
   user@PE1# set ge-1/2/1 unit 6 family inet address 10.0.0.6/30

   user@PE1# set ge-1/2/2 unit 9 description to-P3
   user@PE1# set ge-1/2/2 unit 9 family inet address 10.0.0.9/30

   user@PE1# set lo0 unit 93 family inet address 10.255.165.93/32 primary
   ```

2. Configure secondary addresses, 1.1.1.30 and 2.2.2.30.

   A specific protocol next-hop IP address is required for each topology on each router injecting IBGP routes. You can configure multiple secondary loopback IP addresses on a router to be used as protocol next-hop addresses. This configuration shows nonprimary IP addresses 1.1.1.30/32 and 2.2.2.30/32 configured on loopback interface lo0 for use in the red and blue topologies, respectively.

   A group of BGP routes associated with a routing topology use the same unique protocol next hop. For instance, if you configure a PE router to handle two routing topologies, then you would also configure two unique nonprimary addresses under loopback interface lo0.

   ```
   [edit interfaces]
   user@PE1# set lo0 unit 93 family inet address 1.1.1.30/32
   user@PE1# set lo0 unit 93 family inet address 2.2.2.30/32
   ```

3. Associate each nonprimary loopback IP address with a topology for inclusion in the associated topology routing table.

Configure the loopback IP address and topology under an OSPF interface statement. You must specifically disable all other topologies known to OSPF for two reasons. First, the loopback address specific to a topology must reside in only one topology routing table. Second, once the topology is added to OSPF, the topology defaults to being enabled on all subsequent interfaces under OSPF.

The Device PE1 configuration places the loopback address 1.1.1.30/32 into the OSPF database as a stub route under this router's OSPF Router-LSA. It belongs to the red and default topologies, but not to the blue topology. The loopback address 1.1.1.30/32 is installed in the remote core routers' topology routing tables **inet.0** and **:red.inet.0**, (but not in **:blue.inet.0**). Use a similar configuration for the blue loopback address 2.2.2.30/32.

```
[edit protocols ospf]
user@PE1# set topology red topology-id 126
user@PE1# set topology blue topology-id 52

[edit protocols ospf area 0.0.0.0]
user@PE1# set interface 1.1.1.30 topology red
user@PE1# set interface 1.1.1.30 topology blue disable

user@PE1# set interface 2.2.2.30 topology blue
user@PE1# set interface 2.2.2.30 topology red disable
```

4. Enable OSPF on the interfaces, and configure specific OSPF link metrics on topologies to identify paths and build trees to different servers.

   Links can support all routing topologies to provide backup should a primary multicast path fail.

   When a multicast tree gets built through PIM join messages directed toward the source, it follows the most preferred path. A multicast tree to a different multicast source (in a different routing topology) can create another tree along a different path.

   ```
   [edit protocols ospf area 0.0.0.0]
   user@PE1# set interface ge-1/2/1.6 metric 10
   user@PE1# set interface ge-1/2/1.6 topology blue metric 1
   user@PE1# set interface ge-1/2/1.6 topology red

   user@PE1# set interface ge-1/2/2.9 metric 10
   user@PE1# set interface ge-1/2/2.9 topology red metric 1
   user@PE1# set interface ge-1/2/2.9 topology blue

   user@PE1# set interface lo0.93 passive
   ```

5. Create the multicast routing table **inet.2**, and configure PIM to use the **inet.2** routing table.

   Set up a separate routing table for multicast lookups. It is populated with routes from **inet.2**. The **inet.2** routing table is populated by routes of type multicast.

   ```
   [edit routing-options]
   user@PE1# set rib-groups mcast-rib import-rib inet.2
   ```

6. Configure PIM to use the routes in **inet.2**.

```
[edit protocols pim]
user@PE1# set rib-group inet mcast-rib
```

7. Enable PIM on the interfaces.

```
[edit protocols pim]
user@PE1# set interface ge-1/2/0.2 mode sparse
user@PE1# set interface ge-1/2/1.6 mode sparse
user@PE1# set interface ge-1/2/2.9 mode sparse
```

8. Configure the router to perform route resolution on protocol next hops using specified routing tables.

   The protocol next hop is used to determine the forwarding next-hop interface out of which to forward PIM join messages. This configuration directs **inet.2** route resolution to use topology routing tables **:red.inet.0** and **:blue.inet.0** for protocol next-hop IP address lookups.

   You can specify up to two routing tables in the resolution configuration. A key element to this solution is that the protocol next-hop address resides in only one topology routing table. That is, the protocol next hop belongs to a remote PE secondary loopback address and is injected into only one topology routing table. The route resolution scheme first checks routing table **:red.inet.0** for the protocol next-hop address. If the address is found, it uses this entry. If it is not found, the resolution scheme checks routing table **:blue.inet.0**. Hence, only one topology routing table is used for each protocol nexthop address.

```
[edit routing-options resolution rib inet.2]
user@PE1# set resolution-ribs :red.inet.0
user@PE1# set resolution-ribs :blue.inet.0
```

9. Configure the autonomous system (AS) number.

```
[edit routing-options]
user@PE1# set autonomous-system 100
```

10. Configure BGP.

```
[edit protocols bgp group ibgp]
user@PE1# set type internal
user@PE1# set local-address 10.255.165.93
user@PE1# set family inet unicast
user@PE1# set family inet multicast
user@PE1# set neighbor 10.255.165.111
user@PE1# set neighbor 10.255.165.203
user@PE1# set neighbor 10.255.165.113
user@PE1# set neighbor 10.255.165.95
user@PE1# set neighbor 10.255.165.99

[edit protocols bgp group ebgp]
user@PE1# set type external
user@PE1# set local-address 10.0.0.2
user@PE1# set family inet unicast
user@PE1# set family inet multicast
user@PE1# set peer-as 101
user@PE1# set neighbor 10.0.0.1
```

11. Set the protocol next hop when exporting EBGP routes into IBGP.

    Configure the ingress Device PE1 router to set the BGP route's protocol next-hop address when exporting the route into IBGP.

    BGP uses an export policy to set the next hop when injecting the EBGP routes into IBGP.

    This configuration is an export policy where there are three possibilities of next hops being set. Route 1.1.1.30 is associated with the red topology. Route 2.2.2.30 is associated with the blue topology. For the default next-hop self policy, the primary loopback address 10.255.165.93 on Device PE1 is used.

    The **nhs_test** policy sets the protocol next-hop based on the community in the BGP update.

    ```
    [edit policy-options]
    user@PE1# set community blue members target:50:50
    user@PE1# set community red members target:40:40

    [edit policy-options policy-statement nhs_test term a]
    user@PE1# set from protocol bgp
    user@PE1# set from community red
    user@PE1# set then next-hop 1.1.1.30
    user@PE1# set then next policy
    user@PE1# set then accept

    [edit policy-options policy-statement nhs_test term b]
    user@PE1# set from protocol bgp
    user@PE1# set from community blue
    user@PE1# set then next-hop 2.2.2.30
    user@PE1# set then next policy
    user@PE1# set then accept
    user@PE1# set policy-options policy-statement nhs_test term c then next-hop self

    [edit policy-options policy-statement nhs_inet0_self term a]
    user@PE1# set from protocol bgp
    user@PE1# set from rib inet.0
    user@PE1# set then next-hop self
    ```

12. Apply the next-hop self policies to the IBGP sessions.

    ```
    [edit protocols bgp group ibgp]
    user@PE1# set export nhs_test
    user@PE1# set export nhs_inet0_self
    ```

13. Configure the voice and video topologies, which enable you to use these topologies with OSPF and BGP.

    The names **voice** and **video** are local to the router. The names are not propagated beyond this router. However, for management purposes, a consistent naming scheme across routers in a multitopology environment is convenient.

    ```
    [edit routing-options topologies family inet]
    user@PE1# set topology red
    user@PE1# set topology blue
    ```

Results From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, and **show routing-options**, and **show policy-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@PE1# show interfaces
ge-1/2/0 {
    unit 2 {
        description to-CE1;
        family inet {
            address 10.0.0.2/30;
        }
    }
}
ge-1/2/1 {
    unit 6 {
        description to-P1;
        family inet {
            address 10.0.0.6/30;
        }
    }
}
ge-1/2/2 {
    unit 9 {
        description to-P3;
        family inet {
            address 10.0.0.9/30;
        }
    }
}
lo0 {
    unit 93 {
        family inet {
            address 10.255.165.93/32 {
                primary;
            }
            address 1.1.1.30/32;
            address 2.2.2.30/32;
        }
    }
}
```

```
user@PE1# show protocols
bgp {
    group ibgp {
        type internal;
        local-address 10.255.165.93;
        family inet {
            unicast;
            multicast;
        }
        export [ nhs_test nhs_inet0_self ];
        neighbor 10.255.165.111;
        neighbor 10.255.165.203;
        neighbor 10.255.165.113;
        neighbor 10.255.165.95;
```

```
        neighbor 10.255.165.99;
    }
    group ebgp {
        type external;
        local-address 10.0.0.2;
        family inet {
            unicast;
            multicast;
        }
        peer-as 101;
        neighbor 10.0.0.1;
    }
}
ospf {
    topology red topology-id 126;
    topology blue topology-id 52;
    area 0.0.0.0 {
        interface ge-1/2/1.6 {
            metric 10;
            topology blue metric 1;
            topology red;
        }
        interface ge-1/2/2.9 {
            metric 10;
            topology red metric 1;
            topology blue;
        }
        interface lo0.93 {
            passive;
        }
        interface 1.1.1.30 {
            topology red;
            topology blue disable;
        }
        interface 2.2.2.30 {
            topology blue;
            topology red disable;
        }
    }
}
pim {
    rib-group inet mcast-rib;
    interface ge-1/2/0.2 {
        mode sparse;
    }
    interface ge-1/2/1.6 {
        mode sparse;
    }
    interface ge-1/2/2.9 {
        mode sparse;
    }
}
```

```
user@PE1# show policy-options
policy-statement nhs_inet0_self {
    term a {
```

```
      from {
        protocol bgp;
        rib inet.0;
      }
      then {
        next-hop self;
      }
    }
}
policy-statement nhs_test {
    term a {
      from {
        protocol bgp;
        community red;
      }
      then {
        next-hop 1.1.1.30;
        next policy;
        accept;
      }
    }
    term b {
      from {
        protocol bgp;
        community blue;
      }
      then {
        next-hop 2.2.2.30;
        next policy;
        accept;
      }
    }
    term c {
      then {
        next-hop self;
      }
    }
}
community blue members target:50:50;
community red members target:40:40;
```

```
user@PE1# show routing-options
rib-groups {
    mcast-rib {
      import-rib inet.2;
    }
}
autonomous-system 100;
resolution {
    rib inet.2 {
      resolution-ribs [ :red.inet.0 :blue.inet.0 ];
    }
}
topologies {
    family inet {
      topology red;
```

```
        topology blue;
    }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

Checking the IBGP routes in inet.2

Purpose Make sure that the routes injected into IBGP by Device PE1 have next hops that are based on the topology to which they belong.

Action From operational mode, enter the **show route table extensive** command.

```
user@PE1> show route 11.19.130.0/24 table inet.2 extensive
inet.2: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
11.19.130.0/24 (1 entry, 1 announced)
TSI:
Page 0 idx 0 Type 1 val 93e9768
    Flags: Nexthop Change
    Nexthop: 1.1.1.30
    Localpref: 100
    AS path: [100] 101 I
    Communities: target:40:40
Path 11.19.130.0 from 10.0.0.1 Vector len 4.  Val: 0
        *BGP    Preference: 170/-101
                Next hop type: Router, Next hop index: 1180
                Address: 0x94003ec
                Next-hop reference count: 16
                Source: 10.0.0.1
                Next hop: 10.0.0.1 via lt-1/2/0.2, selected
                Session Id: 0x380004
                State: <Active Ext>
                Local AS:   100 Peer AS:   101
                Age: 22
                Validation State: unverified
                Task: BGP_101.10.0.0.1+58346
                Announcement bits (1): 0-BGP_RT_Background
                AS path: 101 I
                Communities: target:40:40
                Accepted
                Localpref: 100
                Router ID: 10.255.165.97
```


Meaning This output shows an IBGP route in the **inet.2** routing table, as seen from Device PE1. The route was originally injected into IBGP by Device PE1, where the next hop was set based on the topology to which the route belonged. The BGP community value determined the topology association.

The route 11.19.130/24 belongs to the red topology because it has a community value of target:40:40. The protocol next hop is 1.1.1.30, and the forwarding next hop is ge-1/2/1.42.

Verifying the Routes

Purpose Make sure that the routes are in the expected routing tables and that the expected communities are attached to the routes.

Action From operational mode, enter the show route detail command on Device PE1.

```
user@PE1> show route 11.19.130.0/24 detail

inet.0: 29 destinations, 30 routes (29 active, 0 holddown, 0 hidden)
11.19.130.0/24 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next hop type: Router, Next hop index: 812
                Address: 0xb9f064c
                Next-hop reference count: 22
                Source: 10.0.0.1
                Next hop: 10.0.0.1 via fe-1/2/0.2, selected
                Session Id: 0x600004
                State: <Active Ext>
                Local AS:   100 Peer AS:   101
                Age: 3d 21:44:07
                Task: BGP_101.10.0.0.1+51873
                Announcement bits (3): 0-KRT 3-BGP_RT_Background 4-Resolve tree
3
                AS path: 101 I
                Communities: target:40:40
                Accepted
                Localpref: 100
                Router ID: 10.255.165.97
                Secondary Tables: :voice.inet.0

:voice.inet.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)

11.19.130.0/24 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next hop type: Router, Next hop index: 812
                Address: 0xb9f064c
                Next-hop reference count: 22
                Source: 10.0.0.1
                Next hop: 10.0.0.1 via fe-1/2/0.2, selected
                Session Id: 0x600004
                State: <Secondary Active IndepResolution Ext>
                Local AS:   100 Peer AS:   101
                Age: 3d 21:44:07
                Task: BGP_101.10.0.0.1+51873
                Announcement bits (2): 0-KRT 1-Resolve tree 1
                AS path: 101 I
                Communities: target:40:40
                Accepted
                Localpref: 100
```

```
                    Router ID: 10.255.165.97
                    Primary Routing Table inet.0
```

Meaning This output shows BGP route 11.19.130.0/24 with community value target:40:40. Because the route matches the criteria for the voice topology, it is added to both the default and voice topology routing tables (**inet.0** and **:voice.inet.0**). Device PE1 learns the route from Device CE1 through EBGP and then injects the route into IBGP.

Checking the Resolving BGP Next Hops

Purpose Check the protocol next hop and forwarding next hop.

Action From operational mode, enter the show route detail command on Device PE2.

```
user@PE2> show route 11.19.130.0/24 detail
inet.0: 29 destinations, 30 routes (29 active, 0 holddown, 0 hidden)
11.19.130.0/24 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next hop type: Indirect
                Address: 0xb9f0e04
                Next-hop reference count: 12
                Source: 10.255.165.93
                Next hop type: Router, Next hop index: 262153
                Next hop: 10.0.0.37 via fe-1/2/0.38
                Session Id: 0x700004
                Next hop: 10.0.0.41 via fe-1/2/1.42, selected
                Session Id: 0x700005
                Protocol next hop: 10.255.165.93
                Indirect next hop: bb8c000 262154 INH Session ID: 0x700007
                State: <Active Int Ext>
                Local AS:   100 Peer AS:   100
                Age: 3d 4:27:40         Metric2: 30
                Task: BGP_100.10.255.165.93+179
                Announcement bits (3): 0-KRT 3-BGP_RT_Background 4-Resolve tree
3
                AS path: 101 I
                Communities: target:40:40
                Accepted
                Localpref: 100
                Router ID: 10.255.165.93
                Secondary Tables: :voice.inet.0

:voice.inet.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)

11.19.130.0/24 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next hop type: Indirect
                Address: 0xb9f0f34
                Next-hop reference count: 6
                Source: 10.255.165.93
                Next hop type: Router, Next hop index: 1188
                Next hop: 10.0.0.37 via fe-1/2/0.38, selected
                Session Id: 0x700004
                Protocol next hop: 10.255.165.93
                Indirect next hop: bb8c1d8 262177 INH Session ID: 0x700007
                State: <Secondary Active IndepResolution Int Ext>
                Local AS:   100 Peer AS:   100
                Age: 3d 2:00:20         Metric2: 30
                Task: BGP_100.10.255.165.93+179
```



```
Announcement bits (2): 0-KRT 1-Resolve tree 1
AS path: 101 I
Communities: target:40:40
Accepted
Localpref: 100
Router ID: 10.255.165.93
Primary Routing Table inet.0
```

Meaning A typical IBGP core has BGP routes with protocol next hops that resolve using the underlying IGP routes. IBGP routes in a topology routing table have protocol next-hop IP addresses. By default, the same topology routing table is used to look up and resolve the protocol next-hop IP address to a forwarding next hop. This output from Device PE2 shows the same BGP route as seen in the previous example: 11.19.130.0/24. The route is being shown from a different perspective, that is, from Device PE2 as an IBGP route. Similarly, this IBGP route is added to both **inet.0** and **:voice.inet.0** on Device PE2. However, while each route has the same protocol next hop, each route has a different forwarding next hop (ge-0/0/3.0 instead of ge-0/1/4.0). The reason for this difference is when the protocol next-hop IP address 10.255.165.93 is resolved, it uses the corresponding routing table (**inet.0** or **:voice.inet.0**) to look up the protocol next hop.

Examining the Protocol Next Hop

Purpose Check the protocol next hop and forwarding next hop.

Action From operational mode, enter the show route command on Device PE2.

```
user@PE2> show route 10.255.165.93
inet.0: 29 destinations, 30 routes (29 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.255.165.93/32   *[OSPF/10] 3d 04:37:26, metric 30
                    > to 10.0.0.37 via fe-1/2/0.38
                      to 10.0.0.41 via fe-1/2/1.42

:voice.inet.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.255.165.93/32   *[OSPF/10] 3d 02:10:04, metric 30
                    > to 10.0.0.37 via fe-1/2/0.38

:video.inet.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.255.165.93/32   *[OSPF/10] 3d 02:03:16, metric 30
                    > to 10.0.0.41 via fe-1/2/1.42
```

Meaning This output from Device PE2 shows the protocol next hop of 11.19.130.0/24, which is IP address 10.255.165.93, thus further demonstrating how IBGP route 11.19.130.0/24 resolves its protocol next hop. The forwarding next hops of 10.255.165.93 match the IBGP forwarding next hops of route 11.19.130/24 as shown in the previous example. Observe here that the IP address 10.255.165.93 is also in routing table **:video.inet.0**. This address is the loopback address of Device PE1, and as such, resides in all three routing tables. This example also shows how traffic entering Device PE2 destined to 11.19.130.0/24 exits different interfaces depending on its associated topology. The actual traffic is marked

in such a way that a firewall filter can direct the traffic to use a particular topology routing table.

Verifying the OSPF Neighbor

Purpose Make sure that the expected topologies are enabled on the OSPF neighbor.

Action From operational mode, enter the show (ospf | ospf3) neighbor **extensive** command on Device P2.

```
user@P2> show ospf neighbor 10.0.0.21 extensive
Address          Interface              State     ID               Pri  Dead
10.0.0.21        fe-1/2/0.22            Full      10.255.165.111   128    39
  Area 0.0.0.0, opt 0x52, DR 10.0.0.22, BDR 10.0.0.21
  Up 3d 06:09:50, adjacent 3d 06:09:50
   Topology default (ID 0) -> Bidirectional
   Topology video (ID 52) -> Bidirectional
```

Meaning This Device P2 output shows OSPF neighbor PE2 (10.0.0.21), where multitopology OSPF default and video are participants. The **Bidirectional** flag shows that the neighbor is configured using the same multitopology OSPF ID.

Checking the Router LSA

Purpose Check the links where video and voice topologies are enabled.

Action From operational mode, enter the show ospf database **extensive** command on Device P2.

```
user@P2> show ospf database lsa-id 10.255.165.203 extensive

    OSPF database, Area 0.0.0.0
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.165.203   10.255.165.203   0x80000063  1552  0x22 0xdff3  80
  bits 0x0, link count 3
  id 10.255.165.203, data 255.255.255.255, Type Stub (3)
    Topology count: 2, Default metric: 0
    Topology video (ID 52) -> Metric: 0
    Topology voice (ID 126) -> Metric: 0
  id 10.0.0.38, data 10.0.0.38, Type Transit (2)
    Topology count: 2, Default metric: 10
    Topology video (ID 52) -> Metric: 200
    Topology voice (ID 126) -> Metric: 10
  id 10.0.0.42, data 10.0.0.42, Type Transit (2)
    Topology count: 1, Default metric: 10
    Topology video (ID 52) -> Metric: 10
  Topology default (ID 0)
    Type: Transit, Node ID: 10.0.0.42
      Metric: 10, Bidirectional
    Type: Transit, Node ID: 10.0.0.38
      Metric: 10, Bidirectional
  Topology video (ID 52)
    Type: Transit, Node ID: 10.0.0.42
      Metric: 10, Bidirectional
    Type: Transit, Node ID: 10.0.0.38
      Metric: 200, Bidirectional
  Topology voice (ID 126)
```

```
    Type: Transit, Node ID: 10.0.0.38
      Metric: 10, Bidirectional
  Aging timer 00:34:08
  Installed 00:25:49 ago, expires in 00:34:08, sent 00:25:47 ago
  Last changed 3d 01:45:51 ago, Change count: 10
```

Meaning This Device P2 output shows the Router-LSA originated by Device PE2. The LSA shows links where video and voice topologies are enabled (in addition to the default topology).

Checking How Traffic Traverses the Network

Purpose Make sure that the expected paths are used.

Action From operational mode, enter the traceroute command on Device CE1.

The first example output shows that a traceroute over the voice topology goes from Device CE1 to Device CE2 where DSCPs are set. The routes are resolved over **:voice.inet.0**. This traceroute path follows the voice path CE1-PE1-P1-P2-PE2-CE2.

```
user@CE1> traceroute 11.19.140.1 source 11.19.130.1 tos 160
traceroute to 11.19.140.1 (11.19.140.1) from 11.19.130.1, 30 hops max, 40 byte
packets
 1  10.0.0.2 (10.0.0.2)  2.015 ms  1.924 ms  1.770 ms
 2  10.0.0.5 (10.0.0.5)  1.890 ms  1.010 ms  0.974 ms
 3  10.0.0.34 (10.0.0.34)  0.986 ms  1.031 ms  0.973 ms
 4  10.0.0.38 (10.0.0.38)  1.213 ms  1.065 ms  1.154 ms
 5  11.19.140.1 (11.19.140.1)  1.696 ms  4.286 ms  1.332 ms
```

This output shows a traceroute from Device CE1 to Device CE2 for voice where no DSCPs are set. The routes are resolved over **inet.0**, and the resulting path is different from the previous case where the DSCPs are set. This traceroute path follows the default path CE1-PE1-P4-PE2-CE2.

```
user@CE1> traceroute 11.19.140.1 source 11.19.130.1

traceroute to 11.19.140.1 (11.19.140.1) from 11.19.130.1, 30 hops max, 40 byte
packets
 1  10.0.0.2 (10.0.0.2)  1.654 ms  1.710 ms  1.703 ms
 2  10.0.0.5 (10.0.0.5)  1.790 ms  1.045 ms  0.975 ms
 3  10.0.0.18 (10.0.0.18)  0.989 ms  1.041 ms  0.983 ms
 4  10.0.0.42 (10.0.0.42)  0.994 ms  1.036 ms  1.002 ms
 5  11.19.140.1 (11.19.140.1)  1.329 ms  2.248 ms  2.225 ms
```

This output shows a traceroute from Device CE1 to Device CE2 for video traffic where the firewall filter is based on the destination address. The routes are resolved over **:video.inet.0**. This traceroute follows the video path CE1-PE1-P3-P4-PE2-CE2.

```
user@CE1> traceroute 11.19.142.1 source 11.19.132.1

traceroute to 11.19.142.1 (11.19.142.1) from 11.19.132.1, 30 hops max, 40 byte
packets
 1  10.0.0.2 (10.0.0.2)  1.126 ms  1.300 ms  0.995 ms
 2  10.0.0.10 (10.0.0.10)  0.981 ms  1.018 ms  0.991 ms
 3  10.0.0.30 (10.0.0.30)  0.997 ms  1.886 ms  1.952 ms
```

```
 4  10.0.0.42 (10.0.0.42)  1.800 ms  1.038 ms  0.980 ms
 5  11.19.142.1 (11.19.142.1)  1.367 ms  1.352 ms  1.328 ms
```

This output shows a traceroute from Device CE1 to Device CE2 for video where DSCPs are set. The DSCP bits are directing Device PE1 to use the topology table **:voice.inet.0**. Because there is no entry in the voice routing table for the video routes, traffic is dropped.

```
user@CE1> traceroute 11.19.142.1 source 11.19.132.1 tos 160

traceroute to 11.19.142.1 (11.19.142.1) from 11.19.132.1, 30 hops max, 40 byte
packets
 1  10.0.0.2 (10.0.0.2)  1.135 ms !N  1.007 ms !N  0.954 ms !N
```

Related Documentation

- Example: Configuring Multitopology Routing Based on Applications on page 13

CHAPTER 4

Multitopology Routing Configuration Statements

community (Protocols BGP)

Syntax

```
community {
    target identifier;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols bgp family (inet | inet6) unicast topology *name*],
[edit logical-systems *logical-system-name* protocols bgp group *group-name* family (inet | inet6) unicast topology *name*],
[edit logical-systems *logical-system-name* protocols bgp group *group-name* neighbor *address* family (inet | inet6) unicast topology *name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols bgp family (inet | inet6) unicast topology *name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols bgp group *group-name* family (inet | inet6) unicast topology *name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols bgp group *group-name* neighbor *address* family (inet | inet6) unicast topology *name*],
[edit protocols bgp family (inet | inet6) unicast topology *name*],
[edit protocols bgp group *group-name* family (inet | inet6) unicast topology *name*],
[edit protocols bgp group *group-name* neighbor *address* family (inet | inet6) unicast topology *name*],
[edit routing-instances *routing-instance-name* protocols bgp family (inet | inet6) unicast topology *name*],
[edit routing-instances *routing-instance-name* protocols bgp group *group-name* family (inet | inet6) unicast topology *name*],
[edit routing-instances *routing-instance-name* protocols bgp group *group-name* neighbor *address* family (inet | inet6) topology *name*]

Release Information

Statement introduced in Junos OS Release 9.0.

Description

Configure the community to identify the multitopology routes. BGP uses the target community identifier to install the routes it learns in the appropriate multitopology routing tables.

Options

target *identifier*—Configure the destination to which the route is going.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring Multitopology Routing Based on Applications on page 13
- *Example: Configuring Origin Validation for BGP*

rib (Multitopology Routing)

Syntax

```
rib routing-table-name {
  static {
    route destination-prefix {
      next-hop;
    }
    static-options;
  }
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* routing-options],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* routing-options],
[edit routing-instances *routing-instance-name* routing-options],
[edit routing-options]

Release Information

Statement support for multitopology routing introduced in Junos OS Release 9.0.
Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description

Configure a static route to install routes in the routing table for a specific topology.

Options

routing-table-name—Name of the routing table for a topology. Use the following format: ***logical-system-name/routing-instance-name*:*topology-name*.*protocol*.*identifier***. Include the routing instance string only if the instance is not the master. The logical system string is included only if the logical system identifier has a value other than 0 (zero). Each routing table for a topology includes a colon (:) before the topology name. ***protocol*** is the protocol family, which can be **inet** or **inet6**. ***identifier*** is the positive integer that specifies the instance of the routing table. For example, to install IPv6 routes to the routing table for a topology named voice in the master instance, include **:voice.inet6.0**.

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Examples: Configuring Static Routes*
- *Examples: Configuring Multiprotocol BGP*
- *Example: Configuring Martian Addresses*
- *static*

topologies (Multitopology Routing)

Syntax

```
topologies {
  family (inet | inet6) {
    topology topology-name;
  }
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* routing-options],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* routing-options],
[edit routing-instances *routing-instance-name* routing-options],
[edit routing-options]

Release Information

Statement introduced in Junos OS Release 9.0.
Statement introduced in Junos OS Release 12.3 for ACX Series routers.

Description

Configure a topology for multitopology routing. Each topology creates a new routing table that is populated with direct routes from the topology.

Options

family—Configure the type of family address type.

inet—IPv4

inet6—IPv6

The remaining statement is explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring Multitopology Routing Based on Applications on page 13
- Example: Configuring Multitopology Routing Based on a Multicast Source on page 39

topology (Filter-Based Forwarding)

Syntax topology *topology-name*;

Hierarchy Level [edit firewall family (inet | inet6) filter *filter-name* term *term-name* then],
[edit firewall family (inet | inet6) filter *filter-name* term *term-name* then logical-system *logical-system-name*],
[edit firewall family (inet | inet6) filter *filter-name* term *term-name* then logical-system *logical-system-name* routing-instance *routing-instance-name*],
[edit firewall family (inet | inet6) filter *filter-name* term *term-name* then routing-instance *routing-instance-name*]

Release Information Statement introduced in Junos OS Release 9.0.

Description Configure a topology for filter-based forwarding for multitopology routing. The firewall filter you apply to the ingress interface is used to look up traffic against the configured topology, and, if a route matches the conditions you configure for the term, the route is accepted and added to the routing table for the specific topology.

There are multiple ways to configure a topology for filter-based forwarding, depending on the type of instance or logical system you want to specify for the forwarding class.

NOTE: The options for logical system and routing instance precede the topology statement with the then statement.

Options ***topology-name***—Name of a topology against which you want to match traffic.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring Multitopology Routing Based on Applications on page 13
- *Routing Policy Feature Guide for Routing Devices*

topology (Multitopology Routing)

Syntax topology *topology-name*;

Hierarchy Level
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* routing-options topologies family (inet | inet6)],
[edit logical-systems *logical-system-name* routing-options topologies family (inet | inet6)],
[edit routing-instances *routing-instance-name* routing-options topologies family (inet | inet6)],
[edit routing-options topologies family (inet | inet6)]

Release Information
Statement introduced in Junos OS Release 9.0.
Statement introduced in Junos OS Release 12.3 for ACX Series routers.

Description Configure the name of a topology configured to run multitopology routing.

Options
topology-name—Name of the topology. Include a string value that describes the type of traffic, such as voice or video. For IPv4 multicast traffic, include **ipv4-multicast** as the name.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring Multitopology Routing Based on Applications on page 13
- Example: Configuring Multitopology Routing Based on a Multicast Source on page 39

topology (OSPF)

Syntax

```
topology (default | ipv4-multicast | name) {
  spf-options {
    delay milliseconds;
    holddown milliseconds;
    rapid-runs number;
  }
  topology-id number;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols ospf],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols ospf],
[edit protocols ospf],
[edit routing-instances *routing-instance-name* protocols ospf]

Release Information

Statement introduced in Junos OS Release 9.0.
Statement introduced in Junos OS Release 11.3 for the QFX Series.

Description

Enable a topology for OSPF multitopology routing. You must first configure one or more topologies under the **[edit routing-options]** hierarchy level.

Options

default—Name of the default topology. This topology is automatically created, and all routes that correspond to it are automatically added to the **inet.0** routing table. You can modify certain default parameters, such as for the SPF algorithm.

ipv4-multicast—Name of the topology for IPv4 multicast traffic.

name—Name of a topology you configured at the **[edit routing-options]** hierarchy level to create a topology for a specific type of traffic, such as voice or video.

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring Multitopology Routing Based on Applications on page 13
- Example: Configuring Multitopology Routing Based on a Multicast Source on page 39

topology (OSPF Interface)

Syntax

```
topology (ipv4-multicast | name) {
    metric metric;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols ospf area *area-id* interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols ospf area *area-id* interface *interface-name*],
[edit protocols ospf area *area-id* interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols ospf area *area-id* interface *interface-name*]

Release Information

Statement introduced in Junos OS Release 9.0.

Description

Configure interface-specific properties for multitopology OSPF, including topology-specific metric values for an interface.

All OSPF interfaces have a cost, which is a routing metric that is used in the link-state calculation. Routes with lower total path metrics are preferred over those with higher path metrics. The default value for the OSPF metric for an interface is 1. You can modify the default value for an OSPF interface and configure a topology-specific metric for that interface. The topology-specific metric applies to routes advertised from the interface that belong only to that topology.

Default

The default value of the topology metric is the same as the default metric value calculated by OSPF or the value configured for the OSPF metric.

Options

ipv4-multicast—Name of the topology for IPv4 multicast traffic.

name—Name of a topology created under the **[edit routing-options]** hierarchy level.

metric *metric*—Cost of a route from an OSPF interface. You can specify a metric value for a topology that is different from the value specified for the interface.

Range: 1 through 65,535

Default: 1

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring Multitopology Routing Based on Applications on page 13
- Example: Configuring Multitopology Routing Based on a Multicast Source on page 39

topology-id

Syntax topology-id *number*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols ospf topology *name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols ospf topology *name*],
[edit protocols ospf topology *name*],
[edit routing-instances *routing-instance-name* protocols ospf topology *name*]

Release Information Statement introduced in Junos OS Release 9.0.

Description Configure a topology identifier for a topology enabled for OSPF.

Default The default identifier for the default topology is 0, and the default identifier for the topology for IPv4 multicast traffic is 1. These identifiers are predefined and cannot be modified.

Options *number*—The integer value used to identify the topology.

Range: 32 through 127

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring Multitopology Routing Based on Applications on page 13
- Example: Configuring Multitopology Routing Based on a Multicast Source on page 39
- topology on page 73

PART 3

Administration

CHAPTER 5

Multitopology Routing Operational Commands

show ospf database

Syntax

show ospf database
<brief | detail | extensive | summary>
<advertising-router (*address* | self)>
<area *area-id*>
<asbrsummary>
<external>
<instance *instance-name*>
<link-local>
<logical-system (all | *logical-system-name*)>
<lsa-id *lsa-id*>
<netsummary>
<network>
<nssa>
<opaque-area>
<router>

Syntax (EX Series Switches and QFX Series)

show ospf database
<brief | detail | extensive | summary>
<advertising-router (*address* | self)>
<area *area-id*>
<asbrsummary>
<external>
<instance *instance-name*>
<link-local>
<lsa-id *lsa-id*>
<netsummary>
<network>
<nssa>
<opaque-area>
<router>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
advertising-router self (***address*** | **self**) option introduced in Junos OS Release 9.5.
advertising-router self (***address*** | **self**) option introduced in Junos OS Release 9.5 for EX Series switches.
Command introduced in Junos OS Release 11.3 for the QFX Series.

Description

Display the entries in the OSPF version 2 (OSPFv2) link-state database, which contains data about link-state advertisement (LSA) packets.

Options

none—Display standard information about entries in the OSPFv2 link-state database for all routing instances.

brief | detail | extensive | summary—(Optional) Display the specified level of output.

advertising-router (*address* | self)—(Optional) Display the LSAs advertised either by a particular routing device or by this routing device.

area *area-id*—(Optional) Display the LSAs in a particular area.

asbrsummary—(Optional) Display summary AS boundary router LSA entries.

external—(Optional) Display external LSAs.

instance *instance-name*—(Optional) Display all OSPF database information under the named routing instance.

link-local—(Optional) Display information about link-local LSAs.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

lsa-id *lsa-id*—(Optional) Display the LSA with the specified LSA identifier.

netsummary—(Optional) Display summary network LSAs.

network—(Optional) Display information about network LSAs.

nssa—(Optional) Display information about not-so-stubby area (NSSA) LSAs.

opaque-area—(Optional) Display opaque area-scope LSAs.

router—(Optional) Display information about router LSAs.

Required Privilege Level view

Related Documentation
- *clear (ospf | ospf3) database*

List of Sample Output
show ospf database on page 84
show ospf database brief on page 84
show ospf database detail on page 84
show ospf database extensive on page 85
show ospf database summary on page 88

Output Fields Table 4 on page 81 describes the output fields for the **show ospf database** command. Output fields are listed in the approximate order in which they appear.

Table 4: show ospf database Output Fields

Field Name	Field Description	Level of Output
area	Area number. Area **0.0.0.0** is the backbone area.	All levels
Type	Type of link advertisement: **ASBRSum**, **Extern**, **Network**, **NSSA**, **OpaqArea**, **Router**, or **Summary**.	All levels
ID	LSA identifier included in the advertisement. An asterisk preceding the identifier marks database entries that originated from the local routing device.	All levels
Adv Rtr	Address of the routing device that sent the advertisement.	All levels
Seq	Link sequence number of the advertisement.	All levels

Table 4: show ospf database Output Fields *(continued)*

Field Name	Field Description	Level of Output
Age	Time elapsed since the LSA was originated, in seconds.	All levels
Opt	Optional OSPF capabilities associated with the LSA.	All levels
Cksum	Checksum value of the LSA.	All levels
Len	Length of the advertisement, in bytes.	All levels
Router	Router link-state advertisement information: • **bits**—Flags describing the routing device that generated the LSP. • **link count**—Number of links in the advertisement. • **id**—ID of a routing device or subnet on the link. • **data**—For stub networks, the subnet mask. Otherwise, the IP address of the routing device that generated the LSP. • **type**—Type of link. It can be **PointToPoint**, **Transit**, **Stub**, or **Virtual**. • **TOS count**—Number of type-of-service (ToS) entries in the advertisement. • **TOS 0 metric**—Metric for ToS 0. • **TOS**—Type-of-service (ToS) value. • **metric**—Metric for the ToS.	**detail extensive**
Network	Network link-state advertisement information: • **mask**—Network mask. • **attached router**—ID of the attached neighbor.	**detail extensive**
Summary	Summary link-state advertisement information: • **mask**—Network mask. • **TOS**—Type-of-service (ToS) value. • **metric**—Metric for the ToS.	**detail extensive**
Gen timer	How long until the LSA is regenerated.	**extensive**
Aging timer	How long until the LSA expires.	**extensive**
Installed *hh:mm:ss* ago	How long ago the route was installed.	**extensive**
expires in *hh:mm:ss*	How long until the route expires.	**extensive**
sent *hh:mm:ss* ago	How long ago the LSA was sent.	**extensive**
Last changed *hh:mm:ss* ago	How long ago the route was changed.	**extensive**
Change count	Number of times the route has changed.	**extensive**

Table 4: show ospf database Output Fields *(continued)*

Field Name	Field Description	Level of Output
Ours	Indicates that this is a local advertisement.	**extensive**
Router LSAs	Number of router link-state advertisements in the link-state database.	**summary**
Network LSAs	Number of network link-state advertisements in the link-state database.	**summary**
Summary LSAs	Number of summary link-state advertisements in the link-state database.	**summary**
NSSA LSAs	Number of not-so-stubby area link-state advertisements in the link-state database.	**summary**

Sample Output

show ospf database

```
user@host> show ospf database
OSPF link state database, Area 0.0.0.1
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.70.103    10.255.70.103    0x80000002   215  0x20 0x4112  48
Router  *10.255.71.242    10.255.71.242    0x80000002   214  0x20 0x11b1  48
Summary *23.1.1.0         10.255.71.242    0x80000002   172  0x20 0x6d72  28
Summary *24.1.1.0         10.255.71.242    0x80000002   177  0x20 0x607e  28
NSSA    *33.1.1.1         10.255.71.242    0x80000002   217  0x28 0x73bd  36

    OSPF link state database, Area 0.0.0.2
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.71.52     10.255.71.52     0x80000004   174  0x20 0xd021  36
Router  *10.255.71.242    10.255.71.242    0x80000003   173  0x20 0xe191  36
Network *23.1.1.1         10.255.71.242    0x80000002   173  0x20 0x9c76  32
Summary *12.1.1.0         10.255.71.242    0x80000001   217  0x20 0xfeec  28
Summary *24.1.1.0         10.255.71.242    0x80000002   177  0x20 0x607e  28
NSSA    *33.1.1.1         10.255.71.242    0x80000001   222  0x28 0xe047  36

    OSPF link state database, Area 0.0.0.3
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.71.238    10.255.71.238    0x80000003   179  0x20 0x3942  36
Router  *10.255.71.242    10.255.71.242    0x80000003   177  0x20 0xf37d  36
Network *24.1.1.1         10.255.71.242    0x80000002   177  0x20 0xc591  32
Summary *12.1.1.0         10.255.71.242    0x80000001   217  0x20 0xfeec  28
Summary *23.1.1.0         10.255.71.242    0x80000002   172  0x20 0x6d72  28
NSSA    *33.1.1.1         10.255.71.242    0x80000001   222  0x28 0xeb3b  36
```

show ospf database brief

The output for the **show ospf database brief** command is identical to that for the **show ospf database** command. For sample output, see show ospf database on page 84.

show ospf database detail

```
user@host> show ospf database detail
    OSPF link state database, Area 0.0.0.1
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.70.103    10.255.70.103    0x80000002   261  0x20 0x4112  48
  bits 0x0, link count 2
  id 10.255.71.242, data 12.1.1.1, Type PointToPoint (1)
  TOS count 0, TOS 0 metric 1
  id 12.1.1.0, data 255.255.255.0, Type Stub (3)
  TOS count 0, TOS 0 metric 1
Router  *10.255.71.242    10.255.71.242    0x80000002   260  0x20 0x11b1  48
  bits 0x3, link count 2
  id 10.255.70.103, data 12.1.1.2, Type PointToPoint (1)
  TOS count 0, TOS 0 metric 1
  id 12.1.1.0, data 255.255.255.0, Type Stub (3)
  TOS count 0, TOS 0 metric 1
Summary *23.1.1.0         10.255.71.242    0x80000002   218  0x20 0x6d72  28
  mask 255.255.255.0
  TOS 0x0, metric 1
Summary *24.1.1.0         10.255.71.242    0x80000002   223  0x20 0x607e  28
  mask 255.255.255.0
  TOS 0x0, metric 1
NSSA    *33.1.1.1         10.255.71.242    0x80000002   263  0x28 0x73bd  36
  mask 255.255.255.255
  Type 2, TOS 0x0, metric 0, fwd addr 12.1.1.2, tag 0.0.0.0

    OSPF link state database, Area 0.0.0.2
```

```
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.71.52     10.255.71.52     0x80000004   220  0x20 0xd021  36
  bits 0x0, link count 1
  id 23.1.1.1, data 23.1.1.2, Type Transit (2)
  TOS count 0, TOS 0 metric 1
Router  *10.255.71.242    10.255.71.242    0x80000003   219  0x20 0xe191  36
  bits 0x3, link count 1
  id 23.1.1.1, data 23.1.1.1, Type Transit (2)
  TOS count 0, TOS 0 metric 1
Network *23.1.1.1         10.255.71.242    0x80000002   219  0x20 0x9c76  32
  mask 255.255.255.0
  attached router 10.255.71.242
  attached router 10.255.71.52
Summary *12.1.1.0         10.255.71.242    0x80000001   263  0x20 0xfeec  28
  mask 255.255.255.0
  TOS 0x0, metric 1
Summary *24.1.1.0         10.255.71.242    0x80000002   223  0x20 0x607e  28
  mask 255.255.255.0
  TOS 0x0, metric 1
NSSA    *33.1.1.1         10.255.71.242    0x80000001   268  0x28 0xe047  36
  mask 255.255.255.255
  Type 2, TOS 0x0, metric 0, fwd addr 23.1.1.1, tag 0.0.0.0

    OSPF link state database, Area 0.0.0.3
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.71.238    10.255.71.238    0x80000003   225  0x20 0x3942  36
  bits 0x0, link count 1
  id 24.1.1.1, data 24.1.1.2, Type Transit (2)
  TOS count 0, TOS 0 metric 1
Router  *10.255.71.242    10.255.71.242    0x80000003   223  0x20 0xf37d  36
  bits 0x3, link count 1
  id 24.1.1.1, data 24.1.1.1, Type Transit (2)
  TOS count 0, TOS 0 metric 1
Network *24.1.1.1         10.255.71.242    0x80000002   223  0x20 0xc591  32
  mask 255.255.255.0
  attached router 10.255.71.242
  attached router 10.255.71.238
Summary *12.1.1.0         10.255.71.242    0x80000001   263  0x20 0xfeec  28
  mask 255.255.255.0
  TOS 0x0, metric 1
Summary *23.1.1.0         10.255.71.242    0x80000002   218  0x20 0x6d72  28
  mask 255.255.255.0
  TOS 0x0, metric 1
NSSA    *33.1.1.1         10.255.71.242    0x80000001   268  0x28 0xeb3b  36
  mask 255.255.255.255
  Type 2, TOS 0x0, metric 0, fwd addr 24.1.1.1, tag 0.0.0.0
```

show ospf database extensive

```
user@host> show ospf database extensive
    OSPF link state database, Area 0.0.0.1
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.70.103    10.255.70.103    0x80000002   286  0x20 0x4112  48
  bits 0x0, link count 2
  id 10.255.71.242, data 12.1.1.1, Type PointToPoint (1)
  TOS count 0, TOS 0 metric 1
  id 12.1.1.0, data 255.255.255.0, Type Stub (3)
  TOS count 0, TOS 0 metric 1
  Aging timer 00:55:14
  Installed 00:04:43 ago, expires in 00:55:14
  Last changed 00:04:43 ago, Change count: 2
Router  *10.255.71.242    10.255.71.242    0x80000002   285  0x20 0x11b1  48
  bits 0x3, link count 2
```

```
  id 10.255.70.103, data 12.1.1.2, Type PointToPoint (1)
  TOS count 0, TOS 0 metric 1
  id 12.1.1.0, data 255.255.255.0, Type Stub (3)
  TOS count 0, TOS 0 metric 1
  Gen timer 00:45:15
  Aging timer 00:55:15
  Installed 00:04:45 ago, expires in 00:55:15, sent 00:04:43 ago
  Last changed 00:04:45 ago, Change count: 2, Ours
Summary *23.1.1.0         10.255.71.242    0x80000002   243  0x20 0x6d72  28
  mask 255.255.255.0
  TOS 0x0, metric 1
  Gen timer 00:45:57
  Aging timer 00:55:57
  Installed 00:04:03 ago, expires in 00:55:57, sent 00:04:01 ago
  Last changed 00:04:48 ago, Change count: 1, Ours
Summary *24.1.1.0         10.255.71.242    0x80000002   248  0x20 0x607e  28
  mask 255.255.255.0
  TOS 0x0, metric 1
  Gen timer 00:45:52
  Aging timer 00:55:52
  Installed 00:04:08 ago, expires in 00:55:52, sent 00:04:06 ago
  Last changed 00:04:48 ago, Change count: 1, Ours
NSSA    *33.1.1.1         10.255.71.242    0x80000002   288  0x28 0x73bd  36
  mask 255.255.255.255
  Type 2, TOS 0x0, metric 0, fwd addr 12.1.1.2, tag 0.0.0.0
  Gen timer 00:45:12
  Aging timer 00:55:12
  Installed 00:04:48 ago, expires in 00:55:12, sent 00:04:48 ago
  Last changed 00:04:48 ago, Change count: 2, Ours

    OSPF link state database, Area 0.0.0.2
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.71.52     10.255.71.52     0x80000004   245  0x20 0xd021  36
  bits 0x0, link count 1
  id 23.1.1.1, data 23.1.1.2, Type Transit (2)
  TOS count 0, TOS 0 metric 1
  Aging timer 00:55:55
  Installed 00:04:02 ago, expires in 00:55:55
  Last changed 00:04:02 ago, Change count: 2
Router  *10.255.71.242    10.255.71.242    0x80000003   244  0x20 0xe191  36
  bits 0x3, link count 1
  id 23.1.1.1, data 23.1.1.1, Type Transit (2)
  TOS count 0, TOS 0 metric 1
  Gen timer 00:45:56
  Aging timer 00:55:56
  Installed 00:04:04 ago, expires in 00:55:56, sent 00:04:02 ago
  Last changed 00:04:04 ago, Change count: 2, Ours
Network *23.1.1.1         10.255.71.242    0x80000002   244  0x20 0x9c76  32
  mask 255.255.255.0
  attached router 10.255.71.242
  attached router 10.255.71.52
  Gen timer 00:45:56
  Aging timer 00:55:56
  Installed 00:04:04 ago, expires in 00:55:56, sent 00:04:02 ago
  Last changed 00:04:04 ago, Change count: 1, Ours
Summary *12.1.1.0         10.255.71.242    0x80000001   288  0x20 0xfeec  28
  mask 255.255.255.0
  TOS 0x0, metric 1
  Gen timer 00:45:12
  Aging timer 00:55:12
  Installed 00:04:48 ago, expires in 00:55:12, sent 00:04:04 ago
```

```
  Last changed 00:04:48 ago, Change count: 1, Ours
Summary *24.1.1.0         10.255.71.242    0x80000002   248  0x20 0x607e  28
  mask 255.255.255.0
  TOS 0x0, metric 1
  Gen timer 00:45:52
  Aging timer 00:55:52
  Installed 00:04:08 ago, expires in 00:55:52, sent 00:04:04 ago
  Last changed 00:04:48 ago, Change count: 1, Ours
NSSA    *33.1.1.1         10.255.71.242    0x80000001   293  0x28 0xe047  36
  mask 255.255.255.255
  Type 2, TOS 0x0, metric 0, fwd addr 23.1.1.1, tag 0.0.0.0
  Gen timer 00:45:07
  Aging timer 00:55:07
  Installed 00:04:53 ago, expires in 00:55:07, sent 00:04:04 ago
  Last changed 00:04:53 ago, Change count: 1, Ours

    OSPF link state database, Area 0.0.0.3
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router   10.255.71.238    10.255.71.238    0x80000003   250  0x20 0x3942  36
  bits 0x0, link count 1
  id 24.1.1.1, data 24.1.1.2, Type Transit (2)
  TOS count 0, TOS 0 metric 1
  Aging timer 00:55:50
  Installed 00:04:07 ago, expires in 00:55:50
  Last changed 00:04:07 ago, Change count: 2
Router  *10.255.71.242    10.255.71.242    0x80000003   248  0x20 0xf37d  36
  bits 0x3, link count 1
  id 24.1.1.1, data 24.1.1.1, Type Transit (2)
  TOS count 0, TOS 0 metric 1
  Gen timer 00:45:52
  Aging timer 00:55:52
  Installed 00:04:08 ago, expires in 00:55:52, sent 00:04:06 ago
  Last changed 00:04:08 ago, Change count: 2, Ours
Network *24.1.1.1         10.255.71.242    0x80000002   248  0x20 0xc591  32
  mask 255.255.255.0
  attached router 10.255.71.242
  attached router 10.255.71.238
  Gen timer 00:45:52
  Aging timer 00:55:52
  Installed 00:04:08 ago, expires in 00:55:52, sent 00:04:06 ago
  Last changed 00:04:08 ago, Change count: 1, Ours
Summary *12.1.1.0         10.255.71.242    0x80000001   288  0x20 0xfeec  28
  mask 255.255.255.0
  TOS 0x0, metric 1
  Gen timer 00:45:12
  Aging timer 00:55:12
  Installed 00:04:48 ago, expires in 00:55:12, sent 00:04:13 ago
  Last changed 00:04:48 ago, Change count: 1, Ours
Summary *23.1.1.0         10.255.71.242    0x80000002   243  0x20 0x6d72  28
  mask 255.255.255.0
  TOS 0x0, metric 1
  Gen timer 00:45:57
  Aging timer 00:55:57
  Installed 00:04:03 ago, expires in 00:55:57, sent 00:04:01 ago
  Last changed 00:04:48 ago, Change count: 1, Ours
NSSA    *33.1.1.1         10.255.71.242    0x80000001   293  0x28 0xeb3b  36
  mask 255.255.255.255
  Type 2, TOS 0x0, metric 0, fwd addr 24.1.1.1, tag 0.0.0.0
  Gen timer 00:45:07
  Aging timer 00:55:07
  Installed 00:04:53 ago, expires in 00:55:07, sent 00:04:13 ago
```

```
  Last changed 00:04:53 ago, Change count: 1, Ours
```

show ospf database summary

```
user@host> show ospf database summary
Area 0.0.0.1:
   2 Router LSAs
   2 Summary LSAs
   1 NSSA LSAs
Area 0.0.0.2:
   2 Router LSAs
   1 Network LSAs
   2 Summary LSAs
   1 NSSA LSAs
Area 0.0.0.3:
   2 Router LSAs
   1 Network LSAs
   2 Summary LSAs
   1 NSSA LSAs
Externals:
Interface fe-2/2/1.0:
Interface ge-0/3/2.0:
Interface so-0/1/2.0:
Interface so-0/1/2.0:
```

show ospf3 database

Syntax

show ospf3 database
<brief | detail | extensive | summary>
<advertising-router (*address* | self)>
<area *area-id*>
<external>
<instance *instance-name*>
<inter-area-prefix>
<inter-area-router>
<intra-area-prefix>
<link>
<link-local>
<logical-system (all | *logical-system-name*)>
<lsa-id *lsa-id*>
<network>
<nssa>
<realm (ipv4-multicast | ipv4-unicast | ipv6-multicast)>
<router>

Syntax (EX Series Switches and QFX Series)

show ospf3 database
<brief | detail | extensive | summary>
<advertising-router (*address* | self)>
<area *area-id*>
<external>
<instance *instance-name*>
<inter-area-prefix>
<inter-area-router>
<intra-area-prefix>
<link>
<link-local>
<lsa-id *lsa-id*>
<network>
<nssa>
<router>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
realm option introduced in Junos OS Release 9.2.
advertising-router (***address*** | **self**) option introduced in Junos Relase 9.5.
advertising-router (***address*** | **self**) option introduced in Junos OS Release 9.5 for EX Series switches.
Command introduced in Junos OS Release 11.3 for the QFX Series.

Description

Display the entries in the OSPF version 3 (OSPFv3) link-state database, which contains data about link-state advertisement (LSA) packets.

Options

none—Display standard information about all entries in the OSPFv3 link-state database.

brief | detail | extensive | summary—(Optional) Display the specified level of output.

advertising-router (*address* | self)—(Optional) Display the LSAs advertised either by a particular routing device or by this routing device.

area *area-id*—(Optional) Display the LSAs in a particular area.

external—(Optional) Display external LSAs.

instance *instance-name*—(Optional) Display all OSPF database information under the named routing instance.

inter-area-prefix—(Optional) Display information about interarea-prefix LSAs.

inter-area-router—(Optional) Display information about interarea-router LSAs.

intra-area-prefix—(Optional) Display information about intra-area-prefix LSAs.

link—(Optional) Display information about link LSAs.

link-local—(Optional) Display information about link-local LSAs.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

lsa-id *lsa-id*—(Optional) Display the LSA with the specified LSA identifier.

network—(Optional) Display information about network LSAs.

nssa—(Optional) Display information about not-so-stubby area (NSSA) LSAs.

realm (ipv4-multicast | ipv4-unicast | ipv6-multicast)—(Optional) Display information about the specified OSPFv3 realm, or address family. Use the **realm** option to specify an address family other than IPv6 unicast, which is the default.

router—(Optional) Display information about router LSAs.

Required Privilege Level view

Related Documentation
- *clear (ospf | ospf3) database*

List of Sample Output
show ospf3 database brief on page 96
show ospf3 database extensive on page 96
show ospf3 database summary on page 99

Output Fields Table 5 on page 90 lists the output fields for the **show ospf3 database** command. Output fields are listed in the approximate order in which they appear.

Table 5: show ospf3 database Output Fields

Field Name	Field Description	Level of Output
OSPF link state database, area *area-number*	Entries in the link-state database for this area.	**brief detail extensive**
OSPF AS SCOPE link state database	Entries in the AS scope link-state database.	**brief detail extensive**

Table 5: show ospf3 database Output Fields *(continued)*

Field Name	Field Description	Level of Output
OSPF Link-Local link state database, interface *interface-name*	Entries in the link-local link-state database for this interface.	**brief detail extensive**
area	Area number. Area **0.0.0.0** is the backbone area.	All levels
Type	Type of link advertisement: **Extern**, **InterArPfx**, **InterArRtr**, **IntraArPrx** , **Link**, **Network**, **NSSA**, or **Router**.	**brief detail extensive**
ID	Link identifier included in the advertisement. An asterisk (*) preceding the identifier marks database entries that originated from the local routing device.	**brief detail extensive**
Adv Rtr	Address of the routing device that sent the advertisement.	**brief detail extensive**
Seq	Link sequence number of the advertisement.	**brief detail extensive**
Age	Time elapsed since the LSA was originated, in seconds.	**brief detail extensive**
Cksum	Checksum value of the LSA.	**brief detail extensive**
Len	Length of the advertisement, in bytes.	**brief detail extensive**
Router (Router Link-State Advertisements)		
bits	Flags describing the routing device that generated the LSP.	**detail extensive**
Options	Option bits carried in the router LSA.	**detail extensive**
For Each Router Link		
Type	Type of interface. The value of all other output fields describing a routing device interface depends on the interface's type: • **PointToPoint (1)**—Point-to-point connection to another routing device. • **Transit (2)**—Connection to a transit network. • **Virtual (4)**—Virtual link.	**detail extensive**
Loc-if-id	Local interface ID assigned to the interface that uniquely identifies the interface with the routing device.	**detail extensive**
Nbr-if-id	Interface ID of the neighbor's interface for this routing device link.	**detail extensive**
Nbr-rtr-id	Router ID of the neighbor routing device (for type 2 interfaces, the attached link's designated router).	**detail extensive**
Metric	Cost of the router link.	**detail extensive**
Gen timer	How long until the LSA is regenerated, in the format ***hours*:*minutes*:*seconds***.	**extensive**

Table 5: show ospf3 database Output Fields *(continued)*

Field Name	Field Description	Level of Output
Aging timer	How long until the LSA expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Installed *nn*:*nn*:*nn* ago	How long ago the route was installed, in the format ***hours*:*minutes*:*seconds***.	**extensive**
expires in *nn*:*nn*:*nn*	How long until the route expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**
sent *nn*:*nn*:*nn* ago	Time elapsed since the LSA was last transmitted or flooded to an adjacency or an interface, respectively, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Ours	Indicates that this is a local advertisement.	**extensive**
Network (Network Link-State Advertisements)		
Options	Option bits carried in the network LSA.	**detail extensive**
Attached Router	Router IDs of each of the routing devices attached to the link. Only routing devices that are fully adjacent to the designated router are listed. The designated router includes itself in this list.	**detail extensive**
InterArPfx (Interarea-Prefix Link-State Advertisements)		
Prefix	IPv6 address prefix.	**detail extensive**
Prefix-options	Option bit associated with the prefix.	**detail extensive**
Metric	Cost of this route. Expressed in the same units as the interface costs in the router LSAs. When the interarea-prefix LSA is describing a route to a range of addresses, the cost is set to the maximum cost to any reachable component of the address range.	**detail extensive**
Gen timer	How long until the LSA is regenerated, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Aging timer	How long until the LSA expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Installed *nn*:*nn*:*nn* ago	How long ago the route was installed, in the format ***hours*:*minutes*:*seconds***.	**extensive**
expires in *nn*:*nn*:*nn*	How long until the route expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**
sent *nn*:*nn*:*nn* ago	Time elapsed since the LSA was last transmitted or flooded to an adjacency or an interface, respectively, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Ours	Indicates that this is a local advertisement.	**extensive**
InterArRtr (Interarea-Router Link-State Advertisements)		
Dest-router-id	Router ID of the routing device described by the LSA.	**detail extensive**
options	Optional capabilities supported by the routing device.	**detail extensive**

Table 5: show ospf3 database Output Fields *(continued)*

Field Name	Field Description	Level of Output
Metric	Cost of this route. Expressed in the same units as the interface costs in the router LSAs. When the interarea-prefix LSA is describing a route to a range of addresses, the cost is set to the maximum cost to any reachable component of the address range.	**detail extensive**
Prefix	IPv6 address prefix.	**extensive**
Prefix-options	Option bit associated with the prefix.	**extensive**
Extern (External Link-State Advertisements)		
Prefix	IPv6 address prefix.	**detail extensive**
Prefix-options	Option bit associated with the prefix.	**detail extensive**
Metric	Cost of the route, which depends on the value of **Type**.	**detail extensive**
Type *n*	Type of external metric: **Type 1** or **Type 2**.	**detail extensive**
Aging timer	How long until the LSA expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Installed *nn:nn:nn* **ago**	How long ago the route was installed, in the format ***hours*:*minutes*:*seconds***.	**extensive**
expires in *nn:nn:nn*	How long until the route expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**
sent *nn:nn:nn* **ago**	Time elapsed since the LSA was last transmitted or flooded to an adjacency or an interface, respectively, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Link (Link-State Advertisements)		
IPv6-Address	IPv6 link-local address on the link for which this link LSA originated.	**detail extensive**
Options	Option bits carried in the link LSA.	**detail extensive**
priority	Router priority of the interface attaching the originating routing device to the link.	**detail extensive**
Prefix-count	Number of IPv6 address prefixes contained in the LSA. The rest of the link LSA contains a list of IPv6 prefixes to be associated with the link.	**detail extensive**
Prefix	IPv6 address prefix.	**detail extensive**
Prefix-options	Option bit associated with the prefix.	**detail extensive**
Gen timer	How long until the LSA is regenerated, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Aging timer	How long until the LSA expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**

Table 5: show ospf3 database Output Fields *(continued)*

Field Name	Field Description	Level of Output
Installed *nn:nn:nn* ago	How long ago the route was installed, in the format ***hours*:*minutes*:*seconds***.	**extensive**
expires in *nn:nn:nn*	How long until the route expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**
sent *nn:nn:nn* ago	Time elapsed since the LSA was last transmitted or flooded to an adjacency or an interface, respectively, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Ours	Indicates that this is a local advertisement.	**extensive**
IntraArPfx (Intra-Area-Prefix Link-State Advertisements)		
Ref-lsa-type	LSA type of the referenced LSA. • **Router**—Address prefixes are associated with a router LSA. • **Network**—Address prefixes are associated with a network LSA.	**detail extensive**
Ref-lsa-id	Link-state ID of the referenced LSA.	**detail extensive**
Ref-router-id	Advertising router ID of the referenced LSA.	**detail extensive**
Prefix-count	Number of IPv6 address prefixes contained in the LSA. The rest of the link LSA contains a list of IPv6 prefixes to be associated with the link.	**detail extensive**
Prefix	IPv6 address prefix.	**detail extensive**
Prefix-options	Option bit associated with the prefix.	**detail extensive**
Metric	Cost of this prefix. Expressed in the same units as the interface costs in the router LSAs.	**detail extensive**
Gen timer	How long until the LSA is regenerated, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Aging timer	How long until the LSA expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**
Installed *hh*:*mm*:*ss* ago	How long ago the route was installed, in the format ***hours*:*minutes*:*seconds***.	**extensive**
expires in *hh*:*mm*:*ss*	How long until the route expires, in the format ***hours*:*minutes*:*seconds***.	**extensive**
sent *hh*:*mm*:*ss* ago	Time elapsed since the LSA was last transmitted or flooded to an adjacency or an interface, respectively, in the format ***hours*:*minutes*:*seconds***.	**extensive**
***n* Router LSAs**	Number of router LSAs in the link-state database.	**summary**
***n* Network LSAs**	Number of network LSAs in the link-state database.	**summary**
***n* InterArPfx LSAs**	Number of interarea-prefix LSAs in the link-state database.	**summary**

Table 5: show ospf3 database Output Fields *(continued)*

Field Name	Field Description	Level of Output
***n* InterArRtr LSAs**	Number of interarea-router LSAs in the link-state database.	**summary**
***n* IntraArPfx LSAs**	Number of intra-area-prefix LSAs in the link-state database.	**summary**
Externals	Display of the external LSA database.	**summary**
***n* Extern LSAs**	Number of external LSAs in the link-state database.	**summary**
Interface ***interface-name***	Name of the interface for which link-local LSA information is displayed.	**summary**
***n* Link LSAs**	Number of link LSAs in the link-state database.	**summary**

Sample Output

show ospf3 database brief

```
user@host> show ospf3 database brief
    OSPF3 link state database, area 0.0.0.0
 Type       ID               Adv Rtr           Seq         Age  Cksum  Len
Router      0.0.0.1          10.255.4.85       0x80000003   885  0xa697  40
Router     *0.0.0.1          10.255.4.93       0x80000002   953  0xc677  40
InterArPfx *0.0.0.2          10.255.4.93       0x80000001   910  0xb96f  44
InterArRtr *0.0.0.1          10.255.4.93       0x80000001   910  0xe159  32
IntraArPfx *0.0.0.1          10.255.4.93       0x80000002   432  0x788f  72

    OSPF3 link state database, area 0.0.0.1
 Type       ID               Adv Rtr           Seq         Age  Cksum  Len
Router     *0.0.0.1          10.255.4.93       0x80000003   916  0xea40  40
Router      0.0.0.1          10.255.4.97       0x80000006   851  0xc95b  40
Network     0.0.0.2          10.255.4.97       0x80000002   916  0x4598  32
InterArPfx *0.0.0.1          10.255.4.93       0x80000002   117  0xa980  44
InterArPfx *0.0.0.2          10.255.4.93       0x80000002    62  0xd47e  44
NSSA        0.0.0.1          10.255.4.97       0x80000002   362  0x45ee  44
IntraArPfx  0.0.0.1          10.255.4.97       0x80000006   851  0x2f77  52

    OSPF3 AS SCOPE link state database
 Type       ID               Adv Rtr           Seq         Age  Cksum  Len
Extern      0.0.0.1          10.255.4.85       0x80000002    63  0x9b86  44
Extern     *0.0.0.1          10.255.4.93       0x80000001   910  0x59c9  44

    OSPF3 Link-Local link state database, interface ge-1/3/0.0
 Type       ID               Adv Rtr           Seq         Age  Cksum  Len
Link       *0.0.0.2          10.255.4.93       0x80000003   916  0x4dab  64
```

show ospf3 database extensive

```
user@host> show ospf3 database extensive
    OSPF3 link state database, area 0.0.0.0
 Type       ID               Adv Rtr           Seq         Age  Cksum  Len
Router      0.0.0.1          10.255.4.85       0x80000003  1028  0xa697  40
  bits 0x2, Options 0x13
  Type PointToPoint (1), Metric 10
      Loc-If-Id 2, Nbr-If-Id 3, Nbr-Rtr-Id 10.255.4.93
  Aging timer 00:42:51
  Installed 00:17:05 ago, expires in 00:42:52, sent 02:37:54 ago
Router     *0.0.0.1          10.255.4.93       0x80000002  1096  0xc677  40
  bits 0x3, Options 0x13
  Type PointToPoint (1), Metric 10
      Loc-If-Id 3, Nbr-If-Id 2, Nbr-Rtr-Id 10.255.4.85
  Gen timer 00:00:40
  Aging timer 00:41:44
  Installed 00:18:16 ago, expires in 00:41:44, sent 00:18:14 ago
  Ours
InterArPfx *0.0.0.2          10.255.4.93       0x80000001  1053  0xb96f  44
  Prefix feee::10:10:2:0/126
  Prefix-options 0x0, Metric 10
  Gen timer 00:17:02
  Aging timer 00:42:26
  Installed 00:17:33 ago, expires in 00:42:27, sent 00:17:31 ago
  Ours
InterArPfx *0.0.0.3          10.255.4.93       0x80000001  1053  0x71d3  44
  Prefix feee::10:255:4:97/128
  Prefix-options 0x0, Metric 10
  Gen timer 00:21:07
  Aging timer 00:42:26
```

```
  Installed 00:17:33 ago, expires in 00:42:27, sent 00:17:31 ago
  Ours
InterArRtr *0.0.0.1          10.255.4.93      0x80000001  1053  0xe159  32
  Dest-router-id 10.255.4.97, Options 0x19, Metric 10
  Gen timer 00:29:18
  Aging timer 00:42:26
  Installed 00:17:33 ago, expires in 00:42:27, sent 00:17:31 ago
  Ours
IntraArPfx  0.0.0.1          10.255.4.85      0x80000002  1028  0x2403  72
  Ref-lsa-type Router, Ref-lsa-id 0.0.0.0, Ref-router-id 10.255.4.85
  Prefix-count 2
  Prefix feee::10:255:4:85/128
    Prefix-options 0x2, Metric 0
  Prefix feee::10:10:1:0/126
    Prefix-options 0x0, Metric 10
  Aging timer 00:42:51
  Installed 00:17:05 ago, expires in 00:42:52, sent 02:37:54 ago
IntraArPfx *0.0.0.1          10.255.4.93      0x80000002   575  0x788f  72
  Ref-lsa-type Router, Ref-lsa-id 0.0.0.0, Ref-router-id 10.255.4.93
  Prefix-count 2
  Prefix feee::10:255:4:93/128
    Prefix-options 0x2, Metric 0
  Prefix feee::10:10:1:0/126
    Prefix-options 0x0, Metric 10
  Gen timer 00:33:23
  Aging timer 00:50:24
  Installed 00:09:35 ago, expires in 00:50:25, sent 00:09:33 ago
    OSPF3 link state database, area 0.0.0.1
 Type       ID               Adv Rtr           Seq         Age  Cksum  Len
Router     *0.0.0.1          10.255.4.93      0x80000003  1059  0xea40  40
  bits 0x3, Options 0x19
  Type Transit (2), Metric 10
      Loc-If-Id 2, Nbr-If-Id 2, Nbr-Rtr-Id 10.255.4.97
  Gen timer 00:08:51
  Aging timer 00:42:20
  Installed 00:17:39 ago, expires in 00:42:21, sent 00:17:37 ago
Router      0.0.0.1          10.255.4.97      0x80000006   994  0xc95b  40
  bits 0x2, Options 0x19
  Type Transit (2), Metric 10
      Loc-If-Id 2, Nbr-If-Id 2, Nbr-Rtr-Id 10.255.4.97
  Aging timer 00:43:25
  Installed 00:16:31 ago, expires in 00:43:26, sent 02:37:54 ago
Network     0.0.0.2          10.255.4.97      0x80000002  1059  0x4598  32
  Options 0x11
  Attached router 10.255.4.97
  Attached router 10.255.4.93
  Aging timer 00:42:20
  Installed 00:17:36 ago, expires in 00:42:21, sent 02:37:54 ago
InterArPfx *0.0.0.1          10.255.4.93      0x80000002   260  0xa980  44
  Prefix feee::10:10:1:0/126
  Prefix-options 0x0, Metric 10
  Gen timer 00:45:39
  Aging timer 00:55:39
  Installed 00:04:20 ago, expires in 00:55:40, sent 00:04:18 ago
  Ours
InterArPfx *0.0.0.2          10.255.4.93      0x80000002   205  0xd47e  44
  Prefix feee::10:255:4:93/128
  Prefix-options 0x0, Metric 0
  Gen timer 00:46:35
  Aging timer 00:56:35
  Installed 00:03:25 ago, expires in 00:56:35, sent 00:03:23 ago
```

```
  Ours
InterArPfx *0.0.0.3          10.255.4.93      0x80000001  1089  0x9bbb  44
  Prefix feee::10:255:4:85/128
  Prefix-options 0x0, Metric 10
  Gen timer 00:04:46
  Aging timer 00:41:51
  Installed 00:18:09 ago, expires in 00:41:51, sent 00:17:43 ago
  Ours
NSSA        0.0.0.1          10.255.4.97      0x80000002   505  0x45ee  44
  Prefix feee::200:200:1:0/124
  Prefix-options 0x8, Metric 10, Type 2,
  Aging timer 00:51:35
  Installed 00:08:22 ago, expires in 00:51:35, sent 02:37:54 ago
IntraArPfx  0.0.0.1          10.255.4.97      0x80000006   994  0x2f77  52
  Ref-lsa-type Router, Ref-lsa-id 0.0.0.0, Ref-router-id 10.255.4.97
  Prefix-count 1
  Prefix feee::10:255:4:97/128
    Prefix-options 0x2, Metric 0
  Aging timer 00:43:25
  Installed 00:16:31 ago, expires in 00:43:26, sent 02:37:54 ago
IntraArPfx  0.0.0.3          10.255.4.97      0x80000002  1059  0x4446  52
  Ref-lsa-type Network, Ref-lsa-id 0.0.0.2, Ref-router-id 10.255.4.97
  Prefix-count 1
  Prefix feee::10:10:2:0/126
    Prefix-options 0x0, Metric 0
  Aging timer 00:42:20
  Installed 00:17:36 ago, expires in 00:42:21, sent 02:37:54 ago
    OSPF3 AS SCOPE link state database
 Type       ID               Adv Rtr           Seq         Age  Cksum  Len
Extern      0.0.0.1          10.255.4.85      0x80000002   206  0x9b86  44
  Prefix feee::100:100:1:0/124
  Prefix-options 0x0, Metric 20, Type 2,
  Aging timer 00:56:34
  Installed 00:03:23 ago, expires in 00:56:34, sent 02:37:54 ago
Extern     *0.0.0.1          10.255.4.93      0x80000001  1053  0x59c9  44
  Prefix feee::200:200:1:0/124
  Prefix-options 0x0, Metric 10, Type 2,
  Gen timer 00:25:12
  Aging timer 00:42:26
  Installed 00:17:33 ago, expires in 00:42:27, sent 00:17:31 ago

    OSPF3 Link-Local link state database, interface ge-1/3/0
 Type       ID               Adv Rtr           Seq         Age  Cksum  Len
Link       *0.0.0.2          10.255.4.93      0x80000003  1059  0x4dab  64
  fe80::290:69ff:fe39:1cdb
  Options 0x11, priority 128
  Prefix-count 1
  Prefix feee::10:10:2:0/126 Prefix-options 0x0
  Gen timer 00:12:56
  Aging timer 00:42:20
  Installed 00:17:39 ago, expires in 00:42:21, sent 00:17:37 ago
Link        0.0.0.2          10.255.4.97      0x80000003   205  0xa87d  64
  fe80::290:69ff:fe38:883e
  Options 0x11, priority 128
  Prefix-count 1
  Prefix feee::10:10:2:0/126 Prefix-options 0x0
  Aging timer 00:56:35
  Installed 00:03:22 ago, expires in 00:56:35, sent 02:37:54 ago

    OSPF3 Link-Local link state database, interface so-2/2/0.0
 Type       ID               Adv Rtr           Seq         Age  Cksum  Len
```

```
Link        0.0.0.2          10.255.4.85      0x80000002   506  0x42bb  64
  fe80::280:42ff:fe10:f169
  Options 0x13, priority 128
  Prefix-count 1
  Prefix feee::10:10:1:0/126 Prefix-options 0x0
  Aging timer 00:51:34
  Installed 00:08:23 ago, expires in 00:51:34, sent 02:37:54 ago
Link       *0.0.0.3          10.255.4.93      0x80000002   505  0x6b7a  64
  fe80::280:42ff:fe10:f177
  Options 0x13, priority 128
  Prefix-count 1
  Prefix feee::10:10:1:0/126 Prefix-options 0x0
  Gen timer 00:37:28
  Aging timer 00:51:35
  Installed 00:08:25 ago, expires in 00:51:35, sent 00:08:23 ago
  Ours
```

show ospf3 database summary

```
user@host> show ospf3 database summary
Area 0.0.0.0:
   2 Router LSAs
   1 InterArPfx LSAs
   1 InterArRtr LSAs
   1 IntraArPfx LSAs
Area 0.0.0.1:
   2 Router LSAs
   1 Network LSAs
   2 InterArPfx LSAs
   1 NSSA LSAs
   1 IntraArPfx LSAs
Externals:
   2 Extern LSAs
Interface ge-1/3/0.0:
   1 Link LSAs
Interface lo0.0:
Interface so-2/2/0.0:
   1 Link LSAs
```

show (ospf | ospf3) interface

Syntax

show (ospf | ospf3) interface
<brief | detail | extensive>
<area *area-id*>
<*interface-name*>
<instance *instance-name*>
<logical-system (all | *logical-system-name*)>
<realm (ip4-multicast | ipv4-unicast | ipv6-multicast)>

Syntax (EX Series Switches and QFX Series)

show (ospf | ospf3) interface
<brief | detail | extensive>
<area *area-id*>
<*interface-name*>
<instance *instance-name*>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
area option introduced in Junos OS Release 9.2.
area option introduced in Junos OS Release 9.2 for EX Series switches.
realm option introduced in Junos OS Release 9.2.
Command introduced in Junos OS Release 11.3 for the QFX Series.

Description

Display the status of OSPF interfaces.

Options

none—Display standard information about the status of all OSPF interfaces for all routing instances

brief | detail | extensive—(Optional) Display the specified level of output.

area *area-id*—(Optional) Display information about the interfaces that belong to the specified area.

interface-name—(Optional) Display information for the specified interface.

instance *instance-name*—(Optional) Display all OSPF interfaces under the named routing instance.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

realm (ipv4-multicast | ipv4-unicast | ipv6-multicast)—(OSPFv3 only) (Optional) Display information about the interfaces for the specified OSPFv3 realm, or address family. Use the **realm** option to specify an address family for OSPFv3 other than IPv6 unicast, which is the default.

Required Privilege Level

view

List of Sample Output

show ospf interface brief on page 103
show ospf interface detail on page 103
show ospf3 interface detail on page 103

show ospf interface detail(When Multiarea Adjacency Is Configured) on page 103
show ospf interface area area-id on page 104
show ospf interface extensive (When Flooding Reduction Is Enabled) on page 104
show ospf interface extensive (When LDP Synchronization Is Configured) on page 105

Output Fields Table 6 on page 101 lists the output fields for the **show (ospf | ospf3) interface** command. Output fields are listed in the approximate order in which they appear.

Table 6: show (ospf | ospf3) interface Output Fields

Field Name	Field Description	Level of Output
Interface	Name of the interface running OSPF version 2 or OSPF version 3.	All levels
State	State of the interface: **BDR**, **Down**, **DR**, **DRother**, **Loop**, **PtToPt**, or **Waiting**.	All levels
Area	Number of the area that the interface is in.	All levels
DR ID	Address of the area's designated router.	All levels
BDR ID	Backup designated router for a particular subnet.	All levels
Nbrs	Number of neighbors on this interface.	All levels
Type	Type of interface: **LAN**, **NBMA**, **P2MP**, **P2P**, or **Virtual**.	**detail extensive**
Address	IP address of the neighbor.	**detail extensive**
Mask	Netmask of the neighbor.	**detail extensive**
Prefix-length	(OSPFv3) IPv6 prefix length, in bits.	**detail extensive**
OSPF3-Intf-Index	(OSPFv3) OSPF version 3 interface index.	**detail extensive**
MTU	Interface maximum transmission unit (MTU).	**detail extensive**
Cost	Interface cost (metric).	**detail extensive**
DR addr	Address of the designated router.	**detail extensive**
BDR addr	Address of the backup designated router.	**detail extensive**
Adj count	Number of adjacent neighbors.	**detail extensive**
Secondary	Indicates that this interface is configured as a secondary interface for this area. This interface can belong to more than one area, but can be designated as a primary interface for only one area.	**detail extensive**
Flood Reduction	Indicates that this interface is configured with flooding reduction. All self-originated LSAs from this interface are initially sent with the **DoNotAge** bit set. As a result, LSAs are refreshed only when a change occurs.	**extensive**

Table 6: show (ospf | ospf3) interface Output Fields *(continued)*

Field Name	Field Description	Level of Output
Priority	Router priority used in designated router (DR) election on this interface.	**detail extensive**
Flood list	List of link-state advertisements (LSAs) that might be about to flood this interface.	**extensive**
Ack list	Acknowledgment list. List of pending acknowledgments on this interface.	**extensive**
Descriptor list	List of packet descriptors.	**extensive**
Hello	Configured value for the hello timer.	**detail extensive**
Dead	Configured value for the dead timer.	**detail extensive**
Auth type	(OSPFv2) Authentication mechanism for sending and receiving OSPF protocol packets: • **MD5**—The MD5 mechanism is configured in accordance with RFC 2328. • **None**—No authentication method is configured. • **Password**—A simple password (RFC 2328) is configured.	**detail extensive**
Topology	(Multiarea adjacency) Name of topology: **default** or ***name***.	
LDP sync state	(OSPFv2 and LDP synchronization) Current state of LDP synchronization: **in sync**, **in holddown**, and **not supported**.	**extensive**
reason	(OSPFv2 and LDP synchronization) Reason for the current state of LDP synchronization. The LDP session might be up or down, or adjacency might be up or down.	**extensive**
config holdtime	(OSPFv2 and LDP synchronization) Configured value of the hold timer. If the state is not synchronized, and the hold time is not infinity, the **remaining** field displays the number of seconds that remain until the configured hold timer expires.	**extensive**
IPSec SA name	(OSPFv2) Name of the IPSec security association name.	**detail extensive**
Active key ID	(OSPFv2 and MD5) Number from **0** to **255** that uniquely identifies an MD5 key.	**detail extensive**
Start time	(OSPFv2 and MD5) Time at which the routing device starts using an MD5 key to authenticate OSPF packets transmitted on the interface on which this key is configured. To authenticate received OSPF protocol packets, the key becomes effective immediately after the configuration is committed. If the start time option is not configured, the key is effective immediately for send and receive and is displayed as **Start time 1970 Jan 01 00:00:00 PST.**	**detail extensive**
ReXmit	Configured value for the Retransmit timer.	**detail extensive**
Stub, **Not Stub**, or **Stub NSSA**	Type of area.	**detail extensive**

Sample Output

show ospf interface brief

```
user@host> show ospf interface brief
Intf                State     Area            DR ID           BDR ID       Nbrs
at-5/1/0.0          PtToPt   0.0.0.0         0.0.0.0         0.0.0.0         1
ge-2/3/0.0          DR       0.0.0.0         192.168.4.16    192.168.4.15    1
lo0.0               DR       0.0.0.0         192.168.4.16    0.0.0.0         0
so-0/0/0.0          Down     0.0.0.0         0.0.0.0         0.0.0.0         0
so-6/0/1.0          PtToPt   0.0.0.0         0.0.0.0         0.0.0.0         1
so-6/0/2.0          Down     0.0.0.0         0.0.0.0         0.0.0.0         0
so-6/0/3.0          PtToPt   0.0.0.0         0.0.0.0         0.0.0.0         1
```

show ospf interface detail

```
user@host> show ospf interface detail
Interface             State     Area            DR ID           BDR ID Nbrs
fe-0/0/1.0            BDR      0.0.0.0         192.168.37.12   10.255.245.215 1
Type LAN, address 192.168.37.11, Mask 255.255.255.248, MTU 4460, Cost 40
DR addr 192.168.37.12, BDR addr 192.168.37.11, Adj count 1, Priority 128
Hello 10, Dead 40, ReXmit 5, Not Stub
t1-0/2/1.0            PtToPt   0.0.0.0         0.0.0.0         0.0.0.0 0
Type P2P, Address 0.0.0.0, Mask 0.0.0.0, MTU 1500, Cost 2604
  Adj count 0
Hello 10, Dead 40, ReXmit 5, Not Stub
Auth type: MD5, Active key ID 3, Start time 2002 Nov 19 10:00:00 PST
IPsec SA Name: sa
```

show ospf3 interface detail

```
user@host> show ospf3 interface so-0/0/3.0 detail
Interface             State     Area           DR-ID         BDR-ID     Nbrs
so-0/0/3.0            PtToPt   0.0.0.0        0.0.0.0       0.0.0.0       1
Address fe80::2a0:a5ff:fe28:1dfc, Prefix-length 64
OSPF3-Intf-index 1, Type P2P, MTU 4470, Cost 12, Adj-count 1
Hello 10, Dead 40, ReXmit 5, Not Stub
```

show ospf interface detail (When Multiarea Adjacency Is Configured)

```
user@host> show ospf interface detail
regress@router> show ospf interface detail
Interface          State   Area            DR ID           BDR ID          Nbrs
lo0.0              DR      0.0.0.0         10.255.245.2    0.0.0.0            0

  Type: LAN, Address: 127.0.0.1, Mask: 255.255.255.255, MTU: 65535, Cost: 0
  DR addr: 127.0.0.1, Adj count: 0, Priority: 128
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Cost: 0
lo0.0              DR      0.0.0.0         10.255.245.2    0.0.0.0            0

  Type: LAN, Address: 10.255.245.2, Mask: 255.255.255.255, MTU: 65535, Cost: 0
  DR addr: 10.255.245.2, Adj count: 0, Priority: 128
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Cost: 0
so-0/0/0.0         PtToPt  0.0.0.0         0.0.0.0         0.0.0.0            1

  Type: P2P, Address: 0.0.0.0, Mask: 0.0.0.0, MTU: 4470, Cost: 1
  Adj count: 1
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Cost: 1
so-0/0/0.0         PtToPt  0.0.0.0         0.0.0.0         0.0.0.0            0
```

```
  Type: P2P, Address: 192.168.37.46, Mask: 255.255.255.254, MTU: 4470, Cost: 1
  Adj count: 0, , Passive
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Passive, Cost: 1
so-1/0/0.0          PtToPt  0.0.0.0         0.0.0.0         0.0.0.0            1

  Type: P2P, Address: 0.0.0.0, Mask: 0.0.0.0, MTU: 4470, Cost: 1
  Adj count: 1
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Cost: 1
so-1/0/0.0          PtToPt  0.0.0.0         0.0.0.0         0.0.0.0            0

  Type: P2P, Address: 192.168.37.54, Mask: 255.255.255.254, MTU: 4470, Cost: 1
  Adj count: 0, , Passive
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Passive, Cost: 1
so-0/0/0.0          PtToPt  1.1.1.1         0.0.0.0         0.0.0.0            1

  Type: P2P, Address: 0.0.0.0, Mask: 0.0.0.0, MTU: 4470, Cost: 1
  Adj count: 1, Secondary
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Cost: 1
so-1/0/0.0          PtToPt  1.1.1.1         0.0.0.0         0.0.0.0            1

  Type: P2P, Address: 0.0.0.0, Mask: 0.0.0.0, MTU: 4470, Cost: 1
  Adj count: 1, Secondary
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Cost: 1
so-0/0/0.0          PtToPt  2.2.2.2         0.0.0.0         0.0.0.0            1

  Type: P2P, Address: 0.0.0.0, Mask: 0.0.0.0, MTU: 4470, Cost: 1
  Adj count: 1, Secondary
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Cost: 1
so-1/0/0.0          PtToPt  2.2.2.2         0.0.0.0         0.0.0.0            1

  Type: P2P, Address: 0.0.0.0, Mask: 0.0.0.0, MTU: 4470, Cost: 1
  Adj count: 1, Secondary
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Cost: 1
```

show ospf interface area area-id

```
user@host> show ospf interface area 1.1.1.1
Interface           State   Area            DR ID           BDR ID          Nbrs
so-0/0/0.0          PtToPt  1.1.1.1         0.0.0.0         0.0.0.0            1
so-1/0/0.0          PtToPt  1.1.1.1         0.0.0.0         0.0.0.0            1
```

show ospf interface extensive (When Flooding Reduction Is Enabled)

```
user@host> show ospf interface extensive
Interface           State   Area            DR ID           BDR ID          Nbrs
fe-0/0/0.0          PtToPt  0.0.0.0         0.0.0.0         0.0.0.0            0

  Type: P2P, Address: 10.10.10.1, Mask: 255.255.255.0, MTU: 1500, Cost: 1
  Adj count: 0
```

```
  Secondary, Flood Reduction
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  Topology default (ID 0) -> Cost: 1
```

show ospf interface extensive (When LDP Synchronization Is Configured)

```
user@host> show ospf interface extensive
Interface             State     Area            DR ID           BDR ID
Nbrs
so-1/0/3.0            Down      0.0.0.0         0.0.0.0         0.0.0.0
0
  Type: P2P, Address: 0.0.0.0, Mask: 0.0.0.0, MTU: 4470, Cost: 65535
  Adj count: 0
  Hello: 10, Dead: 40, ReXmit: 5, Not Stub
  Auth type: None
  LDP sync state: in holddown, for: 00:00:08, reason: LDP down during config
          config holdtime: 10 seconds, remaining: 1
```

show (ospf | ospf3) neighbor

Syntax

show (ospf | ospf3) neighbor
<brief | detail | extensive>
<area *area-id*>
<instance (all | *instance-name*)>
<interface *interface-name*>
<logical-system (all | *logical-system-name*)>
<*neighbor*>
<realm (ipv4-multicast | ipv4-unicast | ipv6-multicast)>

Syntax (EX Series Switches and QFX Series)

show (ospf | ospf3) neighbor
<brief | detail | extensive>
<area *area-id*>
<instance (all | *instance-name*)>
<interface *interface-name*>
<*neighbor*>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
instance all option introduced in Junos OS Release 9.1.
instance all option introduced in Junos OS Release 9.1 for EX Series switches.
area, **interface**, and **realm** options introduced in Junos OS Release 9.2.
area and **interface** options introduced in Junos OS Release 9.2 for EX Series switches.
Command introduced in Junos OS Release 11.3 for the QFX Series.

Description

Display information about OSPF neighbors.

CPU utilization might increase while the device learns its OSPF neighbors. We recommend that you use the **show (ospf | ospf3) neighbor** command after the device learns and establishes OSPF neighbor adjacencies. Depending on the size of your network, this might take several minutes. If you receive a "timeout communicating with routing daemon" error when using the **show (ospf | ospf3) neighbor** command, wait several minutes before attempting to use the command again. This is not a critical system error, but you might experience a delay in using the CLI.

Options

none—Display standard information about all OSPF neighbors for all routing instances.

brief | detail | extensive—(Optional) Display the specified level of output.

area *area-id*—(Optional) Display information about the OSPF neighbors for the specified area.

instance (all | *instance-name*)—(Optional) Display all OSPF interfaces for all routing instances or under the named routing instance.

interface *interface-name*—(Optional) Display information about OSPF neighbors for the specified logical interface.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

neighbor—(Optional) Display information about the specified OSPF neighbor.

realm (ipv4-multicast | ipv4-unicast | ipv6-multicast)—(OSPFv3 only) (Optional) Display information about the OSPF neighbors for the specified OSPFv3 realm, or address family. Use the **realm** option to specify an address family for OSPFv3 other than IPv6 unicast, which is the default.

Required Privilege Level view

Related Documentation
- *clear (ospf | ospf3) neighbor*

List of Sample Output
show ospf neighbor brief on page 110
show ospf neighbor detail on page 110
show ospf neighbor extensive on page 110
show ospf3 neighbor detail on page 111
show ospf neighbor area area-id on page 111
show ospf neighbor interface interface-name on page 111
show ospf3 neighbor instance all (OSPFv3 Multiple Family Address Support Enabled) on page 112

Output Fields Table 7 on page 107 lists the output fields for the **show (ospf | ospf3) neighbor** command. Output fields are listed in the approximate order in which they appear.

Table 7: show (ospf | ospf3) neighbor Output Fields

Field Name	Field Description	Level of Output
Address	Address of the neighbor.	All levels
Interface	Interface through which the neighbor is reachable.	All levels

Table 7: show (ospf | ospf3) neighbor Output Fields *(continued)*

Field Name	Field Description	Level of Output
State	State of the neighbor: • **Attempt**—Valid only for neighbors attached to nonbroadcast networks. It indicates that no recent information has been received from the neighbor, but that a more concerted effort must be made to contact the neighbor. • **Down**—Initial state of a neighbor conversation. It indicates that no recent information has been received from the neighbor. Hello packets might continue to be sent to neighbors in the **Down** state, although at a reduced frequency. • **Exchange**—Routing device is describing its entire link-state database by sending database description packets to the neighbor. Each packet has a sequence number and is explicitly acknowledged. • **ExStart**—First step in creating an adjacency between the two neighboring routing devices. The goal of this step is to determine which routing device is the master, and to determine the initial sequence number. • **Full**—Neighboring routing devices are fully adjacent. These adjacencies appear in router link and network link advertisements. • **Init**—A hello packet has recently been sent by the neighbor. However, bidirectional communication has not yet been established with the neighbor. This state might occur, for example, because the routing device itself did not appear in the neighbor's hello packet. • **Loading**—Link-state request packets are sent to the neighbor to acquire more recent advertisements that have been discovered (but not yet received) in the **Exchange** state. • **2Way**—Communication between the two routing devices is bidirectional. This state has been ensured by the operation of the Hello Protocol. This is the most advanced state short of beginning adjacency establishment. The (backup) designated router is selected from the set of neighbors in state **2Way** or greater.	All levels
ID	Router ID of the neighbor.	All levels
Pri	Priority of the neighbor to become the designated router.	All levels
Dead	Number of seconds until the neighbor becomes unreachable.	All levels
Link state acknowledgment list	Number of link-state acknowledgments received.	**extensive**
Link state retransmission list	Total number of link-state advertisements retransmitted. For **extensive** output only, the following information is also displayed: • **Type**—Type of link advertisement: **ASBR**, **Sum**, **Extern**, **Network**, **NSSA**, **OpaqArea**, **Router**, or **Summary**. • **LSA ID**—LSA identifier included in the advertisement. An asterisk preceding the identifier marks database entries that originated from the local routing device. • **Adv rtr**—Address of the routing device that sent the advertisement. • **Seq**—Link sequence number of the advertisement.	**detail extensive**

Table 7: show (ospf | ospf3) neighbor Output Fields *(continued)*

Field Name	Field Description	Level of Output
Neighbor-address	(OSPFv3 only) If the neighbor uses virtual links, the **Neighbor-address** is the site-local, local, or global address. If the neighbor uses a physical interface, the **Neighbor-address** is an IPv6 link-local address.	**detail extensive**
area	Area that the neighbor is in.	**detail extensive**
OSPF3-Intf-Index	(OSPFv3 only) Displays the OSPFv3 interface index.	**detail extensive**
opt	Option bits received in the hello packets from the neighbor.	**detail extensive**
DR or **DR-ID**	Address of the designated router.	**detail extensive**
BDR or **BDR-ID**	Address of the backup designated router.	**detail extensive**
Up	Length of time since the neighbor came up.	**detail extensive**
adjacent	Length of time since the adjacency with the neighbor was established.	**detail extensive**

Sample Output

show ospf neighbor brief

```
user@host> show ospf neighbor brief
  Address          Intf              State      ID              Pri  Dead
192.168.254.225  fxp3.0              2Way       10.250.240.32   128   36
192.168.254.230  fxp3.0              Full       10.250.240.8    128   38
192.168.254.229  fxp3.0              Full       10.250.240.35   128   33
10.1.1.129       fxp2.0              Full       10.250.240.12   128   37
10.1.1.131       fxp2.0              Full       10.250.240.11   128   38
10.1.2.1         fxp1.0              Full       10.250.240.9    128   32
10.1.2.81        fxp0.0              Full       10.250.240.10   128   33
```

show ospf neighbor detail

```
user@host> show ospf neighbor detail
  Address          Interface             State      ID              Pri  Dead
10.5.1.2         ge-1/2/0.1            Full       10.5.1.2        128   37
  area 0.0.0.1, opt 0x42, DR 10.5.1.2, BDR 10.5.1.1
  Up 06:09:28, adjacent 05:17:36
    Link state acknowledgment list:  3 entries

    Link state retransmission list:  9 entries

10.5.10.2        ge-1/2/0.10           ExStart   10.5.1.38       128   34
  area 0.0.0.1, opt 0x42, DR 10.5.10.2, BDR 10.5.10.1
  Up 06:09:28
    master, seq 0xac1530f8, rexmit DBD in 3 sec
    rexmit LSREQ in 0 sec
10.5.11.2        ge-1/2/0.11           Full       10.5.1.42       128   38
  area 0.0.0.1, opt 0x42, DR 10.5.11.2, BDR 10.5.11.1
  Up 06:09:28, adjacent 05:26:46
    Link state retransmission list:  1 entries

10.5.12.2        ge-1/2/0.12           ExStart   10.5.1.46       128   33
  area 0.0.0.1, opt 0x42, DR 10.5.12.2, BDR 10.5.12.1
  Up 06:09:28
    master, seq 0xac188a68, rexmit DBD in 2 sec
    rexmit LSREQ in 0 sec
```

show ospf neighbor extensive

```
user@host> show ospf neighbor extensive
  Address          Interface             State      ID              Pri  Dead
10.5.1.2         ge-1/2/0.1            Full       10.5.1.2        128   33
  area 0.0.0.1, opt 0x42, DR 10.5.1.2, BDR 10.5.1.1
  Up 06:09:42, adjacent 05:17:50
    Link state retransmission list:

      Type       LSA ID           Adv rtr          Seq

     Summary  10.8.56.0        172.25.27.82     0x8000004d

     Router   10.5.1.94        10.5.1.94        0x8000005c

     Network  10.5.24.2        10.5.1.94        0x80000036

     Summary  10.8.57.0        172.25.27.82     0x80000024

     Extern   1.10.90.0        10.8.1.2         0x80000041

     Extern   1.4.109.0        10.6.1.2         0x80000041
```

```
    Router   10.5.1.190       10.5.1.190       0x8000005f

    Network  10.5.48.2        10.5.1.190       0x8000003d

    Summary  10.8.58.0        172.25.27.82     0x8000004d

    Extern   1.10.91.0        10.8.1.2         0x80000041

    Extern   1.4.110.0        10.6.1.2         0x80000041

    Router   10.5.1.18        10.5.1.18        0x8000005f

    Network  10.5.5.2         10.5.1.18        0x80000033

    Summary  10.8.59.0        172.25.27.82     0x8000003a

    Summary  10.8.62.0        172.25.27.82     0x80000025

10.5.10.2        ge-1/2/0.10            ExStart   10.5.1.38        128   38
  area 0.0.0.1, opt 0x42, DR 10.5.10.2, BDR 10.5.10.1
  Up 06:09:42
    master, seq 0xac1530f8, rexmit DBD in 2 sec
    rexmit LSREQ in 0 sec
10.5.11.2        ge-1/2/0.11            Full      10.5.1.42        128   33
  area 0.0.0.1, opt 0x42, DR 10.5.11.2, BDR 10.5.11.1
  Up 06:09:42, adjacent 05:27:00
    Link state retransmission list:

      Type      LSA ID           Adv rtr          Seq

    Summary  10.8.58.0        172.25.27.82     0x8000004d

    Extern   1.10.91.0        10.8.1.2         0x80000041

    Extern   1.1.247.0        10.5.1.2         0x8000003f

    Extern   1.4.110.0        10.6.1.2         0x80000041

    Router   10.5.1.18        10.5.1.18        0x8000005f

    Network  10.5.5.2         10.5.1.18        0x80000033

    Summary  10.8.59.0        172.25.27.82     0x8000003a
```

show ospf3 neighbor detail

```
user@host> show ospf3 neighbor detail
ID              Interface             State     Pri   Dead
10.255.71.13    fe-0/0/2.0            Full      128   30
  Neighbor-address fe80::290:69ff:fe9b:e002
  area 0.0.0.0, opt 0x13, OSPF3-Intf-Index 2
  DR-ID 10.255.71.13, BDR-ID 10.255.71.12
  Up 02:51:43, adjacent 02:51:43
```

show ospf neighbor area area-id

```
user@host >show ospf neighbor area 1.1.1.1
Address          Interface             State     ID               Pri  Dead
192.168.37.47    so-0/0/0.0            Full      10.255.245.4     128    33
  Area 1.1.1.1
192.168.37.55    so-1/0/0.0            Full      10.255.245.5     128    37
  Area 1.1.1.1
```

show ospf neighbor interface interface-name

```
user@host >show ospf neighbor interface so-0/0/0.0
Address          Interface              State     ID               Pri  Dead
192.168.37.47    so-0/0/0.0             Full      10.255.245.4     128    37
  Area 0.0.0.0
192.168.37.47    so-0/0/0.0             Full      10.255.245.4     128    33
  Area 1.1.1.1
192.168.37.47    so-0/0/0.0             Full      10.255.245.4     128    32
  Area 2.2.2.2
```

show ospf3 neighbor instance all (OSPFv3 Multiple Family Address Support Enabled)

```
user @host > show ospf3 neighbor instance all
Instance: ina
    Realm: ipv6-unicast
    ID              Interface             State     Pri   Dead
   100.1.1.1        fe-0/0/2.0            Full      128     37
       Neighbor-address fe80::217:cb00:c87c:8c03
   Instance: inb
   Realm: ipv4-unicast
   ID              Interface             State     Pri   Dead
  100.1.2.1        fe-0/0/2.1            Full      128     33
      Neighbor-address fe80::217:cb00:c97c:8c03
```

show route

Syntax

show route
<all>
<*destination-prefix*>
<logical-system (all | *logical-system-name*)>
<private>

Syntax (EX Series Switches)

show route
<all>
<*destination-prefix*>
<private>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Option **private** introduced in Junos OS Release 9.5.
Option **private** introduced in Junos OS Release 9.5 for EX Series switches.

Description

Display the active entries in the routing tables.

Options

none—Display brief information about all active entries in the routing tables.

all—(Optional) Display information about all routing tables, including private, or internal, routing tables.

destination-prefix—(Optional) Display active entries for the specified address or range of addresses.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

private—(Optional) Display information only about all private, or internal, routing tables.

Required Privilege Level

view

Related Documentation

- *Example: Configuring RIP*
- *Example: Configuring RIPng*
- *Example: Configuring IS-IS*
- *Examples: Configuring Internal BGP Peering*
- *Examples: Configuring External BGP Peering*
- *Examples: Configuring OSPF Routing Policy*

List of Sample Output

show route on page 117
show route on page 117
show route destination-prefix on page 117
show route extensive on page 117

Output Fields Table 8 on page 114 describes the output fields for the **show route** command. Output fields are listed in the approximate order in which they appear.

Table 8: show route Output Fields

Field Name	Field Description
routing-table-name	Name of the routing table (for example, inet.0).
number **destinations**	Number of destinations for which there are routes in the routing table.
number **routes**	Number of routes in the routing table and total number of routes in the following states: • **active** (routes that are active). • **holddown** (routes that are in the pending state before being declared inactive). A holddown route was once the active route and is no longer the active route. The route is in the holddown state because a protocol still has interest in the route, meaning that the interest bit is set. A protocol might have its interest bit set on the previously active route because the protocol is still advertising the route. The route will be deleted after all protocols withdraw their advertisement of the route and remove their interest bit. A persistent holddown state often means that the interested protocol is not releasing its interest bit properly. However, if you have configured advertisement of multiple routes (with the **add-path** or **advertise-inactive** statement), the holddown bit is most likely set because BGP is advertising the route as an active route. In this case, you can ignore the holddown state because nothing is wrong. • **hidden** (routes that are not used because of a routing policy).
destination-prefix	Route destination (for example:10.0.0.1/24). Sometimes the route information is presented in another format, such as: • *MPLS-label* (for example, 80001). • *interface-name* (for example, ge-1/0/2). • *neighbor-address*:*control-word-status*:*encapsulation type*:*vc-id*:*source* (Layer 2 circuit only. For example, 10.1.1.195:NoCtrlWord:1:1:Local/96): ◦ *neighbor-address*—Address of the neighbor. ◦ *control-word-status*—Whether the use of the control word has been negotiated for this virtual circuit: **NoCtrlWord** or **CtrlWord**. ◦ *encapsulation type*—Type of encapsulation, represented by a number: (1) Frame Relay DLCI, (2) ATM AAL5 VCC transport, (3) ATM transparent cell transport, (4) Ethernet, (5) VLAN Ethernet, (6) HDLC, (7) PPP, (8) ATM VCC cell transport, (10) ATM VPC cell transport. ◦ *vc-id*—Virtual circuit identifier. ◦ *source*—Source of the advertisement: **Local** or **Remote**.
[*protocol*, *preference* **]**	Protocol from which the route was learned and the preference value for the route. • **+**—A plus sign indicates the active route, which is the route installed from the routing table into the forwarding table. • **-** —A hyphen indicates the last active route. • *****—An asterisk indicates that the route is both the active and the last active route. An asterisk before a **to** line indicates the best subpath to the route. In every routing metric except for the BGP **LocalPref** attribute, a lesser value is preferred. In order to use common comparison routines, Junos OS stores the 1's complement of the **LocalPref** value in the **Preference2** field. For example, if the **LocalPref** value for Route 1 is 100, the **Preference2** value is -101. If the **LocalPref** value for Route 2 is 155, the **Preference2** value is -156. Route 2 is preferred because it has a higher **LocalPref** value and a lower **Preference2** value.

Table 8: show route Output Fields *(continued)*

Field Name	Field Description
weeks:days hours:minutes:seconds	How long the route been known (for example, **2w4d 13:11:14**, or 2 weeks, 4 days, 13 hours, 11 minutes, and 14 seconds).
metric	Cost value of the indicated route. For routes within an AS, the cost is determined by the IGP and the individual protocol metrics. For external routes, destinations, or routing domains, the cost is determined by a preference value.
localpref	Local preference value included in the route.
from	Interface from which the route was received.
AS path	AS path through which the route was learned. The letters at the end of the AS path indicate the path origin, providing an indication of the state of the route at the point at which the AS path originated: • **I**—IGP. • **E**—EGP. • **?**—Incomplete; typically, the AS path was aggregated. When AS path numbers are included in the route, the format is as follows: • **[ ]**—Brackets enclose the local AS number associated with the AS path if more than one AS number is configured on the routing device, or if AS path prepending is configured. • **{ }**—Braces enclose AS sets, which are groups of AS numbers in which the order does not matter. A set commonly results from route aggregation. The numbers in each AS set are displayed in ascending order. • **( )**—Parentheses enclose a confederation. • **([ ])**—Parentheses and brackets enclose a confederation set. NOTE: In Junos OS Release 10.3 and later, the AS path field displays an unrecognized attribute and associated hexadecimal value if BGP receives attribute 128 (attribute set) and you have not configured an independent domain in any routing instance.
validation-state	(BGP-learned routes) Validation status of the route: • **Invalid**—Indicates that the prefix is found, but either the corresponding AS received from the EBGP peer is not the AS that appears in the database, or the prefix length in the BGP update message is longer than the maximum length permitted in the database. • **Unknown**—Indicates that the prefix is not among the prefixes or prefix ranges in the database. • **Valid**—Indicates that the prefix and autonomous system pair are found in the database.
to	Next hop to the destination. An angle bracket (>) indicates that the route is the selected route. If the destination is **Discard**, traffic is dropped.

Table 8: show route Output Fields *(continued)*

Field Name	Field Description
via	Interface used to reach the next hop. If there is more than one interface available to the next hop, the interface that is actually used is followed by the word **Selected**. This field can also contain the following information: • **Weight**—Value used to distinguish primary, secondary, and fast reroute backup routes. Weight information is available when MPLS label-switched path (LSP) link protection, node-link protection, or fast reroute is enabled, or when the standby state is enabled for secondary paths. A lower weight value is preferred. Among routes with the same weight value, load balancing is possible. • **Balance**—Balance coefficient indicating how traffic of unequal cost is distributed among next hops when a routing device is performing unequal-cost load balancing. This information is available when you enable BGP multipath load balancing. • ***lsp-path-name***—Name of the LSP used to reach the next hop. • ***label-action***—MPLS label and operation occurring at the next hop. The operation can be **pop** (where a label is removed from the top of the stack), **push** (where another label is added to the label stack), or **swap** (where a label is replaced by another label). For VPNs, expect to see multiple **push** operations, corresponding to the inner and outer labels required for VPN routes (in the case of a direct PE-to-PE connection, the VPN route would have the inner label push only).

Sample Output

show route

```
user@host> show route
inet.0: 11 destinations, 12 routes (11 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

1:65500:1:10.0.0.20/240
                   *[MVPN/70] 19:53:41, metric2 1
                      Indirect
1:65500:1:10.0.0.40/240
                   *[BGP/170] 19:53:29, localpref 100, from 10.0.0.30
                      AS path: I
                    > to 10.0.24.4 via lt-0/3/0.24, label-switched-path toD
                    [BGP/170] 19:53:26, localpref 100, from 10.0.0.33
                      AS path: I
                    > to 10.0.24.4 via lt-0/3/0.24, label-switched-path toD
1:65500:1:10.0.0.60/240
                   *[BGP/170] 19:53:29, localpref 100, from 10.0.0.30
                      AS path: I
                    > to 10.0.28.8 via lt-0/3/0.28, label-switched-path toF
                    [BGP/170] 19:53:25, localpref 100, from 10.0.0.33
                      AS path: I
                    > to 10.0.28.8 via lt-0/3/0.28, label-switched-path toF
```

show route

The following sample output shows a VPN route with composite next hops enabled. The first **Push** operation corresponds to the outer label. The second **Push** operation corresponds to the inner label.

```
user@host> show route 70.0.0.0

13979:665001.inet.0: 871 destinations, 3556 routes (871 active, 0 holddown, 0
hidden)
+ = Active Route, - = Last Active, * = Both

70.0.0.0/24        @[BGP/170] 00:28:32, localpref 100, from 10.9.9.160
                      AS path: 13980 ?
                    > to 10.100.0.42 via ae2.0, Push 16, Push 300368(top)
                    [BGP/170] 00:28:28, localpref 100, from 10.9.9.169
                      AS path: 13980 ?
                    > to 10.100.0.42 via ae2.0, Push 126016, Push 300368(top)
                   #[Multipath/255] 00:28:28, metric2 102
                    > to 10.100.0.42 via ae2.0, Push 16, Push 300368(top)
                      to 10.100.0.42 via ae2.0, Push 16, Push 300368(top)
```

show route destination-prefix

```
user@host> show route 172.16.0.0/12

inet.0: 10 destinations, 10 routes (9 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

172.16.0.0/12      *[Static/5] 2w4d 12:54:27
                    > to 192.168.167.254 via fxp0.0
```

show route extensive

```
user@host> show route extensive
v1.mvpn.0: 5 destinations, 8 routes (5 active, 1 holddown, 0 hidden)
1:65500:1:10.0.0.40/240 (1 entry, 1 announced)
    *BGP   Preference: 170/-101
          PMSI: Flags 0x0: Label[0:0:0]: PIM-SM: Sender 10.0.0.40 Group 225.1.1.1
```

```
Next hop type: Indirect
Address: 0x92455b8
Next-hop reference count: 2
Source: 10.0.0.30
Protocol next hop: 10.0.0.40
Indirect next hop: 2 no-forward
State: <Active Int Ext>
          Local AS: 65500 Peer AS: 65500
Age: 3  Metric2: 1
Task: BGP_65500.10.0.0.30+179
Announcement bits (2): 0-PIM.v1 1-mvpn global task
AS path: I (Originator) Cluster list:  10.0.0.30
AS path:  Originator ID: 10.0.0.40
Communities: target:65520:100
Import Accepted
Localpref: 100
Router ID: 10.0.0.30
Primary Routing Table bgp.mvpn.0
Indirect next hops: 1
     Protocol next hop: 10.0.0.40 Metric: 1
     Indirect next hop: 2 no-forward
     Indirect path forwarding next hops: 1
           Next hop type: Router
           Next hop: 10.0.24.4 via lt-0/3/0.24 weight 0x1
     10.0.0.40/32 Originating RIB: inet.3
           Metric: 1                        Node path count: 1
           Forwarding nexthops: 1
              Nexthop: 10.0.24.4 via lt-0/3/0.24
```

show route detail

Syntax
show route detail
<*destination-prefix*>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches)
show route detail
<*destination-prefix*>

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.

Description
Display detailed information about the active entries in the routing tables.

Options
none—Display all active entries in the routing table on all systems.

destination-prefix—(Optional) Display active entries for the specified address or range of addresses.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
view

List of Sample Output
show route detail on page 128
show route detail (with BGP Multipath) on page 133
show route label detail (Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs) on page 133

Output Fields
Table 9 on page 119 describes the output fields for the **show route detail** command. Output fields are listed in the approximate order in which they appear.

Table 9: show route detail Output Fields

Field Name	Field Description
routing-table-name	Name of the routing table (for example, inet.0).
number **destinations**	Number of destinations for which there are routes in the routing table.
number **routes**	Number of routes in the routing table and total number of routes in the following states: • **active** (routes that are active) • **holddown** (routes that are in the pending state before being declared inactive) • **hidden** (routes that are not used because of a routing policy)

Table 9: show route detail Output Fields *(continued)*

Field Name	Field Description

route-destination **(entry, announced)**	Route destination (for example:10.0.0.1/24). The **entry** value is the number of routes for this destination, and the **announced** value is the number of routes being announced for this destination. Sometimes the route destination is presented in another format, such as:
	• ***MPLS-label*** (for example, 80001).
	• ***interface-name*** (for example, ge-1/0/2).
	• ***neighbor-address*:*control-word-status*:*encapsulation type*:*vc-id*:*source*** (Layer 2 circuit only; for example, 10.1.1.195:NoCtrlWord:1:1:Local/96).
	  ◦ ***neighbor-address***—Address of the neighbor.
	  ◦ ***control-word-status***—Whether the use of the control word has been negotiated for this virtual circuit: **NoCtrlWord** or **CtrlWord**.
	  ◦ ***encapsulation type***—Type of encapsulation, represented by a number: (1) Frame Relay DLCI, (2) ATM AAL5 VCC transport, (3) ATM transparent cell transport, (4) Ethernet, (5) VLAN Ethernet, (6) HDLC, (7) PPP, (8) ATM VCC cell transport, (10) ATM VPC cell transport.
	  ◦ ***vc-id***—Virtual circuit identifier.
	  ◦ ***source***—Source of the advertisement: **Local** or **Remote**.

label stacking	**(**Next-to-the-last-hop routing device for MPLS only) Depth of the MPLS label stack, where the label-popping operation is needed to remove one or more labels from the top of the stack. A pair of routes is displayed, because the pop operation is performed only when the stack depth is two or more labels. • **S=0 route** indicates that a packet with an incoming label stack depth of 2 or more exits this routing device with one fewer label (the label-popping operation is performed). • If there is no **S=** information, the route is a normal MPLS route, which has a stack depth of 1 (the label-popping operation is not performed).
[*protocol*, *preference*]	Protocol from which the route was learned and the preference value for the route. • **+**—A plus sign indicates the active route, which is the route installed from the routing table into the forwarding table. • **-** —A hyphen indicates the last active route. • *****—An asterisk indicates that the route is both the active and the last active route. An asterisk before a **to** line indicates the best subpath to the route. In every routing metric except for the BGP **LocalPref** attribute, a lesser value is preferred. In order to use common comparison routines, Junos OS stores the 1's complement of the **LocalPref** value in the **Preference2** field. For example, if the **LocalPref** value for Route 1 is 100, the **Preference2** value is -101. If the **LocalPref** value for Route 2 is 155, the **Preference2** value is -156. Route 2 is preferred because it has a higher **LocalPref** value and a lower **Preference2** value.
Level	(IS-IS only). In IS-IS, a single AS can be divided into smaller groups called areas. Routing between areas is organized hierarchically, allowing a domain to be administratively divided into smaller areas. This organization is accomplished by configuring Level 1 and Level 2 intermediate systems. Level 1 systems route within an area. When the destination is outside an area, they route toward a Level 2 system. Level 2 intermediate systems route between areas and toward other ASs.
Route Distinguisher	IP subnet augmented with a 64-bit prefix.
Next-hop type	Type of next hop. For a description of possible values for this field, see Table 10 on page 123.

Table 9: show route detail Output Fields *(continued)*

Field Name	Field Description
Next-hop reference count	Number of references made to the next hop.
Flood nexthop branches exceed maximum message	Indicates that the number of flood next-hop branches exceeded the system limit of 32 branches, and only a subset of the flood next-hop branches were installed in the kernel.
Source	IP address of the route source.
Next hop	Network layer address of the directly reachable neighboring system.
via	Interface used to reach the next hop. If there is more than one interface available to the next hop, the name of the interface that is actually used is followed by the word **Selected**. This field can also contain the following information: • Weight—Value used to distinguish primary, secondary, and fast reroute backup routes. Weight information is available when MPLS label-switched path (LSP) link protection, node-link protection, or fast reroute is enabled, or when the standby state is enabled for secondary paths. A lower weight value is preferred. Among routes with the same weight value, load balancing is possible. • Balance—Balance coefficient indicating how traffic of unequal cost is distributed among next hops when a routing device is performing unequal-cost load balancing. This information is available when you enable BGP multipath load balancing.
Label-switched-path *lsp-path-name*	Name of the LSP used to reach the next hop.
Label operation	MPLS label and operation occurring at this routing device. The operation can be **pop** (where a label is removed from the top of the stack), **push** (where another label is added to the label stack), or **swap** (where a label is replaced by another label).
Interface	(Local only) Local interface name.
Protocol next hop	Network layer address of the remote routing device that advertised the prefix. This address is used to derive a forwarding next hop.
Indirect next hop	Index designation used to specify the mapping between protocol next hops, tags, kernel export policy, and the forwarding next hops.
State	State of the route (a route can be in more than one state). See Table 11 on page 125.
Local AS	AS number of the local routing device.
Age	How long the route has been known.
AIGP	Accumulated interior gateway protocol (AIGP) BGP attribute.
Metric*n*	Cost value of the indicated route. For routes within an AS, the cost is determined by IGP and the individual protocol metrics. For external routes, destinations, or routing domains, the cost is determined by a preference value.

Table 9: show route detail Output Fields *(continued)*

Field Name	Field Description
MED-plus-IGP	Metric value for BGP path selection to which the IGP cost to the next-hop destination has been added.
TTL-Action	For MPLS LSPs, state of the TTL propagation attribute. Can be enabled or disabled for all RSVP-signaled and LDP-signaled LSPs or for specific VRF routing instances. For sample output, see show route table.
Task	Name of the protocol that has added the route.
Announcement bits	List of protocols that announce this route. ***n*-Resolve inet** indicates that the route is used for route resolution for next hops found in the routing table. ***n*** is an index used by Juniper Networks customer support only.
AS path	AS path through which the route was learned. The letters at the end of the AS path indicate the path origin, providing an indication of the state of the route at the point at which the AS path originated: • **I**—IGP. • **E**—EGP. • **Recorded**—The AS path is recorded by the sample process (sampled). • **?**—Incomplete; typically, the AS path was aggregated. When AS path numbers are included in the route, the format is as follows: • **[ ]**—Brackets enclose the number that precedes the AS path. This number represents the number of ASs present in the AS path, when calculated as defined in RFC 4271. This value is used in the AS-path merge process, as defined in RFC 4893. • **[ ]**—If more than one AS number is configured on the routing device, or if AS path prepending is configured, brackets enclose the local AS number associated with the AS path. • **{ }**—Braces enclose AS sets, which are groups of AS numbers in which the order does not matter. A set commonly results from route aggregation. The numbers in each AS set are displayed in ascending order. • **( )**—Parentheses enclose a confederation. • **([ ])**—Parentheses and brackets enclose a confederation set. NOTE: In Junos OS Release 10.3 and later, the AS path field displays an unrecognized attribute and associated hexadecimal value if BGP receives attribute 128 (attribute set) and you have not configured an independent domain in any routing instance.
FECs bound to route	Point-to-multipoint root address, multicast source address, and multicast group address when multipoint LDP (M-LDP) inband signaling is configured.
VC Label	MPLS label assigned to the Layer 2 circuit virtual connection.
MTU	Maximum transmission unit (MTU) of the Layer 2 circuit.
VLAN ID	VLAN identifier of the Layer 2 circuit.
Prefixes bound to route	Forwarding equivalent class (FEC) bound to this route. Applicable only to routes installed by LDP.
Communities	Community path attribute for the route. See Table 12 on page 127 for all possible values for this field.

Table 9: show route detail Output Fields *(continued)*

Field Name	Field Description
Layer2-info: encaps	Layer 2 encapsulation (for example, VPLS).
control flags	Control flags: **none** or **Site Down**.
mtu	Maximum transmission unit (MTU) information.
Label-Base, range	First label in a block of labels and label block size. A remote PE routing device uses this first label when sending traffic toward the advertising PE routing device.
status vector	Layer 2 VPN and VPLS network layer reachability information (NLRI).
Accepted Multipath	Current active path when BGP multipath is configured.
Accepted MultipathContrib	Path currently contributing to BGP multipath.
Localpref	Local preference value included in the route.
Router ID	BGP router ID as advertised by the neighbor in the open message.
Primary Routing Table	In a routing table group, the name of the primary routing table in which the route resides.
Secondary Tables	In a routing table group, the name of one or more secondary tables in which the route resides.

Table 10 on page 123 describes all possible values for the Next-hop Types output field.

Table 10: Next-hop Types Output Field Values

Next-Hop Type	Description
Broadcast (bcast)	Broadcast next hop.
Deny	Deny next hop.
Discard	Discard next hop.
Flood	Flood next hop. Consists of components called branches, up to a maximum of 32 branches. Each flood next-hop branch sends a copy of the traffic to the forwarding interface. Used by point-to-multipoint RSVP, point-to-multipoint LDP, point-to-multipoint CCC, and multicast.
Hold	Next hop is waiting to be resolved into a unicast or multicast type.
Indexed (idxd)	Indexed next hop.

Table 10: Next-hop Types Output Field Values *(continued)*

Next-Hop Type	Description
Indirect (indr)	Used with applications that have a protocol next hop address that is remote. You are likely to see this next-hop type for internal BGP (IBGP) routes when the BGP next hop is a BGP neighbor that is not directly connected.
Interface	Used for a network address assigned to an interface. Unlike the router next hop, the interface next hop does not reference any specific node on the network.
Local (locl)	Local address on an interface. This next-hop type causes packets with this destination address to be received locally.
Multicast (mcst)	Wire multicast next hop (limited to the LAN).
Multicast discard (mdsc)	Multicast discard.
Multicast group (mgrp)	Multicast group member.
Receive (recv)	Receive.
Reject (rjct)	Discard. An ICMP unreachable message was sent.
Resolve (rslv)	Resolving next hop.
Routed multicast (mcrt)	Regular multicast next hop.
Router	A specific node or set of nodes to which the routing device forwards packets that match the route prefix. To qualify as next-hop type router, the route must meet the following criteria: • Must not be a direct or local subnet for the routing device. • Must have a next hop that is directly connected to the routing device.
Table	Routing table next hop.
Unicast (ucst)	Unicast.
Unilist (ulst)	List of unicast next hops. A packet sent to this next hop goes to any next hop in the list.

Table 11 on page 125 describes all possible values for the State output field. A route can be in more than one state (for example, **<Active NoReadvrt Int Ext>**).

Table 11: State Output Field Values

Value	Description
Accounting	Route needs accounting.
Active	Route is active.
Always Compare MED	Path with a lower multiple exit discriminator (MED) is available.
AS path	Shorter AS path is available.
Cisco Non-deterministic MED selection	Cisco nondeterministic MED is enabled, and a path with a lower MED is available.
Clone	Route is a clone.
Cluster list length	Length of cluster list sent by the route reflector.
Delete	Route has been deleted.
Ex	Exterior route.
Ext	BGP route received from an external BGP neighbor.
FlashAll	Forces all protocols to be notified of a change to any route, active or inactive, for a prefix. When not set, protocols are informed of a prefix only when the active route changes.
Hidden	Route not used because of routing policy.
IfCheck	Route needs forwarding RPF check.
IGP metric	Path through next hop with lower IGP metric is available.
Inactive reason	Flags for this route, which was not selected as best for a particular destination.
Initial	Route being added.
Int	Interior route.
Int Ext	BGP route received from an internal BGP peer or a BGP confederation peer.
Interior > Exterior > Exterior via Interior	Direct, static, IGP, or EBGP path is available.
Local Preference	Path with a higher local preference value is available.
Martian	Route is a martian (ignored because it is obviously invalid).

Table 11: State Output Field Values *(continued)*

Value	Description
MartianOK	Route exempt from martian filtering.
Next hop address	Path with lower metric next hop is available.
No difference	Path from neighbor with lower IP address is available.
NoReadvrt	Route not to be advertised.
NotBest	Route not chosen because it does not have the lowest MED.
Not Best in its group	Incoming BGP AS is not the best of a group (only one AS can be the best).
NotInstall	Route not to be installed in the forwarding table.
Number of gateways	Path with a greater number of next hops is available.
Origin	Path with a lower origin code is available.
Pending	Route pending because of a hold-down configured on another route.
Release	Route scheduled for release.
RIB preference	Route from a higher-numbered routing table is available.
Route Distinguisher	64-bit prefix added to IP subnets to make them unique.
Route Metric or MED comparison	Route with a lower metric or MED is available.
Route Preference	Route with lower preference value is available
Router ID	Path through a neighbor with lower ID is available.
Secondary	Route not a primary route.
Unusable path	Path is not usable because of one of the following conditions: • The route is damped. • The route is rejected by an import policy. • The route is unresolved.
Update source	Last tiebreaker is the lowest IP address value.

Table 12 on page 127 describes the possible values for the Communities output field.

Table 12: Communities Output Field Values

Value	Description
area-number	4 bytes, encoding a 32-bit area number. For AS-external routes, the value is **0**. A nonzero value identifies the route as internal to the OSPF domain, and as within the identified area. Area numbers are relative to a particular OSPF domain.
bandwidth: ***local AS number:link-bandwidth-number***	Link-bandwidth community value used for unequal-cost load balancing. When BGP has several candidate paths available for multipath purposes, it does not perform unequal-cost load balancing according to the link-bandwidth community unless all candidate paths have this attribute.
domain-id	Unique configurable number that identifies the OSPF domain.
domain-id-vendor	Unique configurable number that further identifies the OSPF domain.
link-bandwidth-number	Link-bandwidth number: from **0** through **4,294,967,295** (bytes per second).
local AS number	Local AS number: from **1** through **65,535**.
options	1 byte. Currently this is only used if the route type is **5** or **7**. Setting the least significant bit in the field indicates that the route carries a type 2 metric.
origin	(Used with VPNs) Identifies where the route came from.
ospf-route-type	1 byte, encoded as **1** or **2** for intra-area routes (depending on whether the route came from a type 1 or a type 2 LSA); **3** for summary routes; **5** for external routes (area number must be**0**); **7** for NSSA routes; or **129** for sham link endpoint addresses.
route-type-vendor	Displays the area number, OSPF route type, and option of the route. This is configured using the BGP extended community attribute **0x8000**. The format is ***area-number:ospf-route-type:options***.
rte-type	Displays the area number, OSPF route type, and option of the route. This is configured using the BGP extended community attribute **0x0306**. The format is ***area-number:ospf-route-type:options***.
target	Defines which VPN the route participates in; **target** has the format ***32-bit IP address:16-bit number***. For example, 10.19.0.0:100.
unknown IANA	Incoming IANA codes with a value between **0x1** and **0x7fff**. This code of the BGP extended community attribute is accepted, but it is not recognized.
unknown OSPF vendor community	Incoming IANA codes with a value above **0x8000**. This code of the BGP extended community attribute is accepted, but it is not recognized.

Sample Output

show route detail

```
user@host> show route detail

inet.0: 22 destinations, 23 routes (21 active, 0 holddown, 1 hidden)
10.10.0.0/16 (1 entry, 1 announced)
        *Static Preference: 5
                Next-hop reference count: 29
                Next hop: 192.168.71.254 via fxp0.0, selected
                State: <Active NoReadvrt Int Ext>
                Local AS:    69
                Age: 1:31:43
                Task: RT
                Announcement bits (2): 0-KRT 3-Resolve tree 2
                AS path: I

10.31.1.0/30 (2 entries, 1 announced)
        *Direct Preference: 0
                Next hop type: Interface
                Next-hop reference count: 2
                Next hop: via so-0/3/0.0, selected
                State: <Active Int>
                Local AS:    69
                Age: 1:30:17
                Task: IF
                Announcement bits (1): 3-Resolve tree 2
                AS path: I
         OSPF   Preference: 10
                Next-hop reference count: 1
                Next hop: via so-0/3/0.0, selected
                State: <Int>
                Inactive reason: Route Preference
                Local AS:    69
                Age: 1:30:17    Metric: 1
                Area: 0.0.0.0
                Task: OSPF
                AS path: I

10.31.1.1/32 (1 entry, 1 announced)
        *Local  Preference: 0
                Next hop type: Local
                Next-hop reference count: 7
                Interface: so-0/3/0.0
                State: <Active NoReadvrt Int>
                Local AS:    69
                Age: 1:30:20
                Task: IF
                Announcement bits (1): 3-Resolve tree 2
                AS path: I

...

10.31.2.0/30 (1 entry, 1 announced)
        *OSPF   Preference: 10
                Next-hop reference count: 9
                Next hop: via so-0/3/0.0
                Next hop: 10.31.1.6 via ge-3/1/0.0, selected
                State: <Active Int>
                Local AS:    69
                Age: 1:29:56    Metric: 2
```

```
                Area: 0.0.0.0
                Task: OSPF
                Announcement bits (2): 0-KRT 3-Resolve tree 2
                AS path: I

...

224.0.0.2/32 (1 entry, 1 announced)
        *PIM    Preference: 0
                Next-hop reference count: 18
                State: <Active NoReadvrt Int>
                Local AS:    69
                Age: 1:31:45
                Task: PIM Recv
                Announcement bits (2): 0-KRT 3-Resolve tree 2
                AS path: I

...

224.0.0.22/32 (1 entry, 1 announced)
        *IGMP   Preference: 0
                Next-hop reference count: 18
                State: <Active NoReadvrt Int>
                Local AS:    69
                Age: 1:31:43
                Task: IGMP
                Announcement bits (2): 0-KRT 3-Resolve tree 2
                AS path: I

inet.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)

10.255.70.103/32 (1 entry, 1 announced)
        State: <FlashAll>
        *RSVP   Preference: 7
                Next-hop reference count: 6
                Next hop: 10.31.1.6 via ge-3/1/0.0 weight 0x1, selected
                Label-switched-path green-r1-r3
                Label operation: Push 100096
                State: <Active Int>
                Local AS:    69
                Age: 1:25:49    Metric: 2
                Task: RSVP
                Announcement bits (2): 1-Resolve tree 1 2-Resolve tree 2
                AS path: I

10.255.71.238/32 (1 entry, 1 announced)
        State: <FlashAll>
        *RSVP   Preference: 7
                Next-hop reference count: 6
                Next hop: via so-0/3/0.0 weight 0x1, selected
                Label-switched-path green-r1-r2
                State: <Active Int>
                Local AS:    69
                Age: 1:25:49    Metric: 1
                Task: RSVP
                Announcement bits (2): 1-Resolve tree 1 2-Resolve tree 2
                AS path: I

private__.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

iso.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

```
47.0005.80ff.f800.0000.0108.0001.0102.5507.1052/152 (1 entry, 0 announced)
        *Direct Preference: 0
                Next hop type: Interface
                Next-hop reference count: 1
                Next hop: via lo0.0, selected
                State: <Active Int>
                Local AS:    69
                Age: 1:31:44
                Task: IF
                AS path: I

mpls.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
0   (1 entry, 1 announced)
        *MPLS   Preference: 0
                Next hop type: Receive
                Next-hop reference count: 6
                State: <Active Int>
                Local AS:    69
                Age: 1:31:45    Metric: 1
                Task: MPLS
                Announcement bits (1): 0-KRT
                AS path: I

...

mpls.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
299776 (1 entry, 1 announced)
TSI:
KRT in-kernel 299776 /52 -> {Flood}
        *RSVP   Preference: 7
                Next hop type: Flood
                Next-hop reference count: 130
                Flood nexthop branches exceed maximum
                Address: 0x8ea65d0
...

800010 (1 entry, 1 announced)
        *VPLS   Preference: 7
                Next-hop reference count: 2
                Next hop: via vt-3/2/0.32769, selected
                Label operation: Pop
                State: <Active Int>
                Age: 1:29:30
                Task: Common L2 VC
                Announcement bits (1): 0-KRT
                AS path: I

vt-3/2/0.32769 (1 entry, 1 announced)
        *VPLS   Preference: 7
                Next-hop reference count: 2
                Next hop: 10.31.1.6 via ge-3/1/0.0 weight 0x1, selected
                Label-switched-path green-r1-r3
                Label operation: Push 800012, Push 100096(top)
                Protocol next hop: 10.255.70.103
                Push 800012
                Indirect next hop: 87272e4 1048574
                State: <Active Int>
                Age: 1:29:30    Metric2: 2
                Task: Common L2 VC
                Announcement bits (2): 0-KRT 1-Common L2 VC
```



```
                AS path: I
                Communities: target:11111:1 Layer2-info: encaps:VPLS,
                control flags:, mtu: 0

inet6.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)

abcd::10:255:71:52/128 (1 entry, 0 announced)
        *Direct Preference: 0
                Next hop type: Interface
                Next-hop reference count: 1
                Next hop: via lo0.0, selected
                State: <Active Int>
                Local AS:    69
                Age: 1:31:44
                Task: IF
                AS path: I

fe80::280:42ff:fe10:f179/128 (1 entry, 0 announced)
        *Direct Preference: 0
                Next hop type: Interface
                Next-hop reference count: 1
                Next hop: via lo0.0, selected
                State: <Active NoReadvrt Int>
                Local AS:    69
                Age: 1:31:44
                Task: IF
                AS path: I

ff02::2/128 (1 entry, 1 announced)
        *PIM    Preference: 0
                Next-hop reference count: 18
                State: <Active NoReadvrt Int>
                Local AS:    69
                Age: 1:31:45
                Task: PIM Recv6
                Announcement bits (1): 0-KRT
                AS path: I

ff02::d/128 (1 entry, 1 announced)
        *PIM    Preference: 0
                Next-hop reference count: 18
                State: <Active NoReadvrt Int>
                Local AS:    69
                Age: 1:31:45
                Task: PIM Recv6
                Announcement bits (1): 0-KRT
                AS path: I

ff02::16/128 (1 entry, 1 announced)
        *MLD    Preference: 0
                Next-hop reference count: 18
                State: <Active NoReadvrt Int>
                Local AS:    69
                Age: 1:31:43
                Task: MLD
                Announcement bits (1): 0-KRT
                AS path: I

private.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

fe80::280:42ff:fe10:f179/128 (1 entry, 0 announced)
```

```
        *Direct Preference: 0
                Next hop type: Interface
                Next-hop reference count: 1
                Next hop: via lo0.16385, selected
                State: <Active NoReadvrt Int>
                Age: 1:31:44
                Task: IF
                AS path: I

green.l2vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)

10.255.70.103:1:3:1/96 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Route Distinguisher: 10.255.70.103:1
                Next-hop reference count: 7
                Source: 10.255.70.103
                Protocol next hop: 10.255.70.103
                Indirect next hop: 2 no-forward
                State: <Secondary Active Int Ext>
                Local AS:    69 Peer AS:    69
                Age: 1:25:49    Metric2: 1
                AIGP 210
                Task: BGP_69.10.255.70.103+179
                Announcement bits (1): 0-green-l2vpn
                AS path: I
                Communities: target:11111:1 Layer2-info: encaps:VPLS,
                control flags:, mtu: 0
                Label-base: 800008, range: 8
                Localpref: 100
                Router ID: 10.255.70.103
                Primary Routing Table bgp.l2vpn.0

10.255.71.52:1:1:1/96 (1 entry, 1 announced)
        *L2VPN  Preference: 170/-1
                Next-hop reference count: 5
                Protocol next hop: 10.255.71.52
                Indirect next hop: 0 -
                State: <Active Int Ext>
                Age: 1:31:40    Metric2: 1
                Task: green-l2vpn
                Announcement bits (1): 1-BGP.0.0.0.0+179
                AS path: I
                Communities: Layer2-info: encaps:VPLS, control flags:Site-Down,
                mtu: 0
                Label-base: 800016, range: 8, status-vector: 0x9F

10.255.71.52:1:5:1/96 (1 entry, 1 announced)
        *L2VPN  Preference: 170/-101
                Next-hop reference count: 5
                Protocol next hop: 10.255.71.52
                Indirect next hop: 0 -
                State: <Active Int Ext>
                Age: 1:31:40    Metric2: 1
                Task: green-l2vpn
                Announcement bits (1): 1-BGP.0.0.0.0+179
                AS path: I
                Communities: Layer2-info: encaps:VPLS, control flags:, mtu: 0
                Label-base: 800008, range: 8, status-vector: 0x9F

...
```

```
l2circuit.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
10.245.255.63:CtrlWord:4:3:Local/96 (1 entry, 1 announced)
        *L2CKT  Preference: 7
                Next hop: via so-1/1/2.0 weight 1, selected
                Label-switched-path my-lsp
                Label operation: Push 100000[0]
                Protocol next hop: 10.245.255.63 Indirect next hop: 86af000 296
                State: <Active Int>
                Local AS:    99
                Age: 10:21
                Task: l2 circuit
                Announcement bits (1): 0-LDP
                AS path: I
                VC Label 100000, MTU 1500, VLAN ID 512
```

show route detail (with BGP Multipath)

```
user@host> show route detail

10.1.1.8/30 (2 entries, 1 announced)
        *BGP    Preference: 170/-101
                Next hop type: Router, Next hop index: 262142
                Address: 0x901a010
                Next-hop reference count: 2
                Source: 10.1.1.2
                Next hop: 10.1.1.2 via ge-0/3/0.1, selected
                Next hop: 10.1.1.6 via ge-0/3/0.5
                State: <Active Ext>
                Local AS:     1 Peer AS:     2
                Age: 5:04:43
                Task: BGP_2.10.1.1.2+59955
                Announcement bits (1): 0-KRT
                AS path: 2 I
                Accepted Multipath
                Localpref: 100
                Router ID: 1.1.1.2
         BGP    Preference: 170/-101
                Next hop type: Router, Next hop index: 678
                Address: 0x8f97520
                Next-hop reference count: 9
                Source: 10.1.1.6
                Next hop: 10.1.1.6 via ge-0/3/0.5, selected
                State: <NotBest Ext>
                Inactive reason: Not Best in its group - Active preferred
                Local AS:     1 Peer AS:     2
                Age: 5:04:43
                Task: BGP_2.10.1.1.6+58198
                AS path: 2 I
                Accepted MultipathContrib
                Localpref: 100
                Router ID: 1.1.1.3
```

show route label detail (Multipoint LDP Inband Signaling for

```
user@host> show route label 299872 detail
mpls.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
299872 (1 entry, 1 announced)
        *LDP    Preference: 9
```

Point-to-Multipoint LSPs)

```
                    Next hop type: Flood
                    Next-hop reference count: 3
                    Address: 0x9097d90
                    Next hop: via vt-0/1/0.1
                    Next-hop index: 661
                    Label operation: Pop
                    Address: 0x9172130
                    Next hop: via so-0/0/3.0
                    Next-hop index: 654
                    Label operation: Swap 299872
                    State: **Active Int>
                    Local AS:  1001
                    Age: 8:20       Metric: 1
                    Task: LDP
                    Announcement bits (1): 0-KRT
                    AS path: I
                   FECs bound to route: P2MP root-addr 10.255.72.166, grp 232.1.1.1,
src 192.168.142.2
```

show route forwarding-table

Syntax

show route forwarding-table
<detail | extensive | summary>
<all>
<ccc *interface-name*>
<destination *destination-prefix*>
<family *family* | matching *matching*>
<interface-name *interface-name*>
<label *name*>
<matching *matching*>
<multicast>
<table (default | *logical-system-name/routing-instance-name* | *routing-instance-name*)>
<vlan (all | *vlan-name*)>
<vpn *vpn*>

Syntax (MX Series Routers)

show route forwarding-table
<detail | extensive | summary>
<all>
<bridge-domain (all | *domain-name*)>
<ccc *interface-name*>
<destination *destination-prefix*>
<family *family* | matching *matching*>
<interface-name *interface-name*>
<label *name*>
<learning-vlan-id *learning-vlan-id*>
<matching *matching*>
<multicast>
<table (default | *logical-system-name/routing-instance-name* | *routing-instance-name*)>
<vlan (all | *vlan-name*)>
<vpn *vpn*>

Syntax (TX Matrix and TX Matrix Plus Routers)

show route forwarding-table
<detail | extensive | summary>
<all>
<ccc *interface-name*>
<destination *destination-prefix*>
<family *family* | matching *matching*>
<interface-name *interface-name*>
<matching *matching*>
<label *name*>
<lcc *number*>
<multicast>
<table *routing-instance-name*>
<vpn *vpn*>

Release Information

Command introduced before Junos OS Release 7.4.
Option **bridge-domain** introduced in Junos OS Release 7.5
Option **learning-vlan-id** introduced in Junos OS Release 8.4
Options **all** and **vlan** introduced in Junos OS Release 9.6.
Command introduced in Junos OS Release 11.3 for the QFX Series.

Description Display the Routing Engine's forwarding table, including the network-layer prefixes and their next hops. This command is used to help verify that the routing protocol process has relayed the correction information to the forwarding table. The Routing Engine constructs and maintains one or more routing tables. From the routing tables, the Routing Engine derives a table of active routes, called the forwarding table.

NOTE: The Routing Engine copies the forwarding table to the Packet Forwarding Engine, the part of the router that is responsible for forwarding packets. To display the entries in the Packet Forwarding Engine's forwarding table, use the **show pfe route** command.

Options **none**—Display the routes in the forwarding tables. By default, the **show route forwarding-table** command does not display information about private, or internal, forwarding tables.

detail | extensive | summary—(Optional) Display the specified level of output.

all—(Optional) Display routing table entries for all forwarding tables, including private, or internal, tables.

bridge-domain (all | *bridge-domain-name*)—(MX Series routers only) (Optional) Display route entries for all bridge domains or the specified bridge domain.

ccc *interface-name*—(Optional) Display route entries for the specified circuit cross-connect interface.

destination *destination-prefix*—(Optional) Destination prefix.

family *family*—(Optional) Display routing table entries for the specified family: **fibre-channel**, **fmembers**, **inet**, **inet6**, **iso**, **mpls**, **tnp**, **unix**, **vpls**, or **vlan-classification**.

interface-name *interface-name*—(Optional) Display routing table entries for the specified interface.

label *name*—(Optional) Display route entries for the specified label.

lcc *number*—(TX Matrix and TX matrix Plus routers only) (Optional) On a routing matrix composed of a TX Matrix router and T640 routers, display information for the specified T640 router (or line-card chassis) connected to the TX Matrix router. On a routing matrix composed of the TX Matrix Plus router and T1600 or T4000 routers, display information for the specified router (line-card chassis) connected to the TX Matrix Plus router.

Replace *number* with the following values depending on the LCC configuration:

- 0 through 3, when T640 routers are connected to a TX Matrix router in a routing matrix.
- 0 through 3, when T1600 routers are connected to a TX Matrix Plus router in a routing matrix.

- 0 through 7, when T1600 routers are connected to a TX Matrix Plus router with 3D SIBs in a routing matrix.
- 0, 2, 4, or 6, when T4000 routers are connected to a TX Matrix Plus router with 3D SIBs in a routing matrix.

learning-vlan-id ***learning-vlan-id***—(MX Series routers only) (Optional) Display learned information for all VLANs or for the specified VLAN.

matching ***matching***—(Optional) Display routing table entries matching the specified prefix or prefix length.

multicast—(Optional) Display routing table entries for multicast routes.

table (default | ***logical-system-name/routing-instance-name*** **|** ***routing-instance-name*****)**—(Optional) Display route entries for all the routing tables in the main routing instance or for the specified routing instance. If your device supports logical systems, you can also display route entries for the specified logical system and routing instance. To view the routing instances on your device, use the **show route instance** command.

vlan (all | ***vlan-name*****)**—(Optional) Display information for all VLANs or for the specified VLAN.

vpn ***vpn***—(Optional) Display routing table entries for a specified VPN.

Required Privilege Level view

List of Sample Output

show route forwarding-table on page 140
show route forwarding-table detail on page 140
show route forwarding-table destination extensive (Weights and Balances) on page 141
show route forwarding-table extensive on page 142
show route forwarding-table extensive (RPF) on page 143
show route forwarding-table family mpls on page 145
show route forwarding-table family vpls on page 145
show route forwarding-table family vpls extensive on page 145
show route forwarding-table table default on page 146
show route forwarding-table table
logical-system-name/routing-instance-name on page 147
show route forwarding-table vpn on page 148

Output Fields Table 13 on page 138 lists the output fields for the **show route forwarding-table** command. Output fields are listed in the approximate order in which they appear. Field names might be abbreviated (as shown in parentheses) when no level of output is specified, or when the **detail** keyword is used instead of the **extensive** keyword.

Table 13: show route forwarding-table Output Fields

Field Name	Field Description	Level of Output
Logical system	Name of the logical system. This field is displayed if you specify the **table** ***logical-system-name/routing-instance-name*** option on a device that is configured for and supports logical systems.	All levels
Routing table	Name of the routing table (for example, inet, inet6, mpls).	All levels
Address family	Address family (for example, **IP**, **IPv6**, **ISO**, **MPLS**, and **VPLS**).	All levels
Destination	Destination of the route.	**detail extensive**
Route Type (Type)	How the route was placed into the forwarding table. When the **detail** keyword is used, the route type might be abbreviated (as shown in parentheses): • **cloned** (**clon**)—(TCP or multicast only) Cloned route. • **destination** (**dest**)—Remote addresses directly reachable through an interface. • **destination down** (**iddn**)—Destination route for which the interface is unreachable. • **interface cloned** (**ifcl**)—Cloned route for which the interface is unreachable. • **route down** (**ifdn**)—Interface route for which the interface is unreachable. • **ignore** (**ignr**)—Ignore this route. • **interface** (**intf**)—Installed as a result of configuring an interface. • **permanent** (**perm**)—Routes installed by the kernel when the routing table is initialized. • **user**—Routes installed by the routing protocol process or as a result of the configuration.	All levels
Route Reference (RtRef)	Number of routes to reference.	**detail extensive**
Flags	Route type flags: • **none**—No flags are enabled. • **accounting**—Route has accounting enabled. • **cached**—Cache route. • **incoming-iface** ***interface-number***—Check against incoming interface. • **prefix load balance**—Load balancing is enabled for this prefix. • **rt nh decoupled**—Route has been decoupled from the next hop to the destination. • **sent to PFE**—Route has been sent to the Packet Forwarding Engine. • **static**—Static route.	**extensive**
Next hop	IP address of the next hop to the destination.	**detail extensive**

Table 13: show route forwarding-table Output Fields *(continued)*

Field Name	Field Description	Level of Output
Next hop Type (Type)	Next-hop type. When the **detail** keyword is used, the next-hop type might be abbreviated (as indicated in parentheses): • **broadcast (bcst)**—Broadcast. • **deny**—Deny. • **discard (dscd)** —Discard. • **hold**—Next hop is waiting to be resolved into a unicast or multicast type. • **indexed (idxd)**—Indexed next hop. • **indirect (indr)**—Indirect next hop. • **local (locl)**—Local address on an interface. • **routed multicast (mcrt)**—Regular multicast next hop. • **multicast (mcst)**—Wire multicast next hop (limited to the LAN). • **multicast discard (mdsc)**—Multicast discard. • **multicast group (mgrp)**—Multicast group member. • **receive (recv)**—Receive. • **reject (rjct)**—Discard. An ICMP unreachable message was sent. • **resolve (rslv)**—Resolving the next hop. • **unicast (ucst)**—Unicast. • **unilist (ulst)**—List of unicast next hops. A packet sent to this next hop goes to any next hop in the list.	**detail extensive**
Index	Software index of the next hop that is used to route the traffic for a given prefix.	**detail extensive** none
Route interface-index	Logical interface index from which the route is learned. For example, for interface routes, this is the logical interface index of the route itself. For static routes, this field is zero. For routes learned through routing protocols, this is the logical interface index from which the route is learned.	**extensive**
Reference (NhRef)	Number of routes that refer to this next hop.	**detail extensive** none
Next-hop interface (Netif)	Interface used to reach the next hop.	**detail extensive** none
Weight	Value used to distinguish primary, secondary, and fast reroute backup routes. Weight information is available when MPLS label-switched path (LSP) link protection, node-link protection, or fast reroute is enabled, or when the standby state is enabled for secondary paths. A lower weight value is preferred. Among routes with the same weight value, load balancing is possible (see the **Balance** field description).	**extensive**
Balance	Balance coefficient indicating how traffic of unequal cost is distributed among next hops when a router is performing unequal-cost load balancing. This information is available when you enable BGP multipath load balancing.	**extensive**
RPF interface	List of interfaces from which the prefix can be accepted. Reverse path forwarding (RPF) information is displayed only when **rpf-check** is configured on the interface.	**extensive**

Sample Output

show route forwarding-table

```
user@host> show route forwarding-table
Routing table: default.inet
Internet:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct    46     4
0.0.0.0/32         perm     0                    dscd    44     1
1.1.1.0/24         ifdn     0                    rslv   608     1 ge-2/0/1.0
1.1.1.0/32         iddn     0 1.1.1.0            recv   606     1 ge-2/0/1.0
1.1.1.1/32         user     0                    rjct    46     4
1.1.1.1/32         intf     0 1.1.1.1            locl   607     2
1.1.1.1/32         iddn     0 1.1.1.1            locl   607     2
1.1.1.255/32       iddn     0 ff:ff:ff:ff:ff:ff  bcst   605     1 ge-2/0/1.0
10.0.0.0/24        intf     0                    rslv   616     1 ge-2/0/0.0
10.0.0.0/32        dest     0 10.0.0.0           recv   614     1 ge-2/0/0.0
10.0.0.1/32        intf     0 10.0.0.1           locl   615     2
10.0.0.1/32        dest     0 10.0.0.1           locl   615     2
10.0.0.255/32      dest     0 10.0.0.255         bcst   613     1 ge-2/0/0.0
10.1.1.0/24        ifdn     0                    rslv   612     1 ge-2/0/1.0
10.1.1.0/32        iddn     0 10.1.1.0           recv   610     1 ge-2/0/1.0
10.1.1.1/32        user     0                    rjct    46     4
10.1.1.1/32        intf     0 10.1.1.1           locl   611     2
10.1.1.1/32        iddn     0 10.1.1.1           locl   611     2
10.1.1.255/32      iddn     0 ff:ff:ff:ff:ff:ff  bcst   609     1 ge-2/0/1.0
10.206.0.0/16      user     0 10.209.63.254      ucst   419    20 fxp0.0
10.209.0.0/16      user     1 0:12:1e:ca:98:0    ucst   419    20 fxp0.0
10.209.0.0/18      intf     0                    rslv   418     1 fxp0.0
10.209.0.0/32      dest     0 10.209.0.0         recv   416     1 fxp0.0
10.209.2.131/32    intf     0 10.209.2.131       locl   417     2
10.209.2.131/32    dest     0 10.209.2.131       locl   417     2
10.209.17.55/32    dest     0 0:30:48:5b:78:d2   ucst   435     1 fxp0.0
10.209.63.42/32    dest     0 0:23:7d:58:92:ca   ucst   434     1 fxp0.0
10.209.63.254/32   dest     0 0:12:1e:ca:98:0    ucst   419    20 fxp0.0
10.209.63.255/32   dest     0 10.209.63.255      bcst   415     1 fxp0.0
10.227.0.0/16      user     0 10.209.63.254      ucst   419    20 fxp0.0

...

Routing table: iso
ISO:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                   rjct    27     1
47.0005.80ff.f800.0000.0108.0003.0102.5524.5220.00
intf     0                   locl    28     1

Routing table: inet6
Internet6:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                   rjct     6     1
ff00::/8           perm     0                   mdsc     4     1
ff02::1/128        perm     0 ff02::1           mcst     3     1

Routing table: ccc
MPLS:
Interface.Label    Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct 16     1
100004(top)fe-0/0/1.0
```

show route forwarding-table detail

```
user@host> show route forwarding-table detail
Routing table: inet
Internet:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            user     2 0:90:69:8e:b1:1b   ucst   132     4 fxp0.0
default            perm     0                    rjct    14     1
10.1.1.0/24        intf     0 ff.3.0.21          ucst   322     1 so-5/3/0.0
10.1.1.0/32        dest     0 10.1.1.0           recv   324     1 so-5/3/0.0
10.1.1.1/32        intf     0 10.1.1.1           locl   321     1
10.1.1.255/32      dest     0 10.1.1.255         bcst   323     1 so-5/3/0.0
10.21.21.0/24      intf     0 ff.3.0.21          ucst   326     1 so-5/3/0.0
10.21.21.0/32      dest     0 10.21.21.0         recv   328     1 so-5/3/0.0
10.21.21.1/32      intf     0 10.21.21.1         locl   325     1
10.21.21.255/32    dest     0 10.21.21.255       bcst   327     1 so-5/3/0.0
127.0.0.1/32       intf     0 127.0.0.1          locl   320     1
172.17.28.19/32    clon     1 192.168.4.254      ucst   132     4 fxp0.0
172.17.28.44/32    clon     1 192.168.4.254      ucst   132     4 fxp0.0

...

Routing table: private1__.inet
Internet:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct    46     1
10.0.0.0/8         intf     0                    rslv   136     1 fxp1.0
10.0.0.0/32        dest     0 10.0.0.0           recv   134     1 fxp1.0
10.0.0.4/32        intf     0 10.0.0.4           locl   135     2
10.0.0.4/32        dest     0 10.0.0.4           locl   135     2

...

Routing table: iso
ISO:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct    38     1

Routing table: inet6
Internet6:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct    22     1
ff00::/8           perm     0                    mdsc    21     1
ff02::1/128        perm     0 ff02::1            mcst    17     1

...

Routing table: mpls
MPLS:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct 28     1
```

show route forwarding-table destination extensive

```
user@host> show route forwarding-table destination 3.4.2.1 extensive
Routing table: inet [Index 0]
Internet:
```

(Weights and Balances)

```
Destination:  3.4.2.1/32
  Route type: user
  Route reference: 0                    Route interface-index: 0
  Flags: sent to PFE
  Next-hop type: unilist                Index: 262143   Reference: 1
  Nexthop: 4.4.4.4
  Next-hop type: unicast                Index: 335      Reference: 2
  Next-hop interface: so-1/1/0.0        Weight: 22      Balance: 3
  Nexthop: 145.12.1.2
  Next-hop type: unicast                Index: 337      Reference: 2
  Next-hop interface: so-0/1/2.0        Weight: 33      Balance: 33
```

show route forwarding-table extensive

```
user@host> show route forwarding-table extensive
Routing table: inet [Index 0]
Internet:

Destination:  default
  Route type: user
  Route reference: 2                    Route interface-index: 0
  Flags: sent to PFE
  Nexthop: 0:90:69:8e:b1:1b
  Next-hop type: unicast                Index: 132      Reference: 4
  Next-hop interface: fxp0.0

Destination:  default
  Route type: permanent
  Route reference: 0                    Route interface-index: 0
  Flags: none
  Next-hop type: reject                 Index: 14       Reference: 1

Destination:  127.0.0.1/32
  Route type: interface
  Route reference: 0                    Route interface-index: 0
  Flags: sent to PFE
  Nexthop: 127.0.0.1
  Next-hop type: local                  Index: 320      Reference: 1

...

Routing table: private1__.inet [Index 1]
Internet:

Destination:  default
  Route type: permanent
  Route reference: 0                    Route interface-index: 0
  Flags: sent to PFE
  Next-hop type: reject                 Index: 46       Reference: 1

Destination:  10.0.0.0/8
  Route type: interface
  Route reference: 0                    Route interface-index: 3
  Flags: sent to PFE
  Next-hop type: resolve                Index: 136      Reference: 1
  Next-hop interface: fxp1.0

...

Routing table: iso [Index 0]
ISO:

Destination:  default
```

```
  Route type: permanent
  Route reference: 0                    Route interface-index: 0
  Flags: sent to PFE
  Next-hop type: reject                 Index: 38       Reference: 1

Routing table: inet6 [Index 0]
Internet6:

Destination:  default
  Route type: permanent
  Route reference: 0                    Route interface-index: 0
  Flags: sent to PFE
  Next-hop type: reject                 Index: 22       Reference: 1

Destination:  ff00::/8
  Route type: permanent
  Route reference: 0                    Route interface-index: 0
  Flags: sent to PFE
  Next-hop type: multicast discard      Index: 21       Reference: 1

...

Routing table: private1__.inet6 [Index 1]
Internet6:

Destination:  default
  Route type: permanent
  Route reference: 0                    Route interface-index: 0
  Flags: sent to PFE
  Next-hop type: reject                 Index: 54       Reference: 1

Destination:  fe80::2a0:a5ff:fe3d:375/128
  Route type: interface
  Route reference: 0                    Route interface-index: 0
  Flags: sent to PFE
  Nexthop: fe80::2a0:a5ff:fe3d:375
  Next-hop type: local                  Index: 75       Reference: 1

...
```

show route forwarding-table extensive (RPF)

The next example is based on the following configuration, which enables an RPF check on all routes that are learned from this interface, including the interface route:

```
so-1/1/0 {
    unit 0 {
        family inet {
            rpf-check;
            address 15.95.1.2/30;
        }
    }
}

user@host> show route forwarding-table extensive
Routing table: inet [Index 0]
Internet:
...
...
Destination:  15.95.1.3/32
  Route type: destination
  Route reference: 0                    Route interface-index: 67
```

```
Flags: sent to PFE
Nexthop: 15.95.1.3
Next-hop type: broadcast             Index: 328      Reference: 1
Next-hop interface: so-1/1/0.0
RPF interface: so-1/1/0.0
```

show route forwarding-table family mpls

```
user@host> show route forwarding-table family mpls
Routing table: mpls
MPLS:
Destination        Type RtRef Next hop          Type Index NhRef Netif
default            perm     0                   rjct    19     1
0                  user     0                   recv    18     3
1                  user     0                   recv    18     3
2                  user     0                   recv    18     3
100000             user     0 10.31.1.6         swap  100001     fe-1/1/0.0
800002             user     0                   Pop              vt-0/3/0.32770

vt-0/3/0.32770 (VPLS)
                   user     0                   indr   351     4
                                                Push 800000, Push 100002(top)
so-0/0/0.0
```

show route forwarding-table family vpls

```
user@host> show route forwarding-table family vpls
Routing table: green.vpls
VPLS:
Destination        Type RtRef Next hop          Type Index NhRef Netif
default            dynm     0                   flood   353     1
default            perm     0                   rjct    298     1
fe-0/1/0.0         dynm     0                   flood   355     1
00:90:69:0c:20:1f/48             <<<<<Remote CE

                   dynm     0                   indr   351     4
                                                Push 800000, Push 100002(top)
so-0/0/0.0
00:90:69:85:b0:1f/48             <<<<<<Local CE

                   dynm     0                   ucst   354     2 fe-0/1/0.0
```

show route forwarding-table family vpls extensive

```
user@host> show route forwarding-table family vpls extensive
Routing table: green.vpls [Index 2]
VPLS:

Destination:  default
  Route type: dynamic
  Route reference: 0                    Route interface-index: 72
  Flags: sent to PFE
  Next-hop type: flood                  Index: 289      Reference: 1
  Next-hop type: unicast                Index: 291      Reference: 3
  Next-hop interface: fe-0/1/3.0
  Next-hop type: unicast                Index: 290      Reference: 3
  Next-hop interface: fe-0/1/2.0

Destination:  default
  Route type: permanent
  Route reference: 0                    Route interface-index: 0
  Flags: none
  Next-hop type: discard                Index: 341      Reference: 1

Destination:  fe-0/1/2.0
  Route type: dynamic
  Route reference: 0                    Route interface-index: 69
  Flags: sent to PFE
  Next-hop type: flood                  Index: 293      Reference: 1
  Next-hop type: indirect               Index: 363      Reference: 4
  Next-hop type: Push 800016
```

```
  Next-hop interface: at-1/0/1.0
  Next-hop type: indirect              Index: 301      Reference: 5
  Next hop: 10.31.3.2
  Next-hop type: Push 800000
  Next-hop interface: fe-0/1/1.0
  Next-hop type: unicast               Index: 291      Reference: 3
  Next-hop interface: fe-0/1/3.0

Destination:  fe-0/1/3.0
  Route type: dynamic
  Route reference: 0                   Route interface-index: 70
  Flags: sent to PFE
  Next-hop type: flood                 Index: 292      Reference: 1
  Next-hop type: indirect              Index: 363      Reference: 4
  Next-hop type: Push 800016
  Next-hop interface: at-1/0/1.0
  Next-hop type: indirect              Index: 301      Reference: 5
  Next hop: 10.31.3.2
  Next-hop type: Push 800000
  Next-hop interface: fe-0/1/1.0
  Next-hop type: unicast               Index: 290      Reference: 3
  Next-hop interface: fe-0/1/2.0

Destination:  10:00:00:01:01:01/48
  Route type: dynamic
  Route reference: 0                   Route interface-index: 70
  Flags: sent to PFE, prefix load balance
  Next-hop type: unicast               Index: 291      Reference: 3
  Next-hop interface: fe-0/1/3.0
  Route used as destination:
    Packet count:         6640    Byte count:      675786
  Route used as source
    Packet count:         6894    Byte count:      696424

Destination:  10:00:00:01:01:04/48
  Route type: dynamic
  Route reference: 0                   Route interface-index: 69
  Flags: sent to PFE, prefix load balance
  Next-hop type: unicast               Index: 290      Reference: 3
  Next-hop interface: fe-0/1/2.0
  Route used as destination:
    Packet count:           96    Byte count:        8079
  Route used as source:
    Packet count:          296    Byte count:       24955

Destination:  10:00:00:01:03:05/48
  Route type: dynamic
  Route reference: 0                   Route interface-index: 74
  Flags: sent to PFE, prefix load balance
  Next-hop type: indirect              Index: 301      Reference: 5
  Next hop: 10.31.3.2
  Next-hop type: Push 800000
  Next-hop interface: fe-0/1/1.0
```

show route forwarding-table table default

```
user@host> show route forwarding-table table default
Routing table: default.inet
Internet:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct    36     2
0.0.0.0/32         perm     0                    dscd    34     1
10.0.60.0/30       user     0 10.0.60.13         ucst   713     5 fe-0/1/3.0
```

```
10.0.60.12/30      intf     0                    rslv   688     1 fe-0/1/3.0
10.0.60.12/32      dest     0 10.0.60.12         recv   686     1 fe-0/1/3.0
10.0.60.13/32      dest     0 0:5:85:8b:bc:22    ucst   713     5 fe-0/1/3.0
10.0.60.14/32      intf     0 10.0.60.14         locl   687     2
10.0.60.14/32      dest     0 10.0.60.14         locl   687     2
10.0.60.15/32      dest     0 10.0.60.15         bcst   685     1 fe-0/1/3.0
10.0.67.12/30      user     0 10.0.60.13         ucst   713     5 fe-0/1/3.0
10.0.80.0/30       ifdn     0 ff.3.0.21          ucst   676     1 so-0/0/1.0
10.0.80.0/32       dest     0 10.0.80.0          recv   678     1 so-0/0/1.0
10.0.80.2/32       user     0                    rjct    36     2
10.0.80.2/32       intf     0 10.0.80.2          locl   675     1
10.0.80.3/32       dest     0 10.0.80.3          bcst   677     1 so-0/0/1.0
10.0.90.12/30      intf     0                    rslv   684     1 fe-0/1/0.0
10.0.90.12/32      dest     0 10.0.90.12         recv   682     1 fe-0/1/0.0
10.0.90.14/32      intf     0 10.0.90.14         locl   683     2
10.0.90.14/32      dest     0 10.0.90.14         locl   683     2
10.0.90.15/32      dest     0 10.0.90.15         bcst   681     1 fe-0/1/0.0
10.5.0.0/16        user     0 192.168.187.126    ucst   324    15 fxp0.0
10.10.0.0/16       user     0 192.168.187.126    ucst   324    15 fxp0.0
10.13.10.0/23      user     0 192.168.187.126    ucst   324    15 fxp0.0
10.84.0.0/16       user     0 192.168.187.126    ucst   324    15 fxp0.0
10.150.0.0/16      user     0 192.168.187.126    ucst   324    15 fxp0.0
10.157.64.0/19     user     0 192.168.187.126    ucst   324    15 fxp0.0
10.209.0.0/16      user     0 192.168.187.126    ucst   324    15 fxp0.0

...

Routing table: default.iso
ISO:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct    60     1

Routing table: default.inet6
Internet6:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct    44     1
::/128             perm     0                    dscd    42     1
ff00::/8           perm     0                    mdsc    43     1
ff02::1/128        perm     0 ff02::1            mcst    39     1

Routing table: default.mpls
MPLS:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    dscd    50     1
```

show route forwarding-table table *logical-system-name:routing-instance-name*

```
user@host> show route forwarding-table table R4/vpn-red
Logical system: R4
Routing table: vpn-red.inet
Internet:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct   563     1
0.0.0.0/32         perm     0                    dscd   561     2
1.0.0.1/32         user     0                    dscd   561     2
2.0.2.0/24         intf     0                    rslv   771     1 ge-1/2/0.3
2.0.2.0/32         dest     0 2.0.2.0            recv   769     1 ge-1/2/0.3
2.0.2.1/32         intf     0 2.0.2.1            locl   770     2
2.0.2.1/32         dest     0 2.0.2.1            locl   770     2
2.0.2.2/32         dest     0 0.4.80.3.0.1b.c0.d5.e4.bd.0.1b.c0.d5.e4.bc.8.0
                                                 ucst   789     1 ge-1/2/0.3
2.0.2.255/32       dest     0 2.0.2.255          bcst   768     1 ge-1/2/0.3
224.0.0.0/4        perm     1                    mdsc   562     1
```

```
224.0.0.1/32       perm     0 224.0.0.1          mcst   558     1
255.255.255.255/32 perm     0                    bcst   559     1

Logical system: R4
Routing table: vpn-red.iso
ISO:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct   608     1

Logical system: R4
Routing table: vpn-red.inet6
Internet6:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    rjct   708     1
::/128             perm     0                    dscd   706     1
ff00::/8           perm     0                    mdsc   707     1
ff02::1/128        perm     0 ff02::1            mcst   704     1

Logical system: R4
Routing table: vpn-red.mpls
MPLS:
Destination        Type RtRef Next hop           Type Index NhRef Netif
default            perm     0                    dscd   638
```

show route forwarding-table vpn

```
user@host> show route forwarding-table vpn VPN-A
      Routing table:: VPN-A.inet
Internet:
      Destination        Type RtRef Nexthop           Type Index NhRef Netif
      default            perm     0                   rjct     4     4
      10.39.10.20/30     intf     0 ff.3.0.21         ucst    40     1
      so-0/0/0.0
      10.39.10.21/32     intf     0 10.39.10.21       locl    36     1
      10.255.14.172/32   user     0                   ucst    69     2
      so-0/0/0.0
      10.255.14.175/32   user     0                   indr    81     3
                                                      Push 100004, Push
      100004(top) so-1/0/0.0
      224.0.0.0/4        perm     2                   mdsc     5     3
      224.0.0.1/32       perm     0 224.0.0.1         mcst     1     8
      224.0.0.5/32       user     1 224.0.0.5         mcst     1     8
      255.255.255.255/32 perm     0                   bcst     2     3
```

show route hidden

Syntax
show route hidden
<brief | detail | extensive | terse>
<logical-system (all | *logical-system-name*)>

Release Information
Command introduced before Junos OS Release 7.4.

Description
Display only hidden route information. A hidden route is unusable, even if it is the best path.

Options
brief | detail | extensive | terse—(Optional) Display the specified level of output. If you do not specify a level of output, the system defaults to **brief**.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
view

Related Documentation
- *Understanding Hidden Routes*

List of Sample Output
show route hidden on page 150
show route hidden detail on page 150
show route hidden extensive on page 151
show route hidden terse on page 151

Output Fields
For information about output fields, see the output field table for the show route command, the show route detail command, the **show route extensive** command, or the **show route terse** command.

Sample Output

show route hidden

```
user@host> show route hidden
inet.0: 25 destinations, 26 routes (24 active, 0 holddown, 1 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both
127.0.0.1/32        [Direct/0] 04:26:38
                    > via lo0.0

private1__.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

red.inet.0: 6 destinations, 8 routes (4 active, 0 holddown, 3 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both
10.5.5.5/32         [BGP/170] 03:44:10, localpref 100, from 10.4.4.4
                      AS path: 100 I
                      Unusable
10.12.1.0/24        [BGP/170] 03:44:10, localpref 100, from 10.4.4.4
                      AS path: 100 I
                      Unusable
10.12.80.4/30       [BGP/170] 03:44:10, localpref 100, from 10.4.4.4
                      AS path: I
                      Unusable
...
```

show route hidden detail

```
user@host> show route hidden detail

inet.0: 25 destinations, 26 routes (24 active, 0 holddown, 1 hidden)
Restart Complete
127.0.0.1/32 (1 entry, 0 announced)
         Direct Preference: 0
                Next hop type: Interface
                Next-hop reference count: 1
                Next hop: via lo0.0, selected
                State: <Hidden Martian Int>
                Local AS:     1
                Age: 4:27:37
                Task: IF
                AS path: I

private1__.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

red.inet.0: 6 destinations, 8 routes (4 active, 0 holddown, 3 hidden)
Restart Complete

10.5.5.5/32 (1 entry, 0 announced)
         BGP    Preference: 170/-101
                Route Distinguisher: 10.4.4.4:4
                Next hop type: Unusable
                Next-hop reference count: 6
                State: <Secondary Hidden Int Ext>
                Local AS:     1 Peer AS:     1
                Age: 3:45:09
                Task: BGP_1.10.4.4.4+2493
                AS path: 100 I
                Communities: target:1:999
                VPN Label: 100064
                Localpref: 100
                Router ID: 10.4.4.4
```

```
                    Primary Routing Table bgp.l3vpn.0

...
```

show route hidden extensive

The output for the **show route hidden extensive** command is identical to that of the **show route hidden detail** command. For sample output, see show route hidden detail on page 150.

show route hidden terse

```
user@host> show route hidden terse

inet.0: 25 destinations, 26 routes (24 active, 0 holddown, 1 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

A Destination        P Prf   Metric 1   Metric 2  Next hop        AS path
  127.0.0.1/32       D   0                     >lo0.0

private1__.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

red.inet.0: 6 destinations, 8 routes (4 active, 0 holddown, 3 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

A Destination        P Prf   Metric 1   Metric 2  Next hop        AS path
  10.5.5.5/32        B 170        100             Unusable        100 I
  10.12.1.0/24       B 170        100             Unusable        100 I
  10.12.80.4/30      B 170        100             Unusable        I

iso.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
Restart Complete

mpls.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
Restart Complete

bgp.l3vpn.0: 3 destinations, 3 routes (0 active, 0 holddown, 3 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

A Destination        P Prf   Metric 1   Metric 2  Next hop        AS path
  10.4.4.4:4:10.5.5.5/32
                     B 170        100             Unusable        100 I
  10.4.4.4:4:10.12.1.0/24
                     B 170        100             Unusable        100 I
  10.4.4.4:4:10.12.80.4/30
                     B 170        100             Unusable        I

inet6.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
Restart Complete

private1__.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

show route summary

Syntax
show route summary
<logical-system (all | *logical-system-name*)>
<table *routing-table-name*>

Syntax (EX Series Switches)
show route summary

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.

Description
Display summary statistics about the entries in the routing table.

CPU utilization might increase while the device learns routes. We recommend that you use the **show route summary** command after the device learns and enters the routes into the routing table. Depending on the size of your network, this might take several minutes. If you receive a "timeout communicating with routing daemon" error when using the **show route summary** command, wait several minutes before attempting to use the command again. This is not a critical system error, but you might experience a delay in using the command-line interface (CLI).

Options
none—Display summary statistics about the entries in the routing table.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

table *routing-table-name*—(Optional) Display summary statistics for all routing tables whose name begins with this string (for example, **inet.0** and **inet6.0** are both displayed when you run the **show route summary table inet** command). If you only want to display statistics for a specific routing table, make sure to enter the exact name of that routing table.

Required Privilege Level
view

List of Sample Output
show route summary on page 154
show route summary table on page 154
show route summary table (with Route Limits Configured for the Routing Table) on page 155

Output Fields
Table 14 on page 152 lists the output fields for the **show route summary** command. Output fields are listed in the approximate order in which they appear.

Table 14: show route summary Output Fields

Field Name	Field Description
Router ID	Address of the local routing device.
routing-table-name	Name of the routing table (for example, **inet.0**).

Table 14: show route summary Output Fields *(continued)*

Field Name	Field Description
destinations	Number of destinations for which there are routes in the routing table.
routes	Number of routes in the routing table: • **active**—Number of routes that are active. • **holddown**—Number of routes that are in the hold-down state before being declared inactive. • **hidden**—Number of routes that are not used because of routing policy.
Limit/Threshold	Displays the configured route limits for the routing table set with the ***maximum-prefixes*** and the **maximum-paths** statements. If you do not configure route limits for the routing table, the show output does not display this information. • **destinations**—The first number represents the maximum number of route prefixes installed in the routing table. The second number represents the number of route prefixes that trigger a warning message. • **routes**—The first number represents the maximum number of routes. The second number represents the number of routes that trigger a warning message.
Direct	Routes on the directly connected network.
Local	Local routes.
protocol-name	Name of the protocol from which the route was learned. For example, **OSPF**, **RSVP**, and **Static**.

Sample Output

show route summary

```
user@host> show route summary
Autonomous system number: 69
Router ID: 10.255.71.52
Maximum-ECMP: 32
inet.0: 24 destinations, 25 routes (23 active, 0 holddown, 1 hidden)
Restart Complete
              Direct:      6 routes,      5 active
               Local:      4 routes,      4 active
                OSPF:      5 routes,      4 active
              Static:      7 routes,      7 active
                IGMP:      1 routes,      1 active
                 PIM:      2 routes,      2 active

inet.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
Restart Complete
                RSVP:      2 routes,      2 active

iso.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
Restart Complete
              Direct:      1 routes,      1 active

mpls.0: 7 destinations, 7 routes (5 active, 0 holddown, 2 hidden)
Restart Complete
                MPLS:      3 routes,      3 active
                VPLS:      4 routes,      2 active

inet6.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
Restart Complete
              Direct:      2 routes,      2 active
                 PIM:      2 routes,      2 active
                 MLD:      1 routes,      1 active

green.l2vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
Restart Complete
                 BGP:      2 routes,      2 active
               L2VPN:      2 routes,      2 active

red.l2vpn.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
Restart Complete
                 BGP:      2 routes,      2 active
              L2VPN:      1 routes,      1 active

bgp.l2vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
Restart Complete
                 BGP:      4 routes,      4 active
```

show route summary table

```
user@host> show route summary table inet
Router ID: 192.168.0.1

inet.0: 32 destinations, 34 routes (31 active, 0 holddown, 1 hidden)
              Direct:      6 routes,      5 active
               Local:      9 routes,      9 active
                OSPF:      3 routes,      1 active
              Static:     13 routes,     13 active
                IGMP:      1 routes,      1 active
                 PIM:      2 routes,      2 active
```

```
inet.1: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
           Multicast:      1 routes,      1 active

inet6.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
               Local:      1 routes,      1 active
                 PIM:      2 routes,      2 active

inet6.1: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
           Multicast:      1 routes,      1 active
```

show route summary table (with Route Limits Configured for the Routing Table)

```
user@host> show route summary table VPN-A.inet.0
Autonomous system number: 100
Router ID: 10.255.182.142

VPN-A.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)
Limit/Threshold: 2000/200 destinations 20/12 routes
              Direct:      2 routes,      2 active
               Local:      1 routes,      1 active
                OSPF:      4 routes,      3 active
                 BGP:      4 routes,      4 active
                IGMP:      1 routes,      1 active
                 PIM:      2 routes,      2 active
```

show route table

Syntax

show route table *routing-table-name*
<brief | detail | extensive | terse>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches)

show route table *routing-table-name*
<brief | detail | extensive | terse>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.

Description

Display the route entries in a particular routing table.

Options

brief | detail | extensive | terse—(Optional) Display the specified level of output.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

routing-table-name—Display route entries for all routing tables whose name begins with this string (for example, inet.0 and inet6.0 are both displayed when you run the **show route table inet** command).

Required Privilege Level

view

Related Documentation

- show route summary on page 152

List of Sample Output

show route table inetflow detail on page 165

Output Fields For information about output fields, see the output field tables for the show route command, the show route detail command, the **show route extensive** command, or the **show route terse** command.

Sample Output

show route table bgp.l2.vpn

```
user@host> show route table bgp.l2.vpn
bgp.l2vpn.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.24.1:1:4:1/96
                   *[BGP/170] 01:08:58, localpref 100, from 192.168.24.1
                      AS path: I
                    > to 10.0.16.2 via fe-0/0/1.0, label-switched-path am
```

show route table bgp.l3vpn.0

```
user@host> show route table bgp.l3vpn.0
      bgp.l3vpn.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
      + = Active Route, - = Last Active, * = Both

      10.255.71.15:100:10.255.71.17/32
                         *[BGP/170] 00:03:59, MED 1, localpref 100, from
      10.255.71.15
                           AS path: I
                          > via so-2/1/0.0, Push 100020, Push 100011(top)
      10.255.71.15:200:10.255.71.18/32
                         *[BGP/170] 00:03:59, MED 1, localpref 100, from
      10.255.71.15
                           AS path: I
                          > via so-2/1/0.0, Push 100021, Push 100011(top)
```

show route table bgp.l3vpn.0 detail

```
user@host> show route table bgp.l3vpn.0 detail
bgp.l3vpn.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)

10.255.245.12:1:4.0.0.0/8 (1 entry, 1 announced)
  *BGP    Preference: 170/-101
          Route Distinguisher: 10.255.245.12:1
          Source: 10.255.245.12
          Next hop: 192.168.208.66 via fe-0/0/0.0, selected
          Label operation: Push 182449
          Protocol next hop: 10.255.245.12
          Push 182449
          Indirect next hop: 863a630 297
          State: <Active Int Ext>
          Local AS:    35 Peer AS:    35
          Age: 12:19      Metric2: 1
          Task: BGP_35.10.255.245.12+179
          Announcement bits (1): 0-BGP.0.0.0.0+179
          AS path: 30 10458 14203 2914 3356 I (Atomic) Aggregator: 3356 4.68.0.11

          Communities: 2914:420 target:11111:1 origin:56:78
          VPN Label: 182449
          Localpref: 100
           Router ID: 10.255.245.12

10.255.245.12:1:4.17.225.0/24 (1 entry, 1 announced)
  *BGP    Preference: 170/-101
          Route Distinguisher: 10.255.245.12:1
          Source: 10.255.245.12
          Next hop: 192.168.208.66 via fe-0/0/0.0, selected
          Label operation: Push 182465
          Protocol next hop: 10.255.245.12
          Push 182465
```

```
            Indirect next hop: 863a8f0 305
            State: <Active Int Ext>
            Local AS:    35 Peer AS:    35
            Age: 12:19      Metric2: 1
            Task: BGP_35.10.255.245.12+179
            Announcement bits (1): 0-BGP.0.0.0.0+179
AS path: 30 10458 14203 2914 11853 11853 11853 6496 6496 6496 6496 6496 6496 I
                   Communities: 2914:410 target:12:34 target:11111:1 origin:12:34
                   VPN Label: 182465
                   Localpref: 100
                   Router ID: 10.255.245.12

10.255.245.12:1:4.17.226.0/23 (1 entry, 1 announced)
  *BGP   Preference: 170/-101
            Route Distinguisher: 10.255.245.12:1
            Source: 10.255.245.12
            Next hop: 192.168.208.66 via fe-0/0/0.0, selected
            Label operation: Push 182465
            Protocol next hop: 10.255.245.12
            Push 182465
            Indirect next hop: 86bd210 330
            State: <Active Int Ext>
            Local AS:    35 Peer AS:    35
            Age: 12:19      Metric2: 1
            Task: BGP_35.10.255.245.12+179
            Announcement bits (1): 0-BGP.0.0.0.0+179
            AS path: 30 10458 14203 2914 11853 11853 11853 6496 6496 6496 6496 6496

            6496 I
            Communities: 2914:410 target:12:34 target:11111:1 origin:12:34
            VPN Label: 182465
            Localpref: 100
            Router ID: 10.255.245.12

10.255.245.12:1:4.17.251.0/24 (1 entry, 1 announced)
  *BGP   Preference: 170/-101
            Route Distinguisher: 10.255.245.12:1
            Source: 10.255.245.12
            Next hop: 192.168.208.66 via fe-0/0/0.0, selected
            Label operation: Push 182465
            Protocol next hop: 10.255.245.12
            Push 182465
            Indirect next hop: 86bd210 330
            State: <Active Int Ext>
            Local AS:    35 Peer AS:    35
            Age: 12:19      Metric2: 1
            Task: BGP_35.10.255.245.12+179
            Announcement bits (1): 0-BGP.0.0.0.0+179
            AS path: 30 10458 14203 2914 11853 11853 11853 6496 6496 6496 6496 6496

            6496 I
            Communities: 2914:410 target:12:34 target:11111:1 origin:12:34
            VPN Label: 182465
            Localpref: 100
```

show route table bgp.rtarget.0 (When Proxy BGP Route

```
user@host> show route table bgp.rtarget.o
bgp.rtarget.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
```

Target Filtering Is Configured)

```
100:100:100/96
                   *[RTarget/5] 00:03:14
                      Type Proxy
                        for 10.255.165.103
                        for 10.255.166.124
                      Local
```

show route table inet.0

```
user@host> show route table inet.0
inet.0: 12 destinations, 12 routes (11 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

0.0.0.0/0          *[Static/5] 00:51:57
                    > to 111.222.5.254 via fxp0.0
1.0.0.1/32         *[Direct/0] 00:51:58
                    > via at-5/3/0.0
1.0.0.2/32         *[Local/0] 00:51:58
                      Local
12.12.12.21/32     *[Local/0] 00:51:57
                      Reject
13.13.13.13/32     *[Direct/0] 00:51:58
                    > via t3-5/2/1.0
13.13.13.14/32     *[Local/0] 00:51:58
                      Local
13.13.13.21/32     *[Local/0] 00:51:58
                      Local
13.13.13.22/32     *[Direct/0] 00:33:59
                    > via t3-5/2/0.0
127.0.0.1/32        [Direct/0] 00:51:58
                    > via lo0.0
111.222.5.0/24     *[Direct/0] 00:51:58
                    > via fxp0.0
111.222.5.81/32    *[Local/0] 00:51:58
                      Local
```

show route table inet6.0

```
user@host> show route table inet6.0
inet6.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Route, * = Both

fec0:0:0:3::/64 *[Direct/0] 00:01:34
>via fe-0/1/0.0

fec0:0:0:3::/128 *[Local/0] 00:01:34
>Local

fec0:0:0:4::/64 *[Static/5] 00:01:34
>to fec0:0:0:3::ffff via fe-0/1/0.0
```

show route table inet6.3

```
user@router> show route table inet6.3
inet6.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

::10.255.245.195/128
                   *[LDP/9] 00:00:22, metric 1
                    > via so-1/0/0.0
::10.255.245.196/128
                   *[LDP/9] 00:00:08, metric 1
                    > via so-1/0/0.0, Push 100008
```

show route table inetflow detail

```
user@host> show route table inetflow detail
inetflow.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
10.12.44.1,*/48 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next-hop reference count: 2
                State: <Active Ext>
                Local AS: 65002 Peer AS: 65000
                Age: 4
                Task: BGP_65000.10.12.99.5+3792
                Announcement bits (1): 0-Flow
                AS path: 65000 I
                Communities: traffic-rate:0:0
                Validation state: Accept, Originator: 10.12.99.5
                Via: 10.12.44.0/24, Active
                Localpref: 100
                Router ID: 10.255.71.161

10.12.56.1,*/48 (1 entry, 1 announced)
        *Flow   Preference: 5
                Next-hop reference count: 2
                State: <Active>
                Local AS: 65002
                Age: 6:30
                Task: RT Flow
                Announcement bits (2): 0-Flow 1-BGP.0.0.0.0+179
                AS path: I
                Communities: 1:1
```

show route table l2circuit.0

```
user@host> show route table l2circuit.0
l2circuit.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.1.1.195:NoCtrlWord:1:1:Local/96
                   *[L2CKT/7] 00:50:47
                    > via so-0/1/2.0, Push 100049
                      via so-0/1/3.0, Push 100049
10.1.1.195:NoCtrlWord:1:1:Remote/96
                   *[LDP/9] 00:50:14
                      Discard
10.1.1.195:CtrlWord:1:2:Local/96
                   *[L2CKT/7] 00:50:47
                    > via so-0/1/2.0, Push 100049
                      via so-0/1/3.0, Push 100049
10.1.1.195:CtrlWord:1:2:Remote/96
                   *[LDP/9] 00:50:14
                      Discard
```

show route table mpls

```
user@host> show route table mpls
mpls.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

0                  *[MPLS/0] 00:13:55, metric 1
                      Receive
1                  *[MPLS/0] 00:13:55, metric 1
                      Receive
2                  *[MPLS/0] 00:13:55, metric 1
                      Receive
1024               *[VPN/0] 00:04:18
                      to table red.inet.0, Pop
```

show route table mpls extensive

```
user@host> show route table mpls extensive
100000 (1 entry, 1 announced)
TSI:
KRT in-kernel 100000 /36 -> {so-1/0/0.0}
        *LDP    Preference:   9
                Next hop:  via so-1/0/0.0, selected
                Pop
                State: <Active Int>
                Age: 29:50      Metric: 1
                Task: LDP
                Announcement bits (1): 0-KRT
                AS path: I
                Prefixes bound to route: 10.0.0.194/32
```

show route table mpls.0

```
user@host> show route table mpls.0
mpls.0: 11 destinations, 11 routes (11 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

0                  *[MPLS/0] 00:45:09, metric 1
                      Receive
1                  *[MPLS/0] 00:45:09, metric 1
                      Receive
2                  *[MPLS/0] 00:45:09, metric 1
                      Receive
100000             *[L2VPN/7] 00:43:04
                    > via so-0/1/0.1, Pop
100001             *[L2VPN/7] 00:43:03
                    > via so-0/1/0.2, Pop       Offset: 4
100002             *[LDP/9] 00:43:22, metric 1
                      via so-0/1/2.0, Pop
                    > via so-0/1/3.0, Pop
100002(S=0)        *[LDP/9] 00:43:22, metric 1
                      via so-0/1/2.0, Pop
                    > via so-0/1/3.0, Pop
100003             *[LDP/9] 00:43:22, metric 1
                    > via so-0/1/2.0, Swap 100002
                      via so-0/1/3.0, Swap 100002
100004             *[LDP/9] 00:43:16, metric 1
                      via so-0/1/2.0, Swap 100049
                    > via so-0/1/3.0, Swap 100049
so-0/1/0.1         *[L2VPN/7] 00:43:04
                    > via so-0/1/2.0, Push 100001, Push 100049(top)
                      via so-0/1/3.0, Push 100001, Push 100049(top)
so-0/1/0.2         *[L2VPN/7] 00:43:03
                      via so-0/1/2.0, Push 100000, Push 100049(top) Offset: -4
                    > via so-0/1/3.0, Push 100000, Push 100049(top) Offset: -4
```

show route table mpls.0 (RSVP Route—Transit LSP)

```
user@host> show route table mpls.0

mpls.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

0                  *[MPLS/0] 00:37:31, metric 1
                      Receive
1                  *[MPLS/0] 00:37:31, metric 1
                      Receive
2                  *[MPLS/0] 00:37:31, metric 1
                      Receive
```

```
13                 *[MPLS/0] 00:37:31, metric 1
                      Receive
300352             *[RSVP/7/1] 00:08:00, metric 1
                    > to 8.64.0.106 via ge-1/0/1.0, label-switched-path lsp1_p2p
300352(S=0)        *[RSVP/7/1] 00:08:00, metric 1
                    > to 8.64.0.106 via ge-1/0/1.0, label-switched-path lsp1_p2p
300384             *[RSVP/7/2] 00:05:20, metric 1
                    > to 8.64.1.106 via ge-1/0/0.0, Pop
300384(S=0)        *[RSVP/7/2] 00:05:20, metric 1
                    > to 8.64.1.106 via ge-1/0/0.0, Pop
```

show route table vpls_1 detail

```
user@host> show route table vpls_1 detail
vpls_1.l2vpn.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
Restart Complete

1.1.1.11:1000:1:1/96 (1 entry, 1 announced)
*L2VPN Preference: 170/-1
Receive table: vpls_1.l2vpn.0
Next-hop reference count: 2
State: <Active Int Ext>
Age: 4:29:47 Metric2: 1
Task: vpls_1-l2vpn
Announcement bits (1): 1-BGP.0.0.0.0+179
AS path: I
Communities: Layer2-info: encaps:VPLS, control flags:Site-Down
Label-base: 800000, range: 8, status-vector: 0xFF
```

show route table vpn-a

```
user@host> show route table vpn-a
vpn-a.l2vpn.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, * = Both
192.168.16.1:1:1:1/96
                   *[VPN/7] 05:48:27
                     Discard
192.168.24.1:1:2:1/96
                   *[BGP/170] 00:02:53, localpref 100, from 192.168.24.1
                      AS path: I
                    > to 10.0.16.2 via fe-0/0/1.0, label-switched-path am
192.168.24.1:1:3:1/96
                   *[BGP/170] 00:02:53, localpref 100, from 192.168.24.1
                      AS path: I
                    > to 10.0.16.2 via fe-0/0/1.0, label-switched-path am
```

show route table vpn-a.mdt.0

```
user@host> show route table vpn-a.mdt.0
vpn-a.mdt.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

1:1:0:10.255.14.216:232.1.1.1/144
                   *[MVPN/70] 01:23:05, metric2 1
                      Indirect
1:1:1:10.255.14.218:232.1.1.1/144
                   *[BGP/170] 00:57:49, localpref 100, from 10.255.14.218
                      AS path: I
                    > via so-0/0/0.0, label-switched-path r0e-to-r1
1:1:2:10.255.14.217:232.1.1.1/144
                   *[BGP/170] 00:57:49, localpref 100, from 10.255.14.217
                      AS path: I
> via so-0/0/1.0, label-switched-path r0-to-r2
```

show route table VPN-A detail

```
user@host> show route table VPN-A detail
VPN-AB.inet.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
10.255.179.9/32 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Route Distinguisher: 10.255.179.13:200
                Next hop type: Indirect
                Next-hop reference count: 5
                Source: 10.255.179.13
                Next hop type: Router, Next hop index: 732
                Next hop: 10.39.1.14 via fe-0/3/0.0, selected
                Label operation: Push 299824, Push 299824(top)
                Protocol next hop: 10.255.179.13
                Push 299824
                Indirect next hop: 8f275a0 1048574
                State: (Secondary Active Int Ext)
                Local AS: 1 Peer AS: 1
                Age: 3:41:06 Metric: 1 Metric2: 1
                Task: BGP_1.10.255.179.13+64309
                Announcement bits (2): 0-KRT 1-BGP RT Background
                AS path: I
                Communities: target:1:200 rte-type:0.0.0.0:1:0
                Import Accepted
                VPN Label: 299824 TTL Action: vrf-ttl-propagate
                Localpref: 100
                Router ID: 10.255.179.13
                Primary Routing Table bgp.l3vpn.0
```

show route table VPN-AB.inet.0

```
user@host> show route table VPN-AB.inet.0
      VPN-AB.inet.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
      + = Active Route, - = Last Active, * = Both

      10.39.1.0/30       *[OSPF/10] 00:07:24, metric 1
                          > via so-7/3/1.0
      10.39.1.4/30       *[Direct/0] 00:08:42
                          > via so-5/1/0.0
      10.39.1.6/32       *[Local/0] 00:08:46
                            Local
      10.255.71.16/32    *[Static/5] 00:07:24
                          > via so-2/0/0.0
      10.255.71.17/32    *[BGP/170] 00:07:24, MED 1, localpref 100, from
      10.255.71.15
                            AS path: I
                          > via so-2/1/0.0, Push 100020, Push 100011(top)
      10.255.71.18/32    *[BGP/170] 00:07:24, MED 1, localpref 100, from
      10.255.71.15
                            AS path: I
                          > via so-2/1/0.0, Push 100021, Push 100011(top)
      10.255.245.245/32  *[BGP/170] 00:08:35, localpref 100
                            AS path: 2 I
                          > to 10.39.1.5 via so-5/1/0.0
      10.255.245.246/32  *[OSPF/10] 00:07:24, metric 1
                          > via so-7/3/1.0
```

show route table VPN_blue.mvpn-inet6.0

```
user@host> show route table VPN_blue.mvpn-inet6.0
vpn_blue.mvpn-inet6.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

1:10.255.2.202:65535:10.255.2.202/432
```

```
                    *[BGP/170] 00:02:37, localpref 100, from 10.255.2.202
                      AS path: I
                     > via so-0/1/3.0
1:10.255.2.203:65535:10.255.2.203/432
                    *[BGP/170] 00:02:37, localpref 100, from 10.255.2.203
                      AS path: I
                     > via so-0/1/0.0
1:10.255.2.204:65535:10.255.2.204/432
                    *[MVPN/70] 00:57:23, metric2 1
                      Indirect
5:10.255.2.202:65535:128:::192.168.90.2:128:ffff::1/432
                    *[BGP/170] 00:02:37, localpref 100, from 10.255.2.202
                      AS path: I
                     > via so-0/1/3.0
6:10.255.2.203:65535:65000:128:::10.12.53.12:128:ffff::1/432
                    *[PIM/105] 00:02:37
                      Multicast (IPv6)
7:10.255.2.202:65535:65000:128:::192.168.90.2:128:ffff::1/432
                    *[MVPN/70] 00:02:37, metric2 1
                      Indirect
```

show route table VPN-A detail

```
user@host> show route table VPN-A detail
VPN-AB.inet.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
10.255.179.9/32 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Route Distinguisher: 10.255.179.13:200
                Next hop type: Indirect
                Next-hop reference count: 5
                Source: 10.255.179.13
                Next hop type: Router, Next hop index: 732
                Next hop: 10.39.1.14 via fe-0/3/0.0, selected
                Label operation: Push 299824, Push 299824(top)
                Protocol next hop: 10.255.179.13
                Push 299824
                Indirect next hop: 8f275a0 1048574
                State: (Secondary Active Int Ext)
                Local AS: 1 Peer AS: 1
                Age: 3:41:06 Metric: 1 Metric2: 1
                Task: BGP_1.10.255.179.13+64309
                Announcement bits (2): 0-KRT 1-BGP RT Background
                AS path: I
                Communities: target:1:200 rte-type:0.0.0.0:1:0
                Import Accepted
                VPN Label: 299824 TTL Action: vrf-ttl-propagate
                Localpref: 100
                Router ID: 10.255.179.13
                Primary Routing Table bgp.l3vpn.0
```

show route table inetflow detail

```
user@host> show route table inetflow detail
inetflow.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
10.12.44.1,*/48 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Next-hop reference count: 2
                State: <Active Ext>
                Local AS: 65002 Peer AS: 65000
                Age: 4
                Task: BGP_65000.10.12.99.5+3792
                Announcement bits (1): 0-Flow
                AS path: 65000 I
                Communities: traffic-rate:0:0
```

```
                Validation state: Accept, Originator: 10.12.99.5
                Via: 10.12.44.0/24, Active
                Localpref: 100
                Router ID: 10.255.71.161

10.12.56.1,*/48 (1 entry, 1 announced)
        *Flow   Preference: 5
                Next-hop reference count: 2
                State: <Active>
                Local AS: 65002
                Age: 6:30
                Task: RT Flow
                Announcement bits (2): 0-Flow 1-BGP.0.0.0.0+179
                AS path: I
                Communities: 1:1

user@PE1> show route table green.l2vpn.0 (VPLS Multihoming with FEC 129)
green.l2vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

1.1.1.2:100:1.1.1.2/96 AD
                   *[VPLS/170] 1d 03:11:03, metric2 1
                         Indirect
1.1.1.4:100:1.1.1.4/96 AD
                   *[BGP/170] 1d 03:11:02, localpref 100, from 1.1.1.4
                      AS path: I, validation-state: unverified
                    >    via ge-1/2/1.5
1.1.1.2:100:1:0/96 MH
                   *[VPLS/170] 1d 03:11:03, metric2 1
                         Indirect
1.1.1.4:100:1:0/96 MH
                   *[BGP/170] 1d 03:11:02, localpref 100, from 1.1.1.4
                      AS path: I, validation-state: unverified
                    >    via ge-1/2/1.5
1.1.1.4:NoCtrlWord:5:100:100:1.1.1.2:1.1.1.4/176
                   *[VPLS/7] 1d 03:11:02, metric2 1
                    >    via ge-1/2/1.5
1.1.1.4:NoCtrlWord:5:100:100:1.1.1.4:1.1.1.2/176
                   *[LDP/9] 1d 03:11:02
                         Discard

user@host> show route table red extensive
red.inet.0: 364481 destinations, 714087 routes (364480 active, 48448 holddown, 1
 hidden)
22.0.0.0/32 (3 entries, 1 announced)
        State: <OnList CalcForwarding>
TSI:
KRT in-kernel 22.0.0.0/32 -> {composite(1048575)} Page 0 idx 1 Type 1 val 0x934342c

    Nexthop: Self
    AS path: [2] I
    Communities: target:2:1
Path 22.0.0.0 from 2.3.0.0 Vector len 4.  Val: 1
        @BGP    Preference: 170/-1
                Route Distinguisher: 2:1
                Next hop type: Indirect
                Address: 0x258059e4
                Next-hop reference count: 2
                Source: 2.2.0.0
                Next hop type: Router
                Next hop: 10.1.1.1 via ge-1/1/9.0, selected
```

```
                    Label operation: Push 707633
                    Label TTL action: prop-ttl
                    Session Id: 0x17d8
                    Protocol next hop: 2.2.0.0
                    Push 16
                    Composite next hop: 0x25805988 - INH Session ID: 0x193c
                    Indirect next hop: 0x23eea900 - INH Session ID: 0x193c
                    State: <Secondary Active Int Ext ProtectionPath ProtectionCand>
                    Local AS:     2 Peer AS:     2
                    Age: 23         Metric2: 35
                    Validation State: unverified
                    Task: BGP_2.2.2.0.0+34549
                    AS path: I
                    Communities: target:2:1
                    Import Accepted
                    VPN Label: 16
                    Localpref: 0
                    Router ID: 2.2.0.0
                    Primary Routing Table bgp.l3vpn.0
                    Composite next hops: 1
                            Protocol next hop: 2.2.0.0 Metric: 35
                            Push 16
                            Composite next hop: 0x25805988 - INH Session ID: 0x193c
                            Indirect next hop: 0x23eea900 - INH Session ID: 0x193c
                            Indirect path forwarding next hops: 1
                                    Next hop type: Router
                                    Next hop: 10.1.1.1 via ge-1/1/9.0
                                    Session Id: 0x17d8
                            2.2.0.0/32 Originating RIB: inet.3
                              Metric: 35                      Node path count: 1
                              Forwarding nexthops: 1
                                    Nexthop: 10.1.1.1 via ge-1/1/9.0
            BGP     Preference: 170/-1
                    Route Distinguisher: 2:1
                    Next hop type: Indirect
                    Address: 0x9347028
                    Next-hop reference count: 3
                    Source: 2.3.0.0
                    Next hop type: Router, Next hop index: 702
                    Next hop: 10.1.4.2 via ge-1/0/0.0, selected
                    Label operation: Push 634278
                    Label TTL action: prop-ttl
                    Session Id: 0x17d9
                    Protocol next hop: 2.3.0.0
                    Push 16
                    Composite next hop: 0x93463a0 1048575 INH Session ID: 0x17da
                    Indirect next hop: 0x91e8800 1048574 INH Session ID: 0x17da
                    State: <Secondary NotBest Int Ext ProtectionPath ProtectionCand>

                    Inactive reason: Not Best in its group - IGP metric
                    Local AS:     2 Peer AS:     2
                    Age: 3:34       Metric2: 70
                    Validation State: unverified
                    Task: BGP_2.2.3.0.0+32805
                    Announcement bits (2): 0-KRT 1-BGP_RT_Background
                    AS path: I
                    Communities: target:2:1
                    Import Accepted
                    VPN Label: 16
                    Localpref: 0
                    Router ID: 2.3.0.0
```

```
                Primary Routing Table bgp.l3vpn.0
                Composite next hops: 1
                        Protocol next hop: 2.3.0.0 Metric: 70
                        Push 16
                        Composite next hop: 0x93463a0 1048575 INH Session ID:
0x17da
                        Indirect next hop: 0x91e8800 1048574 INH Session ID:
0x17da
                        Indirect path forwarding next hops: 1
                                Next hop type: Router
                                Next hop: 10.1.4.2 via ge-1/0/0.0
                                Session Id: 0x17d9
                        2.3.0.0/32 Originating RIB: inet.3
                          Metric: 70                      Node path count: 1
                          Forwarding nexthops: 1
                                Nexthop: 10.1.4.2 via ge-1/0/0.0
        #Multipath Preference: 255
                Next hop type: Indirect
                Address: 0x24afca30
                Next-hop reference count: 1
                Next hop type: Router
                Next hop: 10.1.1.1 via ge-1/1/9.0, selected
                Label operation: Push 707633
                Label TTL action: prop-ttl
                Session Id: 0x17d8
                Next hop type: Router, Next hop index: 702
                Next hop: 10.1.4.2 via ge-1/0/0.0
                Label operation: Push 634278
                Label TTL action: prop-ttl
                Session Id: 0x17d9
                Protocol next hop: 2.2.0.0
                Push 16
                Composite next hop: 0x25805988 - INH Session ID: 0x193c
               Indirect next hop: 0x23eea900 - INH Session ID: 0x193c Weight 0x1

                Protocol next hop: 2.3.0.0
                Push 16
                Composite next hop: 0x93463a0 1048575 INH Session ID: 0x17da
              Indirect next hop: 0x91e8800 1048574 INH Session ID: 0x17da Weight
 0x4000
                State: <ForwardingOnly Int Ext>
                Inactive reason: Forwarding use only
                Age: 23         Metric2: 35
                Validation State: unverified
                Task: RT
                AS path: I
                Communities: target:2:1
```

traceroute

Syntax

traceroute *host*
<as-number-lookup>
<bypass-routing>
<clns>
<gateway *address*>
<inet | inet6>
<interface *interface-name*>
<logical system *logical-system-name*>
<monitor *host*>
<mpls (ldp *FEC address* | rsvp *label-switched-path-name*)>
<no-resolve>
<propagate-ttl>
<routing-instance *routing-instance-name*>
<source *source-address*>
<tos *value*>
<ttl *value*>
<wait *seconds*>

Syntax (QFX Series)

traceroute *host*
<as-number-lookup>
<bypass-routing>
<gateway *address*>
<inet>
<interface *interface-name*>
<monitor *host*>
<no-resolve>
<routing-instance *routing-instance-name*>
<source *source-address*>
<tos *value*>
<ttl *value*>
<wait *seconds*>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
mpls option introduced in Junos OS Release 9.2.
Command introduced in Junos OS Release 11.1 for the QFX Series.
propagate-ttl option introduced in Junos OS Release 12.1.

Description

Display the route that packets take to a specified network host. Use **traceroute** as a debugging tool to locate points of failure in a network.

Options

host—IP address or name of remote host.

as-number-lookup—(Optional) Display the autonomous system (AS) number of each intermediate hop on the path from the host to the destination.

bypass-routing—(Optional) Bypass the normal routing tables and send requests directly to a system on an attached network. If the system is not on a directly attached network, an error is returned. Use this option to display a route to a local system through an interface that has no route through it.

clns—(Optional) Trace the route belonging to the Connectionless Network Service (CLNS).

gateway *address*—(Optional) Address of a router or switch through which the route transits.

inet | inet6—(Optional) Trace the route belonging to IPv4 or IPv6, respectively.

interface *interface-name*—(Optional) Name of the interface over which to send packets.

logical-system *logical-system-name*—(Optional) Perform this operation on all logical systems or on a particular logical system.

monitor *host*—(Optional) Display real-time monitoring information for the specified host.

mpls (ldp *FEC address* | rsvp *label-switched-path name*)—(Optional) See ***traceroute mpls ldp*** and ***traceroute mpls rsvp***.

no-resolve—(Optional) Do not attempt to determine the hostname that corresponds to the IP address.

propagate-ttl—(Optional) On the PE routing device, use this option to view locally generated Routing Engine transit traffic. This is applicable for MPLS L3VPN traffic only.

Use for troubleshooting, when you want to view hop-by-hop information from the local provider router to the remote provider router, when TTL decrementing is disabled on the core network using the **no-proagate-ttl** configuration statement.

NOTE: Using propagate-ttl with traceroute on the CE router does not show hop-by-hop information.

routing-instance *routing-instance-name*—(Optional) Name of the routing instance for the traceroute attempt.

source *source-address*—(Optional) Source address of the outgoing traceroute packets.

tos *value*—(Optional) Value to include in the IP type-of-service (ToS) field. The range of values is **0** through **255**.

ttl *value*—(Optional) Maximum time-to-live value to include in the traceroute request. The range of values is **0** through **128**.

wait *seconds*—(Optional) Maximum time to wait for a response to the traceroute request.

Required Privilege Level network

Related Documentation

- *traceroute monitor*

List of Sample Output traceroute on page 172

traceroute as-number-lookup host on page 172
traceroute no-resolve on page 172
traceroute propogate-ttl on page 172
traceroute (Between CE Routers, Layer 3 VPN) on page 172
traceroute (Through an MPLS LSP) on page 172

Output Fields Table 15 on page 171 describes the output fields for the **traceroute** command. Output fields are listed in the approximate order in which they appear.

Table 15: traceroute Output Fields

Field Name	Field Description
traceroute to	IP address of the receiver.
hops max	Maximum number of hops allowed.
byte packets	Size of packets being sent.
number-of-hops	Number of hops from the source to the named router or switch.
router-name	Name of the router or switch for this hop.
address	Address of the router or switch for this hop.
Round trip time	Average round-trip time, in milliseconds (ms).

Sample Output

traceroute

```
user@host> traceroute santacruz
traceroute to green.company.net (10.156.169.254), 30 hops max, 40 byte packets
 1  blue23 (10.168.1.254)    2.370 ms  2.853 ms  0.367 ms
 2  red14  (10.168.255.250)  0.778 ms  2.937 ms  0.446 ms
 3  yellow (10.156.169.254)  7.737 ms  89.905 ms  0.834 ms
```

traceroute as-number-lookup host

```
user@host> traceroute as-number-lookup 10.100.1.1
traceroute to 10.100.1.1 (10.100.1.1), 30 hops max, 40 byte packets
 1  10.39.1.1 (10.39.1.1)  0.779 ms  0.728 ms  0.562 ms
 2  10.39.1.6 (10.39.1.6) [AS  32]  0.657 ms  0.611 ms  0.617 ms
 3  10.100.1.1 (10.100.1.1) [AS  10, 40, 50]  0.880 ms  0.808 ms  0.774 ms
```

traceroute no-resolve

```
user@host> traceroute santacruz no-resolve
traceroute to green.company.net (10.156.169.254), 30 hops max, 40 byte packets
 1  10.168.1.254  0.458 ms  0.370 ms  0.365 ms
 2  10.168.255.250  0.474 ms  0.450 ms  0.444 ms
 3  10.156.169.254  0.931 ms  0.876 ms  0.862 ms
```

traceroute propogate-ttl

```
user@host> traceroute propagate-ttl 100.200.2.2 routing-instance VPN-A
traceroute to 100.200.2.2 (100.200.2.2) from 1.1.0.2, 30 hops max, 40 byte packets

 1  1.2.0.2 (1.2.0.2)  2.456 ms  1.753 ms  1.672 ms
     MPLS Label=299776 CoS=0 TTL=1 S=0
     MPLS Label=299792 CoS=0 TTL=1 S=1
 2  1.3.0.2 (1.3.0.2)  1.213 ms  1.225 ms  1.166 ms
     MPLS Label=299792 CoS=0 TTL=1 S=1
 3  100.200.2.2 (100.200.2.2)  1.422 ms  1.521 ms  1.443 ms
```

traceroute (Between CE Routers, Layer 3 VPN)

```
user@host> traceroute vpn09
traceroute to vpn09.skybank.net (10.255.14.179), 30 hops max, 40
      byte packets
       1  10.39.10.21 (10.39.10.21)  0.598 ms  0.500 ms  0.461 ms
       2  10.39.1.13 (10.39.1.13)  0.796 ms  0.775 ms  0.806 ms
           MPLS Label=100006 CoS=0 TTL=1 S=1
       3  vpn09.skybank.net (10.255.14.179)  0.783 ms  0.716 ms  0.686
```

traceroute (Through an MPLS LSP)

```
user@host> traceroute mpls1
traceroute to 10.168.1.224 (10.168.1.224), 30 hops max, 40 byte packets
 1  mpls1-sr0.company.net (10.168.200.101)  0.555 ms  0.393 ms  0.367 ms
     MPLS Label=1024 CoS=0 TTL=1
 2  mpls5-lo0.company.net (10.168.1.224)  0.420 ms  0.394 ms  0.401 ms
```

PART 4

Troubleshooting

CHAPTER 6

Routing Protocol Process Memory FAQs

Routing Protocol Process Memory FAQs Overview

Junos OS is based on the FreeBSD Unix operating system. The open source software is modified and hardened to operate in the device's specialized environment. For example, some executables have been deleted, while other utilities were de-emphasized. Additionally, certain software processes were added to enhance the routing functionality. The result of this transformation is the kernel, the heart of the Junos OS software.

The kernel is responsible for operating multiple processes that perform the actual functions of the device. Each process operates in its own protected memory space, while the communication among all the processes is still controlled by the kernel. This separation provides isolation between the processes, and resiliency in the event of a process failure. This is important in a core routing platform because a single process failure does not cause the entire device to cease functioning.

Some of the common software processes include the routing protocol process (rpd) that controls the device's protocols, the device control process (dcd) that controls the device's interfaces, the management process (mgd) that controls user access to the device, the chassis process (chassisd) that controls the device's properties itself, and the Packet Forwarding Engine process (pfed) that controls the communication between the device's Packet Forwarding Engine and the Routing Engine. The kernel also generates specialized processes as needed for additional functionality, such as SNMP, the Virtual Router Redundancy Protocol (VRRP), and Class of Service (CoS).

The routing protocol process is a software process within the Routing Engine software, which controls the routing protocols that run on the device. Its functionality includes all protocol messages, routing table updates, and implementation of routing policies.

The routing protocol process starts all configured routing protocols and handles all routing messages. It maintains one or more routing tables, which consolidate the routing information learned from all routing protocols. From this routing information, the routing protocol process determines the active routes to network destinations and installs these routes into the Routing Engine's forwarding table. Finally, it implements routing policy, which allows you to control the routing information that is transferred between the routing

protocols and the routing table. Using routing policy, you can filter and limit the transfer of information as well as set properties associated with specific routes.

Related Documentation

- Routing Protocol Process Memory FAQs on page 176

Routing Protocol Process Memory FAQs

The following sections present the most frequently asked questions and answers related to the routing protocol process memory utilization, operation, interpretation of related command outputs, and troubleshooting the software process.

Frequently Asked Questions: Routing Protocol Process Memory

This section presents frequently asked questions and answers related to the memory usage of the routing protocol process.

Why does the routing protocol process use excessive memory?

The routing protocol process uses hundreds of megabytes of RAM in the Routing Engine to store information needed for the operation of routing and related protocols, such as BGP, OSPF, IS-IS, RSVP, LDP and MPLS. Such huge consumption of memory is common for the process, as the information it stores includes routes, next hops, interfaces, routing policies, labels, and label-switched paths (LSPs). Because access to the RAM memory is much faster than access to the hard disk, most of the routing protocol process information is stored in the RAM memory instead of using the hard disk space. This ensures that the performance of the routing protocol process is maximized.

How can I check the amount of memory the routing protocol process is using?

You can check routing protocol process memory usage by entering the **show system processes** and the **show task memory** Junos OS command-line interface (CLI) operational mode commands.

The **show system processes** command displays information about software processes that are running on the device and that have controlling terminals. The **show task memory** command displays memory utilization for routing protocol tasks on the Routing Engine.

You can check the routing protocol process memory usage by using the **show system processes** command with the **extensive** option. The **show task memory** command displays a report generated by the routing protocol process on its own memory usage. However, this report does not display all the memory used by the process. The value reported by the routing protocol process does not account for the memory used for the **TEXT** and **STACK** segments, or the memory used by the process's internal memory manager. Further, the Resident Set Size value includes shared library pages used by the routing protocol process.

For more information about checking the routing protocol process memory usage.

For more information, see the **show system processes** command and the **show task memory** command.

I just deleted a large number of routes from the routing protocol process. Why is it still using so much memory?

The **show system processes extensive** command displays a **RES** value measured in kilobytes. This value represents the amount of program memory resident in the physical memory. This is also known as RSS or Resident Set Size. The **RES** value includes shared library pages used by the process. Any amount of memory freed by the process might still be considered part of the **RES** value. Generally, the kernel delays the migrating of memory out of the **Inact** queue into the **Cache** or **Free** list unless there is a memory shortage. This can lead to large discrepancies between the values reported by the routing protocol process and the kernel, even after the routing protocol process has freed a large amount of memory.

Frequently Asked Questions: Interpreting Routing Protocol Process-Related Command Outputs

This section presents frequently asked questions and answers about the routing protocol process-related Junos OS command-line interface (CLI) command outputs that are used to display the memory usage of the routing protocol process.

How do I interpret memory numbers displayed in the show system processes extensive command output?

The **show system processes extensive** command displays exhaustive system process information about software processes that are running on the device and have controlling terminals. This command is equivalent to the UNIX **top** command. However, the UNIX **top** command shows real-time memory usage, with the memory values constantly changing, while the **show system processes extensive** command provides a snapshot of memory usage in a given moment.

To check overall CPU and memory usage, enter the **show system processes extensive** command. Refer to Table 16 on page 178 for information about the **show system processes extensive** commands output fields.

```
user@host> show system processes extensive
last pid:   544;  load averages:  0.00,  0.00,  0.00    18:30:33
37 processes:  1 running, 36 sleeping

Mem: 25M Active, 3968K Inact, 19M Wired, 184K Cache, 8346K Buf, 202M Free
Swap: 528M Total, 64K Used, 528M Free
  PID USERNAME PRI NICE SIZE    RES STATE    TIME   WCPU    CPU COMMAND
  544 root      30   0   604K   768K RUN      0:00  0.00%  0.00% top
    3 root      28   0     0K    12K psleep   0:00  0.00%  0.00% vmdaemon
    4 root      28   0     0K    12K update   0:03  0.00%  0.00% update
  528 aviva     18   0   660K   948K pause    0:00  0.00%  0.00% tcsh
  204 root      18   0   300K   544K pause    0:00  0.00%  0.00% csh
  131 root      18   0   332K   532K pause    0:00  0.00%  0.00% cron
  186 root      18   0   196K    68K pause    0:00  0.00%  0.00% watchdog
   27 root      10   0   512M 16288K mfsidl   0:00  0.00%  0.00% mount_mfs
    1 root      10   0   620K   344K wait     0:00  0.00%  0.00% init
  304 root       3   0   884K   900K ttyin    0:00  0.00%  0.00% bash
  200 root       3   0   180K   540K ttyin    0:00  0.00%  0.00% getty
  203 root       3   0   180K   540K ttyin    0:00  0.00%  0.00% getty
  202 root       3   0   180K   540K ttyin    0:00  0.00%  0.00% getty
  201 root       3   0   180K   540K ttyin    0:00  0.00%  0.00% getty
  194 root       2   0  2248K  1640K select   0:11  0.00%  0.00% rpd
  205 root       2   0   964K   800K select   0:12  0.00%  0.00% tnp.chassisd
```

```
  189 root      2 -12   352K   740K select   0:03  0.00%  0.00% xntpd
  114 root      2   0   296K   612K select   0:00  0.00%  0.00% amd
  188 root      2   0   780K   600K select   0:00  0.00%  0.00% dcd
  527 root      2   0   176K   580K select   0:00  0.00%  0.00% rlogind
  195 root      2   0   212K   552K select   0:00  0.00%  0.00% inetd
  187 root      2   0   192K   532K select   0:00  0.00%  0.00% tnetd
   83 root      2   0   188K   520K select   0:00  0.00%  0.00% syslogd
  538 root      2   0  1324K   516K select   0:00  0.00%  0.00% mgd
   99 daemon    2   0   176K   492K select   0:00  0.00%  0.00% portmap
  163 root      2   0   572K   420K select   0:00  0.00%  0.00% nsrexecd
  192 root      2   0   560K   400K select   0:10  0.00%  0.00% snmpd
  191 root      2   0  1284K   376K select   0:00  0.00%  0.00% mgd
  537 aviva     2   0   636K   364K select   0:00  0.00%  0.00% cli
  193 root      2   0   312K   204K select   0:07  0.00%  0.00% mib2d
    5 root      2   0     0K    12K pfesel   0:00  0.00%  0.00% if_pfe
    2 root    -18   0     0K    12K psleep   0:00  0.00%  0.00% pagedaemon
    0 root    -18   0     0K     0K sched    0:00  0.00%  0.00% swapper
```

Table 16 on page 178 describes the output fields that represent the memory values for the **show system processes extensive** command. Output fields are listed in the approximate order in which they appear.

Table 16: show system processes extensive Output Fields

Field Name	Field Description
Mem	Information about physical and virtual memory allocation.
Active	Memory allocated and actively used by the program.
Inact	Memory allocated but not recently used or memory freed by the programs. Inactive memory remains mapped in the address space of one or more processes and, therefore, counts toward the RSS value of those processes.
Wired	Memory that is not eligible to be swapped, usually used for in-kernel memory structures and/or memory physically locked by a process.
Cache	Memory that is not associated with any program and does not need to be swapped before being reused.
Buf	Size of memory buffer used to hold data recently called from the disk.
Free	Memory that is not associated with any programs. Memory freed by a process can become **Inactive**, **Cache**, or **Free**, depending on the method used by the process to free the memory.
Swap	Information about swap memory. • Total—Total memory available to be swapped to disk. • Used—Memory swapped to disk. • Free—Memory available for further swap.

The rest of the command output displays information about the memory usage of each process. The **SIZE** field indicates the size of the virtual address space, and the **RES** field indicates the amount of the program in physical memory, which is also known as RSS or Resident Set Size. For more information, see the **show system processes** command.

What is the difference between Active and Inact memory that is displayed by the show system processes extensive command?

When the system is under memory pressure, the pageout process reuses memory from the free, cache, inact and, if necessary, active pages. When the pageout process runs, it scans memory to see which pages are good candidates to be unmapped and freed up. Thus, the distinction between **Active** and **Inact** memory is only used by the pageout process to determine which pool of pages to free first at the time of a memory shortage.

The pageout process first scans the **Inact** list, and checks whether the pages on this list have been accessed since the time they have been listed here. The pages that have been accessed are moved from the **Inact** list to the **Active** list. On the other hand, pages that have not been accessed become prime candidates to be freed by the pageout process. If the pageout process cannot produce enough free pages from the **Inact** list, pages from the **Active** list get freed up.

Because the pageout process runs only when the system is under memory pressure, the pages on the **Inact** list remain untouched – even if they have not been accessed recently – when the amount of **Free** memory is adequate.

How do I interpret memory numbers displayed in the show task memory command output?

The **show task memory** command provides a comprehensive picture of the memory utilization for routing protocol tasks on the Routing Engine. The routing protocol process is the main task that uses Routing Engine memory.

To check routing process memory usage, enter the **show task memory** command. Refer to Table 17 on page 179 for information about the **show task memory** command output fields.

```
user@host> show task memory
Memory                 Size (kB)  %Available  When
  Currently In Use:        29417          3%  now
  Maximum Ever Used:       33882          4%  00/02/11 22:07:03
  Available:              756281        100%  now
```

Table 17 on page 179 describes the output fields for the **show task memory** command. Output fields are listed in the approximate order in which they appear.

Table 17: show task memory Output Fields

Field Name	Field Description
Memory Currently In Use	Memory currently in use. Dynamically allocated memory plus the **DATA** segment memory in kilobytes.
Memory Maximum Ever Used	Maximum memory ever used.
Memory Available	Memory currently available.

The **show task memory** command does not display all the memory used by the routing protocol process. This value does not account for the memory used for the **TEXT** and

STACK segments, or the memory used by the routing protocol process's internal memory manager.

Why is the Currently In Use value less than the RES value?

The **show task memory** command displays a **Currently In Use** value measured in kilobytes. This value represents the memory currently in use. It is the dynamically allocated memory plus the **DATA** segment memory. The **show system processes extensive** command displays a **RES** value measured in kilobytes. This value represents the amount of program memory resident in the physical memory. This is also known as RSS or Resident Set Size.

The **Currently In Use** value does not account for all of the memory that the routing protocol process uses. This value does not include the memory used for the **TEXT** and the **STACK** segments, and a small percentage of memory used by the routing protocol process's internal memory manager. Further, the **RES** value includes shared library pages used by the routing protocol process.

Any amount of memory freed by the routing protocol process might still be considered part of the **RES** value. Generally, the kernel delays the migrating of memory out of the **Inact** queue into the **Cache** or **Free** list unless there is a memory shortage. This can lead to large discrepancies between the **Currently In Use** value and the **RES** value.

Frequently Asked Questions: Routing Protocol Process Memory Swapping

This section presents frequently asked questions and answers related to the memory swapping of the routing protocol process from the Routing Engine memory to the hard disk memory.

How do I monitor swap activity?

When the system is under memory pressure, the pageout process reuses memory from the free, cache, inact and, if necessary, active pages. You can monitor the swap activity by viewing the syslog message reported by the kernel during periods of high pageout activity.

The syslog message appears as follows:

```
Mar  3 20:08:02 olympic /kernel: High pageout rate!! 277 pages/sec.
```

You can use the **vmstat -s** command to print the statistics for the swapout activity. The displayed statistics appear as follows:

```
0 swap pager pageouts
0 swap pager pages paged out
```

The **swap pager pageouts** is the number of pageout operations to the swap device, and the **swap pager pages paged out** is the number of pages paged out to the swap device.

Why does the system start swapping when I try to dump core using the request system core-dumps command?

The **request system core-dumps** command displays a list of system core files created when the device has failed. This command can be useful for diagnostic purposes. Each list item includes the file permissions, number of links, owner, group, size, modification

date, path, and filename. You can use the **core-filename** option and the **core-file-info**, **brief**, and **detail** options to display more information about the specified core-dump files.

You can use the **request system core-dumps** command to perform a non-fatal core-dump without aborting the routing protocol process. To do this, the routing protocol process is forked, generating a second copy, and then aborted. This process can double the memory consumed by the two copies of the routing protocol processes, pushing the system into swap.

Why does the show system processes extensive command show that memory is swapped to disk although there is plenty of free memory?

Memory can remain swapped out indefinitely if it is not accessed again. Therefore, the **show system processes extensive** command shows that memory is swapped to disk even though there is plenty of free memory, and such a situation is not unusual.

Frequently Asked Questions: Troubleshooting the Routing Protocol Process

This section presents frequently asked questions and answers related to a shortage of memory and memory leakage by the routing protocol process.

What does the RPD_OS_MEMHIGH message mean?

The **RPD_OS_MEMHIGH** message is written into the system message file if the routing protocol process is running out of memory. This message alerts you that the routing protocol process is using the indicated amount and percentage of Routing Engine memory, which is considered excessive. This message is generated either because the routing protocol process is leaking memory or the use of system resources is excessive, perhaps because routing filters are misconfigured or the configured network topology is very complex.

When the memory utilization for the routing protocol process is using all available Routing Engine DRAM memory (Routing Engines with maximum 2 GB DRAM) or reaches the limit of 2 GB of memory (Routing Engines with 4 GB DRAM), a message of the following form is written every minute in the syslog message file:

```
RPD_OS_MEMHIGH: Using 188830 KB of memory, 100 percent of available
```

This message includes the amount, in kilobytes and/or the percentage, of the available memory in use.

This message should not appear under normal conditions, as any further memory allocations usually require a portion of existing memory to be written to swap. As a recommended solution, increase the amount of RAM in the Routing Engine. For more information, go to http://kb.juniper.net/InfoCenter/index?page=content&id=KB14186 .

What can I do when there is a memory shortage even after a swap?

It is not recommended for the system to operate in this state, notwithstanding the existence of swap. The protocols that run in the routing protocol process usually have a real-time requirement that cannot reliably withstand the latency of being swapped to hard disk. If the memory shortage has not resulted from a memory leak, then either a

reduction in the memory usage or an upgrade to a higher memory-capacity Routing Engine is required.

How do I determine whether there is a memory leak in the routing protocol process?

Memory leaks are typically the result of a seemingly unbounded growth in the memory usage of a process as reported by the **show system processes extensive** command.

There are two classes of memory leaks that the routing protocol process can experience.

- The first class occurs when the allocated memory that is no longer in use is not freed. This class of leak can usually be fixed by taking several samples of the **show task memory detail** command over a period of time and comparing the deltas.
- The second class occurs when there is a late access to freed memory. If the access is not outside the mapped address space, the kernel backfills the accessed page with real memory. This backfill is done without the knowledge of the routing protocol process's internal memory allocator, which makes this class of leak much more difficult to resolve. If a memory leak of this class is suspected, writing the state of the system to a disk file (creating a core file) is suggested.

A large discrepancy between the **RES** value and the **Currently In Use** value might indicate a memory leak. However, large discrepancies can also occur for legitimate reasons. For example, the memory used for the **TEXT** and **STACK** segments or the memory used by the routing protocol process's internal memory manager might not be displayed. Further, the **RES** value includes shared library pages used by the process.

What is the task_timer?

The source of a routing protocol process memory leak can usually be identified by dumping the timers for each task. You can use the **show task *task-name*** command to display routing protocol tasks on the Routing Engine. Tasks can be baseline tasks performed regardless of the device's configuration, and other tasks that depend on the device configuration.

For more information, see the **show task** command.

Related Documentation

- Routing Protocol Process Memory FAQs Overview on page 175

PART 5

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