



Junos[®] OS

Protocol-Independent Routing Properties Feature Guide for Routing Devices

Release

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Junos[®] OS Protocol-Independent Routing Properties Feature Guide for Routing Devices

14.1

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- Supported Platforms on page xiii
- Using the Examples in This Manual on page xiv
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- Documentation Feedback on page xvii
- Requesting Technical Support on page xviii

Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at <http://www.juniper.net/techpubs/>.

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:

- ACX Series
- J Series
- SRX Series
- T Series
- MX Series
- M Series
- PTX 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.xml;
    }
  }
}
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.xml; }
```

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 xvi](#) 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.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xvi 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
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces or emphasizes important new terms. Identifies guide names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos OS CLI User Guide</i> RFC 1997, <i>BGP Communities Attribute</i>
<i>Italic text like this</i>	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 <i>domain-name</i>

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

Convention	Description	Examples
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none">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)	Encloses optional keywords or variables.	stub <default-metric <i>metric</i>>;
(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 (<i>string1</i> <i>string2</i> <i>string3</i>)
# (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)	Encloses a variable for which you can substitute one or more values.	community name members [<i>community-ids</i>]
Indentation and braces ({ })	Identifies a level in the configuration hierarchy.	<pre>[edit] routing-options { static { route default { nexthop <i>address</i>; retain; } } }</pre>
;(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.	<ul style="list-style-type: none">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)

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- 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.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: <http://www.juniper.net/customers/support/>
- Search for known bugs: <http://www2.juniper.net/kb/>
- 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: <http://kb.juniper.net/InfoCenter/>
- 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

- [Introduction to Protocol-Independent Routing Properties on page 3](#)

CHAPTER 1

Introduction to Protocol-Independent Routing Properties

- [Protocol-Independent Routing Properties Overview on page 3](#)
- [Routing Table Features in the Junos OS on page 3](#)

Protocol-Independent Routing Properties Overview

In Junos OS, routing capabilities and features that are not specific to any particular routing protocol are collectively called protocol-independent routing properties. These features often interact with routing protocols. In many cases, you combine protocol-independent properties and routing policy to achieve a goal. For example, you define a static route using protocol-independent properties, and then, using a routing policy, you can redistribute the static route into a routing protocol, such as BGP, OSPF, or IS-IS.

Protocol-independent routing properties include:

- Static, aggregate, and generated routes
- Bidirectional Forwarding Detection on static routes
- Global preference
- Martian routes
- Routing tables and routing information base (RIB) groups

Related Documentation

- [Examples: Configuring Static Routes on page 9](#)
- [Examples: Creating a Routing Table and Populating It with Routes on page 39](#)

Routing Table Features in the Junos OS

The Junos OS maintains two databases for routing information:

- Routing table—Contains all the routing information learned by all routing protocols. (Some vendors refer to this kind of table as a routing information base [RIB].)
- Forwarding table—Contains the routes actually used to forward packets. (Some vendors refer to this kind of table as a forwarding information base [FIB].)

By default, the Junos OS maintains three routing tables: one for IP version 4 (IPv4) unicast routes, a second for multicast routes, and a third for MPLS. You can configure additional routing tables.

The Junos OS maintains separate routing tables for IPv4 and IP version 6 (IPv6) routes.

The Junos OS installs all active routes from the routing table into the forwarding table. The active routes are routes that are used to forward packets to their destinations. The Junos operating system kernel maintains a master copy of the forwarding table. It copies the forwarding table to the Packet Forwarding Engine, which is the component responsible for forwarding packets.

The Junos routing protocol process generally determines the active route by selecting the route with the lowest preference value. The Junos OS provides support for alternate and tiebreaker preferences, and some of the routing protocols, including BGP and MPLS, use these additional preferences.

You can add martian addresses and static, aggregate, and generated routes to the Junos routing tables, configuring the routes with one or more of the properties shown in [Table 3 on page 4](#).

Table 3: Routing Table Route Properties

Description	Static	Aggregate	Generated
Destination address	X	X	X
Default route to the destination	X	X	X
IP address or interface of the next hop to the destination	X	—	—
Label-switched path (LSP) as next hop	X	—	—
Drop the packets, install a reject route for this destination, and send Internet Control Message Protocol (ICMP) unreachable messages	X	X	X
Drop the packets, install a reject route for this destination, but do not send ICMP unreachable messages	X	X	X
Cause packets to be received by the local router	X	—	—
Associate a metric value with the route	X	X	X
Type of route	X	X	X
Preference values	X	X	X
Additional preference values	X	X	X
Independent preference (qualified-next-hop statement)	X	—	—

Table 3: Routing Table Route Properties (*continued*)

Description	Static	Aggregate	Generated
BGP community information to associate with the route	X	X	X
Autonomous system (AS) path information to associate with the route	X	X	X
Tag values to associate with the route	X	X	X
Do not install active static routes into the forwarding table	X	–	–
Install the route into the forwarding table	X	–	–
Permanently retain a static route in the forwarding table	X	–	–
Include only the longest common leading sequences from the contributing AS paths	–	X	–
Include all AS numbers for a specific route	–	X	–
Retain an inactive route in the routing and forwarding tables	X	X	X
Remove an inactive route from the routing and forwarding tables	X	X	X
Active policy to associate with the route	–	X	X
Specify that a route is ineligible for readvertisement	X	–	–
Specify route to a prefix that is not a directly connected next hop	X	–	–

**Related
Documentation**

- [Understanding Junos OS Routing Tables on page 39](#)
- *MPLS and Routing Tables*
- *IGP Shortcuts and Routing Table*

PART 2

Configuration

- [Configuring Routing Tables and Static Routes on page 9](#)
- [Aggregate and Generated Routes on page 75](#)
- [Bidirectional Forwarding Detection for Static Routes on page 99](#)
- [Packet Forwarding Behavior on page 123](#)
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- [Configuration Statements on page 157](#)

CHAPTER 2

Configuring Routing Tables and Static Routes

- [Examples: Configuring Static Routes on page 9](#)
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- [Example: Configuring Static Routes for CLNS on page 71](#)
- [Verifying the Static Route Configuration on page 74](#)

Examples: Configuring Static Routes

- [Understanding Basic Static Routing on page 9](#)
- [Example: Configuring a Basic Set of Static Routes on page 10](#)
- [Example: Configuring IPv6 Static Routes on page 15](#)

Understanding Basic Static Routing

Routes that are permanent fixtures in the routing and forwarding tables are often configured as static routes. These routes generally do not change, and often include only one or very few paths to the destination.

To create a static route in the routing table, you must, at minimum, define the route as static and associate a next-hop address with it. The static route in the routing table is inserted into the forwarding table when the next-hop address is reachable. All traffic destined for the static route is transmitted to the next-hop address for transit.

You can specify options that define additional information about static routes that is included with the route when it is installed in the routing table. All static options are optional.

Example: Configuring a Basic Set of Static Routes

This example shows how to configure a basic set of static routes.

- [Requirements on page 10](#)
- [Overview on page 10](#)
- [Configuration on page 11](#)
- [Verification on page 13](#)

Requirements

In this example, no special configuration beyond device initialization is required.

Overview

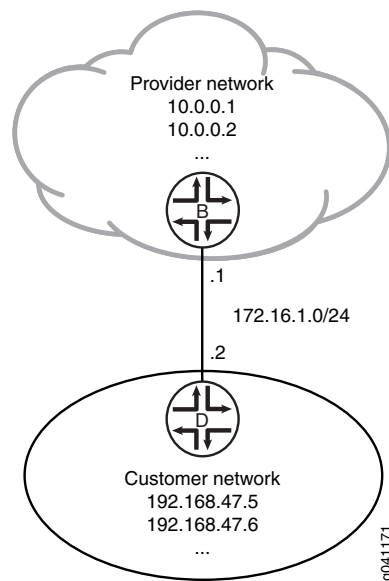
There are many practical applications for static routes. Static routing is often used at the network edge to support attachment to stub networks, which, given their single point of entry and egress, are well suited to the simplicity of a static route. In Junos OS, static routes have a global preference of 5. Static routes are activated if the specified next hop is reachable.

In this example, you configure the static route 192.168.47.0/24 from the provider network to the customer network, using the next-hop address of 172.16.1.2. You also configure a static default route of 0.0.0.0/0 from the customer network to the provider network, using a next-hop address of 172.16.1.1.

For demonstration purposes, some loopback interfaces are configured on Device B and Device D. These loopback interfaces provide addresses to ping and thus verify that the static routes are working.

[Figure 1 on page 11](#) shows the sample network.

Figure 1: Customer Routes Connected to a Service Provider



Configuration

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 B

```
set interfaces ge-1/2/0 unit 0 description B->D
set interfaces ge-1/2/0 unit 0 family inet address 172.16.1.1/24
set interfaces lo0 unit 57 family inet address 10.0.0.1/32
set interfaces lo0 unit 57 family inet address 10.0.0.2/32
set routing-options static route 192.168.47.0/24 next-hop 172.16.1.2
```

Device D

```
set interfaces ge-1/2/0 unit 1 description D->B
set interfaces ge-1/2/0 unit 1 family inet address 172.16.1.2/24
set interfaces lo0 unit 2 family inet address 192.168.47.5/32
set interfaces lo0 unit 2 family inet address 192.168.47.6/32
set routing-options static route 0.0.0.0/0 next-hop 172.16.1.1
```

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 basic static routes:

1. On Device B, configure the interfaces.

```
[edit interfaces]
user@B# set ge-1/2/0 unit 0 description B->D
user@B# set ge-1/2/0 unit 0 family inet address 172.16.1.1/24
user@B# set lo0 unit 57 family inet address 10.0.0.1/32
user@B# set lo0 unit 57 family inet address 10.0.0.2/32
```

2. On Device B, create a static route and set the next-hop address.

```
[edit routing-options]
user@B# set static route 192.168.47.0/24 next-hop 172.16.1.2
```

3. If you are done configuring Device B, commit the configuration.

```
[edit interfaces]
user@B# commit
```

4. On Device D, configure the interfaces.

```
[edit]
user@D# set ge-1/2/0 unit 1 description D->B
user@D# set ge-1/2/0 unit 1 family inet address 172.16.1.2/24
user@D# set lo0 unit 2 family inet address 192.168.47.5/32
user@D# set lo0 unit 2 family inet address 192.168.47.6/32
```

5. On Device D, create a static route and set the next-hop address.

```
[edit routing-options]
user@D# set static route 0.0.0.0/0 next-hop 172.16.1.1
```

6. If you are done configuring Device D, commit the configuration.

```
[edit]
user@D# commit
```

Results

Confirm your configuration by issuing the **show interfaces** and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
Device B user@B# show interfaces
ge-1/2/0 {
  unit 0 {
    description B->D;
    family inet {
      address 172.16.1.1/24;
    }
  }
}
lo0 {
  unit 57 {
    family inet {
      address 10.0.0.1/32;
      address 10.0.0.2/32;
    }
  }
}

user@B# show routing-options
static {
  route 192.168.47.0/24 next-hop 172.16.1.2;
}

Device D user@D# show interfaces
ge-1/2/0 {
```



```
unit 1 {
  description D->B;
  family inet {
    address 172.16.1.2/24;
  }
}
lo0 {
  unit 2 {
    family inet {
      address 192.168.47.5/32;
      address 192.168.47.6/32;
    }
  }
}

user@D# show routing-options
static {
  route 0.0.0.0/0 next-hop 172.16.1.1;
}
```

Verification

Confirm that the configuration is working properly.

- [Checking the Routing Tables on page 13](#)
- [Pinging the Remote Addresses on page 14](#)

Checking the Routing Tables

Purpose Make sure that the static routes appear in the routing tables of Device B and Device D.

Action user@B> show route
inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```
10.0.0.1/32      *[Direct/0] 00:29:43
                  > via lo0.57
10.0.0.2/32      *[Direct/0] 00:29:43
                  > via lo0.57
172.16.1.0/24    *[Direct/0] 00:34:40
                  > via ge-1/2/0.0
172.16.1.1/32    *[Local/0] 00:34:40
                  Local via ge-1/2/0.0
192.168.47.0/24  *[Static/5] 00:31:23
                  > to 172.16.1.2 via ge-1/2/0.0
```

user@D> show route
inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```
0.0.0.0/0        *[Static/5] 00:31:24
                  > to 172.16.1.1 via ge-1/2/0.1
172.16.1.0/24    *[Direct/0] 00:35:21
                  > via ge-1/2/0.1
172.16.1.2/32    *[Local/0] 00:35:21
                  Local via ge-1/2/0.1
192.168.47.5/32  *[Direct/0] 00:35:22
                  > via lo0.2
192.168.47.6/32  *[Direct/0] 00:35:21
                  > via lo0.2
```

Meaning The static routes are in the routing tables.

Pinging the Remote Addresses

Purpose Verify that the static routes are working.

From Device B, ping one of the loopback interface addresses on Device D.

From Device D, ping one of the loopback interface addresses on Device B.

Action user@B> ping 192.168.47.5
PING 192.168.47.5 (192.168.47.5): 56 data bytes
64 bytes from 192.168.47.5: icmp_seq=0 ttl=64 time=156.126 ms
64 bytes from 192.168.47.5: icmp_seq=1 ttl=64 time=120.393 ms
64 bytes from 192.168.47.5: icmp_seq=2 ttl=64 time=175.361 ms

user@D> ping 10.0.0.1
PING 10.0.0.1 (10.0.0.1): 56 data bytes
64 bytes from 10.0.0.1: icmp_seq=0 ttl=64 time=1.315 ms
64 bytes from 10.0.0.1: icmp_seq=1 ttl=64 time=31.819 ms
64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=1.268 ms

Example: Configuring IPv6 Static Routes

This example shows how to configure static routes when the interfaces have IPv6 addresses.

- [Requirements on page 15](#)
- [Overview on page 15](#)
- [Configuration on page 16](#)
- [Verification on page 18](#)

Requirements

In this example, no special configuration beyond device initialization is required.

Overview

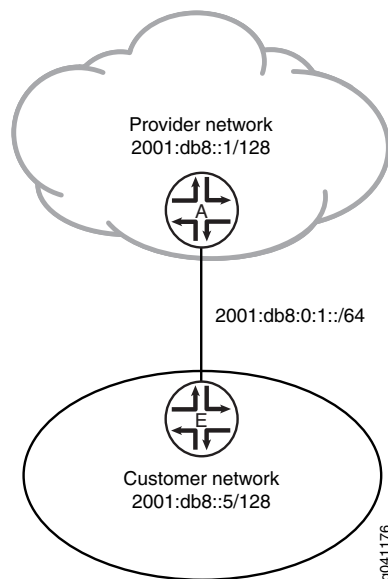
There are many practical applications for static routes. Static routing is often used at the network edge to support attachment to stub networks, which, given their single point of entry and egress, are well suited to the simplicity of a static route. In Junos OS, static routes have a global preference of 5. Static routes are activated if the specified next hop is reachable.

In this example, you configure a static default route of `::/0`, using a next-hop address `2001:db8:0:1:2a0:a502:0:1da`.

For demonstration purposes, some loopback interfaces are configured on Device A and Device E. These loopback interfaces provide addresses to ping and thus verify that the static routes are working.

[Figure 2 on page 16](#) shows the sample network.

Figure 2: Customer Routes Connected to a Service Provider



Configuration

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 A

```
set interfaces fe-1/2/0 unit 1 description to-E
set interfaces fe-1/2/0 unit 1 family inet6 address 2001:db8:0:1:2a0:a502:0:1da/64
set interfaces lo0 unit 1 family inet6 address 2001:db8::1/128 primary
set interfaces lo0 unit 1 family inet6 address 2001:db8::2/128
set interfaces lo0 unit 1 family inet6 address 2001:db8::3/128
set routing-options rib inet6.0 static route 2001:db8::5/128 next-hop
  2001:db8:0:1:2a0:a502:0:19da
```

Device E

```
set interfaces fe-1/2/0 unit 25 description to-A
set interfaces fe-1/2/0 unit 25 family inet6 address 2001:db8:0:1:2a0:a502:0:19da/64
set interfaces lo0 unit 5 family inet6 address 2001:db8::5/128
set routing-options rib inet6.0 static route ::/0 next-hop 2001:db8:0:1:2a0:a502:0:1da
```

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 basic static routes:

- On Device A, configure the interfaces.


```
[edit interfaces]
set interfaces fe-1/2/0 unit 1 description to-E
set interfaces fe-1/2/0 unit 1 family inet6 address 2001:db8:0:1:2a0:a502:0:1da/64

set interfaces lo0 unit 1 family inet6 address 2001:db8::1/128 primary
```

```
set interfaces lo0 unit 1 family inet6 address 2001:db8::2/128
set interfaces lo0 unit 1 family inet6 address 2001:db8::3/128
```

2. On Device A, create a static route to Device E's loopback address and set the next-hop address.

This ensures that Device A has a route back to Device E.

```
[edit routing-options]
set rib inet6.0 static route 2001:db8::5/128 next-hop 2001:db8:0:1:2a0:a502:0:19da
```

3. If you are done configuring Device A, commit the configuration.

```
[edit interfaces]
user@A# commit
```

4. On Device E, configure the interfaces.

```
[edit]
set interfaces fe-1/2/0 unit 25 description to-A
set interfaces fe-1/2/0 unit 25 family inet6 address 2001:db8:0:1:2a0:a502:0:19da/64
set interfaces lo0 unit 5 family inet6 address 2001:db8::5/128
```

5. On Device E, create a static default route and set the next-hop address.

```
[edit routing-options]
set routing-options rib inet6.0 static route ::/0 next-hop 2001:db8:0:1:2a0:a502:0:1da
```

6. If you are done configuring Device E, commit the configuration.

```
[edit]
user@E# commit
```

Results

Confirm your configuration by issuing the **show interfaces** and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
Device A user@A# show interfaces
fe-1/2/0 {
  unit 1 {
    description to-E;
    family inet6 {
      address 2001:db8:0:1:2a0:a502:0:1da/64;
    }
  }
}
lo0 {
  unit 1 {
    family inet6 {
      address 2001:db8::1/128 {
        primary;
      }
      address 2001:db8::2/128;
      address 2001:db8::3/128;
    }
  }
}
```

```
user@A# show routing-options
rib inet6.0 {
  static {
    route 2001:db8::5/128 next-hop 2001:db8:0:1:2a0:a502:0:19da;
  }
}

Device E user@E# show interfaces
fe-1/2/0 {
  unit 25 {
    description to-A;
    family inet6 {
      address 2001:db8:0:1:2a0:a502:0:19da/64;
    }
  }
}
lo0 {
  unit 5 {
    family inet6 {
      address 2001:db8::5/128;
    }
  }
}

user@E# show routing-options
rib inet6.0 {
  static {
    route ::/0 next-hop 2001:db8:0:1:2a0:a502:0:1da;
  }
}
```

Verification

Confirm that the configuration is working properly.

- [Checking the Routing Tables on page 18](#)
- [Pinging the Remote Addresses on page 19](#)

Checking the Routing Tables

Purpose Make sure that the static routes appear in the routing tables of Device A and Device E.

Action user@A> `show route protocol static`
 inet6.0: 9 destinations, 9 routes (9 active, 0 holddown, 0 hidden)
 + = Active Route, - = Last Active, * = Both

```

2001:db8::5/128      *[Static/5] 00:27:46
                    > to 2001:db8:0:1:2a0:a502:0:19da via fe-1/2/0.1

user@E> show route protocol static
inet6.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

::/0                *[Static/5] 00:19:11
                    > to 2001:db8:0:1:2a0:a502:0:1da via fe-1/2/0.25

```

Meaning The static routes are in the routing tables.

Pinging the Remote Addresses

Purpose Verify that the static routes are working.

From Device A, ping one of the loopback interface addresses on Device E.

From Device E, ping one of the loopback interface addresses on Device A.

Action user@A> `ping 2001:db8::5`
 PING6(56=40+8+8 bytes) 2001:db8:0:1:2a0:a502:0:1da --> 2001:db8::5
 16 bytes from 2001:db8::5, icmp_seq=0 hlim=64 time=1.790 ms
 16 bytes from 2001:db8::5, icmp_seq=1 hlim=64 time=1.529 ms
 16 bytes from 2001:db8::5, icmp_seq=2 hlim=64 time=1.531 ms

user@E> `ping 2001:db8::3`
 PING6(56=40+8+8 bytes) 2001:db8:0:1:2a0:a502:0:19da --> 2001:db8::3
 16 bytes from 2001:db8::3, icmp_seq=0 hlim=64 time=2.146 ms
 16 bytes from 2001:db8::3, icmp_seq=1 hlim=64 time=1.964 ms
 16 bytes from 2001:db8::3, icmp_seq=2 hlim=64 time=1.550 ms

Example: Configuring Static Routing on Logical Systems

- [Understanding Basic Static Routing on page 19](#)
- [Example: Configuring Static Routes Between Logical Systems Within the Same Router on page 20](#)

Understanding Basic Static Routing

Routes that are permanent fixtures in the routing and forwarding tables are often configured as static routes. These routes generally do not change, and often include only one or very few paths to the destination.

To create a static route in the routing table, you must, at minimum, define the route as static and associate a next-hop address with it. The static route in the routing table is inserted into the forwarding table when the next-hop address is reachable. All traffic destined for the static route is transmitted to the next-hop address for transit.

You can specify options that define additional information about static routes that is included with the route when it is installed in the routing table. All static options are optional.

Example: Configuring Static Routes Between Logical Systems Within the Same Router

This example shows how to configure static routes between logical systems. The logical systems are configured in a single physical router and are connected by logical tunnel interfaces.

- [Requirements on page 20](#)
- [Overview on page 20](#)
- [Configuration on page 21](#)
- [Verification on page 24](#)

Requirements

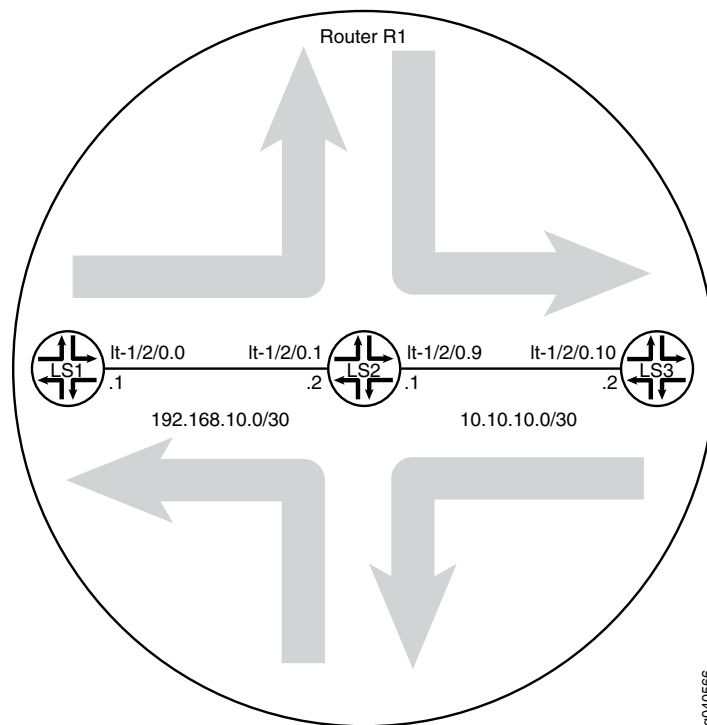
You must connect the logical systems by using logical tunnel (**lt**) interfaces. See *Example: Connecting Logical Systems Within the Same Router Using Logical Tunnel Interfaces*.

Overview

A static route is a hard-coded path in the device that specifies how the route gets to a certain subnet by using a certain path. Routers that are connected to stub networks are often configured to use static routes. A *stub network* is a network with no knowledge of other networks. Stub networks send non-local traffic by way of a single path, with the network aware only of a default route to non-local destinations. In this example, you configure Logical System LS1 with a static route to the 10.10.10.0/30 network and define the next-hop address as 192.168.10.2. You also configure Logical System LS1 with a static route to the 192.168.10.0/30 network and define a next-hop address of 10.10.10.1.

[Figure 3 on page 21](#) shows the sample network.

Figure 3: Static Routes Between Logical Systems



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Configuration

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.

```
set logical-systems LS1 interfaces lt-1/2/0 unit 0 description LS1->LS2
set logical-systems LS1 interfaces lt-1/2/0 unit 0 encapsulation ethernet
set logical-systems LS1 interfaces lt-1/2/0 unit 0 peer-unit 1
set logical-systems LS1 interfaces lt-1/2/0 unit 0 family inet address 192.168.10.1/30
set logical-systems LS2 interfaces lt-1/2/0 unit 1 description LS2->LS1
set logical-systems LS2 interfaces lt-1/2/0 unit 1 encapsulation ethernet
set logical-systems LS2 interfaces lt-1/2/0 unit 1 peer-unit 0
set logical-systems LS2 interfaces lt-1/2/0 unit 1 family inet address 192.168.10.2/30
set logical-systems LS2 interfaces lt-1/2/0 unit 9 description LS2->LS3
set logical-systems LS2 interfaces lt-1/2/0 unit 9 encapsulation ethernet
set logical-systems LS2 interfaces lt-1/2/0 unit 9 peer-unit 10
set logical-systems LS2 interfaces lt-1/2/0 unit 9 family inet address 10.10.10.1/30
set logical-systems LS3 interfaces lt-1/2/0 unit 10 description LS3->LS2
set logical-systems LS3 interfaces lt-1/2/0 unit 10 encapsulation ethernet
set logical-systems LS3 interfaces lt-1/2/0 unit 10 peer-unit 9
set logical-systems LS3 interfaces lt-1/2/0 unit 10 family inet address 10.10.10.2/30
set logical-systems LS1 routing-options static route 10.10.10.0/30 next-hop 192.168.10.2
set logical-systems LS3 routing-options static route 192.168.10.0/30 next-hop 10.10.10.1
```

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 static routes between logical systems:

1. Run the **show interfaces terse** command to verify that the router has a logical tunnel (lt) interface.

```
user@host> show interfaces terse
Interface      Admin Link Proto Local Remote
so-0/0/0       up    down
so-0/0/1       up    down
so-0/0/2       up    down
so-0/0/3       up    down
gr-1/2/0       up    up
ip-1/2/0       up    up
lt-1/2/0       up    up
...
```

2. Configure the logical tunnel interface on Logical System LS1 connecting to Logical System LS2.

```
[edit]
user@host# set logical-systems LS1 interfaces lt-1/2/0 unit 0 description LS1->LS2
user@host# set logical-systems LS1 interfaces lt-1/2/0 unit 0 encapsulation ethernet
user@host# set logical-systems LS1 interfaces lt-1/2/0 unit 0 peer-unit 1
user@host# set logical-systems LS1 interfaces lt-1/2/0 unit 0 family inet address
192.168.10.1/30
```

3. Configure the logical tunnel interface on Logical System LS2 connecting to Logical System LS1.

```
[edit]
user@host# set logical-systems LS2 interfaces lt-1/2/0 unit 1 description LS2->LS1
user@host# set logical-systems LS2 interfaces lt-1/2/0 unit 1 encapsulation ethernet
user@host# set logical-systems LS2 interfaces lt-1/2/0 unit 1 peer-unit 0
user@host# set logical-systems LS2 interfaces lt-1/2/0 unit 1 family inet address
192.168.10.2/30
```

4. Configure the logical tunnel interface on Logical System LS2 connecting to Logical System LS3.

```
[edit]
user@host# set logical-systems LS2 interfaces lt-1/2/0 unit 9 description LS2->LS3
user@host# set logical-systems LS2 interfaces lt-1/2/0 unit 9 encapsulation ethernet
user@host# set logical-systems LS2 interfaces lt-1/2/0 unit 9 peer-unit 10
user@host# set logical-systems LS2 interfaces lt-1/2/0 unit 9 family inet address
10.10.10.1/30
```

5. Configure the logical tunnel interface on Logical System LS3 connecting to Logical System LS2.

```
[edit]
user@host# set logical-systems LS3 interfaces lt-1/2/0 unit 10 description LS3->LS2
user@host# set logical-systems LS3 interfaces lt-1/2/0 unit 10 encapsulation
ethernet
user@host# set logical-systems LS3 interfaces lt-1/2/0 unit 10 peer-unit 9
```

```
user@host# set logical-systems LS3 interfaces lt-1/2/0 unit 10 family inet address
10.10.10.2/30
```

6. Configure the static route on Logical System LS1 connecting to the 10.10.10.0/30 network.

```
[edit]
user@host# set logical-systems LS1 routing-options static route 10.10.10.0/30
next-hop 192.168.10.2
```

7. Configure the static route on Logical System LS3 connecting to the 192.168.10.0/30 network.

```
[edit]
user@host# set logical-systems LS3 routing-options static route 192.168.10.0/30
next-hop 10.10.10.1
```

8. If you are done configuring the device, commit the configuration.

```
[edit]
user@host# commit
```

Results

Confirm your configuration by issuing the **show logical-systems** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show logical-systems
LS1 {
  interfaces {
    lt-1/2/0 {
      unit 0 {
        description LS1->LS2;
        encapsulation ethernet;
        peer-unit 1;
        family inet {
          address 192.168.10.1/30;
        }
      }
    }
  }
  routing-options {
    static {
      route 10.10.10.0/30 next-hop 192.168.10.2;
    }
  }
}
LS2 {
  interfaces {
    lt-1/2/0 {
      unit 1 {
        description LS2->LS1;
        encapsulation ethernet;
        peer-unit 0;
        family inet {
          address 192.168.10.2/30;
        }
      }
    }
  }
}
```

```
    }  
  }  
  unit 9 {  
    description LS2->LS3;  
    encapsulation ethernet;  
    peer-unit 10;  
    family inet {  
      address 10.10.10.1/30;  
    }  
  }  
}  
}  
LS3 {  
  interfaces {  
    lt-1/2/0 {  
      unit 10 {  
        description LS3->LS2;  
        encapsulation ethernet;  
        peer-unit 9;  
        family inet {  
          address 10.10.10.2/30;  
        }  
      }  
    }  
  }  
  routing-options {  
    static {  
      route 192.168.10.0/30 next-hop 10.10.10.1;  
    }  
  }  
}
```

Verification

Confirm that the configuration is working properly.

- [Verifying That the Logical Systems Are Up on page 24](#)
- [Verifying Connectivity Between the Logical Systems on page 25](#)

Verifying That the Logical Systems Are Up

Purpose Make sure that the interfaces are properly configured.

Action user@host> show interfaces terse

Interface	Admin	Link	Proto	Local	Remote
...					
lt-1/2/0	up	up			
lt-1/2/0.0	up	up	inet	192.168.10.1/30	
lt-1/2/0.1	up	up	inet	192.168.10.2/30	
lt-1/2/0.9	up	up	inet	10.10.10.1/30	
lt-1/2/0.10	up	up	inet	10.10.10.2/30	
...					

Verifying Connectivity Between the Logical Systems

Purpose Make sure that the static routes appear in the routing tables of Logical Systems LS1 and LS3. Also, make sure that the logical systems can ping each other.

Action user@host> show route logical-system LS1
inet.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```
10.10.10.0/30      *[Static/5] 18:43:25
                  > to 192.168.10.2 via lt-1/2/0.0
192.168.10.0/30    *[Direct/0] 18:43:25
                  > via lt-1/2/0.0
192.168.10.1/32    *[Local/0] 18:43:25
                  Local via lt-1/2/0.0
```

user@host> show route logical-system LS3
inet.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```
10.10.10.0/30      *[Direct/0] 23:11:21
                  > via lt-1/2/0.10
10.10.10.2/32      *[Local/0] 23:11:21
                  Local via lt-1/2/0.10
192.168.10.0/30    *[Static/5] 00:23:31
                  > to 10.10.10.1 via lt-1/2/0.10
```

From LS1, Ping LS3

```
user@host> set cli logical-system LS1

user@host:LS1> ping 10.10.10.2
PING 10.10.10.2 (10.10.10.2): 56 data bytes
64 bytes from 10.10.10.2: icmp_seq=0 ttl=63 time=1.263 ms
64 bytes from 10.10.10.2: icmp_seq=1 ttl=63 time=1.086 ms
64 bytes from 10.10.10.2: icmp_seq=2 ttl=63 time=1.077 ms
```

From LS3, Ping LS1

```
user@host> set cli logical-system LS3

user@host:LS3> ping 192.168.10.1
PING 192.168.10.1 (192.168.10.1): 56 data bytes
64 bytes from 192.168.10.1: icmp_seq=0 ttl=63 time=10.781 ms
64 bytes from 192.168.10.1: icmp_seq=1 ttl=63 time=1.167 ms
64 bytes from 192.168.10.1: icmp_seq=2 ttl=63 time=1.152 ms
```

Related Documentation

- [Introduction to Logical Systems](#)

Example: Configuring Static Route Preferences and Qualified Next Hops

- [Understanding Static Route Preferences and Qualified Next Hops on page 26](#)
- [Example: Configuring Static Route Preferences and Qualified Next Hops on page 27](#)

Understanding Static Route Preferences and Qualified Next Hops

A static route destination address can have multiple next hops associated with it. In this case, multiple routes are inserted into the routing table, and route selection must occur. Because the primary criterion for route selection is the route preference, you can control the routes that are used as the primary route for a particular destination by setting the route preference associated with a particular next hop. The routes with a lower route

preference are always used to route traffic. When you do not set a preferred route, traffic is alternated between routes in round-robin fashion.

In general, the default properties assigned to a static route apply to all the next-hop addresses configured for the static route. If, however, you want to configure two possible next-hop addresses for a particular route and have them treated differently, you can define one as a qualified next hop.

Qualified next hops allow you to associate one or more properties with a particular next-hop address. You can set an overall preference for a particular static route and then specify a different preference for the qualified next hop. For example, suppose two next-hop addresses (10.10.10.10 and 10.10.10.7) are associated with the static route 192.168.47.5/32. A general preference is assigned to the entire static route, and then a different preference is assigned to only the qualified next-hop address 10.10.10.7. For example:

```
route 192.168.47.5/32 {
  next-hop 10.10.10.10;
  qualified-next-hop 10.10.10.7 {
    preference 2;
  }
  preference 6;
}
```

In this example, the qualified next hop 10.10.10.7 is assigned the preference 2, and the next-hop 10.10.10.10 is assigned the preference 6.



NOTE: The **preference** and **metric** options only apply to the qualified next hops. The qualified next-hop preference and metric override the route preference and metric (for that specific qualified next hop), similar to how the route preference overrides the default preference and metric (for that specific route).

Example: Configuring Static Route Preferences and Qualified Next Hops

This example shows how to control static route selection.

- [Requirements on page 27](#)
- [Overview on page 27](#)
- [Configuration on page 28](#)
- [Verification on page 31](#)

Requirements

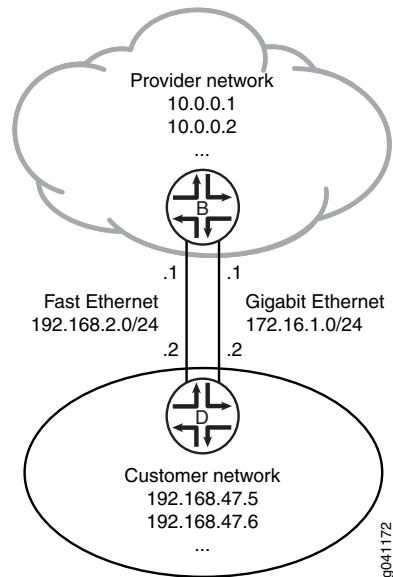
In this example, no special configuration beyond device initialization is required.

Overview

In this example, the static route 192.168.47.0/24 has two possible next hops. Because one link has higher bandwidth, this link is the preferred path. To enforce this preference,

the **qualified-next-hop** statement is included in the configuration on both devices. See [Figure 4 on page 28](#).

Figure 4: Controlling Static Route Selection



Configuration

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 B**
- ```

set interfaces ge-1/2/0 unit 0 description B->D
set interfaces ge-1/2/0 unit 0 family inet address 172.16.1.1/24
set interfaces fe-1/2/1 unit 2 description secondary-B->D
set interfaces fe-1/2/1 unit 2 family inet address 192.168.2.1/24
set interfaces lo0 unit 57 family inet address 10.0.0.1/32
set interfaces lo0 unit 57 family inet address 10.0.0.2/32
set routing-options static route 192.168.47.0/24 next-hop 172.16.1.2
set routing-options static route 192.168.47.0/24 qualified-next-hop 192.168.2.2 preference 25

```
- Device D**
- ```

set interfaces ge-1/2/0 unit 1 description D->B
set interfaces ge-1/2/0 unit 1 family inet address 172.16.1.2/24
set interfaces fe-1/2/1 unit 3 description secondary-D->B
set interfaces fe-1/2/1 unit 3 family inet address 192.168.2.2/24
set interfaces lo0 unit 2 family inet address 192.168.47.5/32
set interfaces lo0 unit 2 family inet address 192.168.47.6/32
set routing-options static route 0.0.0.0/0 next-hop 172.16.1.1
set routing-options static route 0.0.0.0/0 qualified-next-hop 192.168.2.1 preference 25

```


Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To control static route selection:

1. On Device B, configure the interfaces.

```
[edit interfaces]
user@B# set ge-1/2/0 unit 0 description B->D
user@B# set ge-1/2/0 unit 0 family inet address 172.16.1.1/24
user@B# set fe-1/2/1 unit 2 description secondary-B->D
user@B# set fe-1/2/1 unit 2 family inet address 192.168.2.1/24
user@B# set lo0 unit 57 family inet address 10.0.0.1/32
user@B# set lo0 unit 57 family inet address 10.0.0.2/32
```
2. On Device B, configure a static route to the customer network.

```
[edit routing-options static route 192.168.47.0/24]
user@B# set next-hop 172.16.1.2
```
3. On Device B, configure a backup route to the customer network.

```
[edit routing options static route 192.168.47.0/24]
user@B# set qualified-next-hop 192.168.2.2 preference 25
```
4. On Device D, configure the interfaces.

```
[edit interfaces]
user@D# set ge-1/2/0 unit 1 description D->B
user@D# set ge-1/2/0 unit 1 family inet address 172.16.1.2/24
user@D# set fe-1/2/1 unit 3 description secondary-D->B
user@D# set fe-1/2/1 unit 3 family inet address 192.168.2.2/24
user@D# set lo0 unit 2 family inet address 192.168.47.5/32
user@D# set lo0 unit 2 family inet address 192.168.47.6/32
```
5. On Device D, configure a static default route to external networks.

```
[edit routing options static route 0.0.0.0/0]
user@D# set next-hop 172.16.1.1
```
6. On Device D, configure a backup static default route to external networks.

```
[edit routing options static route 0.0.0.0/0]
user@D# set qualified-next-hop 192.168.2.1 preference 25
```

Results Confirm your configuration by issuing the **show interfaces** 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@B# show interfaces
ge-1/2/0 {
  unit 0 {
    description B->D;
    family inet {
      address 172.16.1.1/24;
    }
  }
}
```

```
fe-1/2/1 {
  unit 2 {
    description secondary-B->D;
    family inet {
      address 192.168.2.1/24;
    }
  }
}
lo0 {
  unit 57 {
    family inet {
      address 10.0.0.1/32;
      address 10.0.0.2/32;
    }
  }
}

user@B# show routing-options
static {
  route 192.168.47.0/24 {
    next-hop 172.16.1.2;
    qualified-next-hop 192.168.2.2 {
      preference 25;
    }
  }
}

user@D# show interfaces
ge-1/2/0 {
  unit 1 {
    description D->B;
    family inet {
      address 172.16.1.2/24;
    }
  }
}
fe-1/2/1 {
  unit 3 {
    description secondary-D->B;
    family inet {
      address 192.168.2.2/24;
    }
  }
}
lo0 {
  unit 2 {
    family inet {
      address 192.168.47.5/32;
      address 192.168.47.6/32;
    }
  }
}

user@D# show routing-options
static {
  route 0.0.0.0/0 {
    next-hop 172.16.1.1;
  }
}
```

```

        qualified-next-hop 192.168.2.1 {
            preference 25;
        }
    }
}

```

If you are done configuring the devices, enter **commit** from configuration mode on both devices.

Verification

Confirm that the configuration is working properly.

- [Checking the Routing Tables on page 31](#)
- [Pinging the Remote Addresses on page 31](#)
- [Making Sure That the Backup Route Becomes the Active Route on page 32](#)

Checking the Routing Tables

Purpose Make sure that the static routes appear in the routing tables of Device B and Device D.

Action

```

user@B> show route protocol static
inet.0: 7 destinations, 8 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.47.0/24    *[Static/5] 02:02:03
                  > to 172.16.1.2 via ge-1/2/0.0
                  [Static/25] 01:58:21
                  > to 192.168.2.2 via fe-1/2/1.2

user@D> show route protocol static
inet.0: 7 destinations, 8 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

0.0.0.0/0         *[Static/5] 02:02:12
                  > to 172.16.1.1 via ge-1/2/0.1
                  [Static/25] 01:58:31
                  > to 192.168.2.1 via fe-1/2/1.3

```

Meaning The asterisks (*) in the routing tables show the active routes. The backup routes are listed next.

Pinging the Remote Addresses

Purpose Verify that the static routes are working.

From Device B, ping one of the loopback interface addresses on Device D.

From Device D, ping one of the loopback interface addresses on Device B.

Action user@B> ping 192.168.47.5
PING 192.168.47.5 (192.168.47.5): 56 data bytes
64 bytes from 192.168.47.5: icmp_seq=0 ttl=64 time=156.126 ms
64 bytes from 192.168.47.5: icmp_seq=1 ttl=64 time=120.393 ms
64 bytes from 192.168.47.5: icmp_seq=2 ttl=64 time=175.361 ms

user@D> ping 10.0.0.1
PING 10.0.0.1 (10.0.0.1): 56 data bytes
64 bytes from 10.0.0.1: icmp_seq=0 ttl=64 time=1.315 ms
64 bytes from 10.0.0.1: icmp_seq=1 ttl=64 time=31.819 ms
64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=1.268 ms

Making Sure That the Backup Route Becomes the Active Route

Purpose If the primary route becomes unusable, make sure that the backup secondary route becomes active.

Action 1. Disable the active route by deactivating the ge-1/2/0.0 interface on Device B.

```
user@B# deactivate interfaces ge-1/2/0 unit 0 family inet address 172.16.1.1/24
user@B# commit
```

2. Check Device B's routing table.

```
user@B> show route protocol static
inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.47.0/24      *[Static/25] 02:06:24
                    > to 192.168.2.2 via fe-1/2/1.2
```

Meaning The backup route has become the active route.

Related Documentation

- [Examples: Configuring Static Routes on page 9](#)
- [Example: Configuring Static Routing on Logical Systems on page 19](#)

Example: Controlling Static Routes in Routing and Forwarding Tables

- [Understanding Static Route Control in Routing and Forwarding Tables on page 32](#)
- [Example: Preventing a Static Route from Being Readvertised on page 33](#)

Understanding Static Route Control in Routing and Forwarding Tables

You can control the importation of static routes into the routing and forwarding tables in a number of ways. Primary ways include assigning one or more of the following attributes to the route:

- **retain**—Keeps the route in the forwarding table after the routing process shuts down or the device reboots.
- **no-readvertise**—Prevents the route from being readvertised to other routing protocols.
- **passive**—Rejects traffic destined for the route.

This topic includes the following sections:

- [Route Retention on page 33](#)
- [Readvertisement Prevention on page 33](#)
- [Forced Rejection of Passive Route Traffic on page 33](#)

Route Retention

By default, static routes are not retained in the forwarding table when the routing process shuts down. When the routing process starts up again, any routes configured as static routes must be added to the forwarding table again. To avoid this latency, routes can be flagged as **retain**, so that they are kept in the forwarding table even after the routing process shuts down. Retention ensures that the routes are always in the forwarding table, even immediately after a system reboot.

Readvertisement Prevention

Static routes are eligible for readvertisement by other routing protocols by default. In a stub area where you might not want to readvertise these static routes under any circumstances, you can flag the static routes as **no-readvertise**.

Forced Rejection of Passive Route Traffic

Generally, only active routes are included in the routing and forwarding tables. If a static route's next-hop address is unreachable, the route is marked **passive**, and it is not included in the routing or forwarding tables. To force a route to be included in the routing tables regardless of next-hop reachability, you can flag the route as **passive**. If a route is flagged **passive** and its next-hop address is unreachable, the route is included in the routing table, and all traffic destined for the route is rejected.

Example: Preventing a Static Route from Being Readvertised

This example shows how to prevent a static route from being readvertised into OSPF, thereby preventing the route from appearing in the routing and forwarding tables.

- [Requirements on page 33](#)
- [Overview on page 33](#)
- [Configuration on page 34](#)
- [Verification on page 38](#)

Requirements

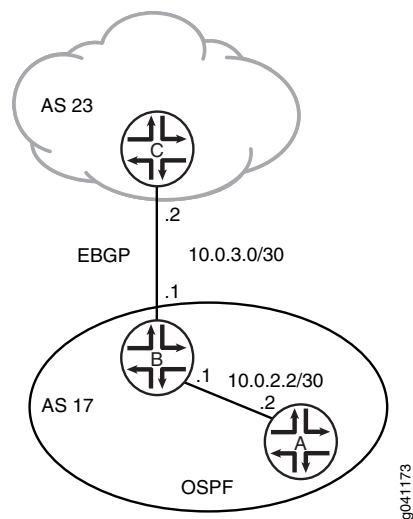
In this example, no special configuration beyond device initialization is required.

Overview

This example shows how to configure a routing policy that readvertises static routes into OSPF, with the exception of one static route that is not readvertised because it is tagged with the **no-readvertise** statement.

[Figure 5 on page 34](#) shows the sample network.

Figure 5: Customer Routes Connected to a Service Provider



Configuration

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 A
set interfaces fe-1/2/0 unit 4 description A->B
set interfaces fe-1/2/0 unit 4 family inet address 10.0.2.2/30
set protocols ospf area 0.0.0.0 interface fe-1/2/0.4

Device B
set interfaces fe-1/2/0 unit 3 description B->A
set interfaces fe-1/2/0 unit 3 family inet address 10.0.2.1/30
set interfaces fe-1/2/1 unit 6 description B->C
set interfaces fe-1/2/1 unit 6 family inet address 10.0.3.1/30
set protocols bgp group ext type external
set protocols bgp group ext peer-as 23
set protocols bgp group ext neighbor 10.0.3.2
set protocols ospf export send-static
set protocols ospf area 0.0.0.0 interface fe-1/2/0.3
set policy-options policy-statement send-static from protocol static
set policy-options policy-statement send-static then accept
set routing-options static route 0.0.0.0/0 next-hop 10.0.3.2
set routing-options static route 192.168.0.0/24 next-hop 10.0.3.2
set routing-options static route 192.168.0.0/24 no-readvertise
set routing-options autonomous-system 17

Device C
set interfaces fe-1/2/0 unit 7 description B->C
set interfaces fe-1/2/0 unit 7 family inet address 10.0.3.2/30
set interfaces lo0 unit 5 family inet address 192.168.0.1/32
set protocols bgp group ext type external
set protocols bgp group ext peer-as 17
set protocols bgp group ext neighbor 10.0.3.1
set routing-options autonomous-system 23

```

Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure Device A:

1. Configure the interface to Device B.

```
[edit interfaces fe-1/2/0 unit 4]
user@A# set description A->B
user@A# set family inet address 10.0.2.2/30
```
2. Configure OSPF to form an OSPF peer relationship with Device B.

```
[edit protocols ospf area 0.0.0.0]
user@A# set interface fe-1/2/0.4
```

Step-by-Step Procedure To configure Device B:

1. Configure the interfaces to Device A and Device C.

```
[edit interfaces]
user@B# set fe-1/2/0 unit 3 description B->A
user@B# set fe-1/2/0 unit 3 family inet address 10.0.2.1/30
user@B# set fe-1/2/1 unit 6 description B->C
user@B# set fe-1/2/1 unit 6 family inet address 10.0.3.1/30
```
2. Configure one or more static routes and the autonomous system (AS) number.

```
[edit routing-options]
user@B# set static route 0.0.0.0/0 next-hop 10.0.3.2
user@B# set static route 192.168.0.0/24 next-hop 10.0.3.2
user@B# set autonomous-system 17
```
3. Configure the routing policy.

This policy exports static routes from the routing table into OSPF.

```
[edit policy-options policy-statement send-static]
user@B# set from protocol static
user@B# set then accept
```
4. Include the **no-readvertise** statement to prevent the 192.168.0.0/24 route from being exported into OSPF.

```
[edit routing-options]
user@B# set static route 192.168.0.0/24 no-readvertise
```
5. Configure the routing protocols.

The BGP configuration forms an external BGP (EBGP) peer relationship with Device C.

The OSPF configuration forms an OSPF peer relationship with Device A and applies the **send-static** routing policy.

```
[edit protocols]
user@B# set bgp group ext type external
user@B# set bgp group ext peer-as 23
user@B# set bgp group ext neighbor 10.0.3.2
```

```
user@B# set ospf export send-static
user@B# set ospf area 0.0.0.0 interface fe-1/2/0.3
```

**Step-by-Step
Procedure**

To configure Device C:

1. Create the interface to Device B, and configure the loopback interface.

```
[edit interfaces ]
user@C# set fe-1/2/0 unit 7 description B->C
user@C# set fe-1/2/0 unit 7 family inet address 10.0.3.2/30
user@C# set lo0 unit 5 family inet address 192.168.0.1/32
```

2. Configure the EBGP peering session with Device B.

```
[edit protocols bgp group ext]
user@C# set type external
user@C# set peer-as 17
user@C# set neighbor 10.0.3.1
```

3. Configure the AS number.

```
[edit routing-options]
user@C# set autonomous-system 23
```

Results

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

Device A

```
user@A# show interfaces
fe-1/2/0 {
  unit 4 {
    description A->B;
    family inet {
      address 10.0.2.2/30;
    }
  }
}
```

```
user@A# show protocols
ospf {
  area 0.0.0.0 {
    interface fe-1/2/0.4;
  }
}
```

Device B

```
user@B# show interfaces
interfaces {
  fe-1/2/0 {
    unit 3 {
      description B->A;
      family inet {
        address 10.0.2.1/30;
      }
    }
  }
  fe-1/2/1 {
    unit 6 {
```



```

        description B->C;
        family inet {
            address 10.0.3.1/30;
        }
    }
}

user@B# show policy-options
policy-statement send-static {
    from protocol static;
    then accept;
}

user@B# show protocols
bgp {
    group ext {
        type external;
        peer-as 23;
        neighbor 10.0.3.2;
    }
}
ospf {
    export send-static;
    area 0.0.0.0 {
        interface fe-1/2/0.3;
    }
}

user@B# show routing-options
static {
    route 0.0.0.0/0 next-hop 10.0.3.2;
    route 192.168.0.0/24 {
        next-hop 10.0.3.2;
        no-readvertise;
    }
}
autonomous-system 17;

```

Device C

```

user@C# show interfaces
fe-1/2/0 {
    unit 7 {
        description B->C;
        family inet {
            address 10.0.3.2/30;
        }
    }
}
lo0 {
    unit 5 {
        family inet {
            address 192.168.0.1/32;
        }
    }
}

user@C# show protocols

```

```
bgp {  
  group ext {  
    type external;  
    peer-as 17;  
    neighbor 10.0.3.1;  
  }  
}
```

```
user@C# show routing-options  
autonomous-system 23;
```

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

Verification

Confirm that the configuration is working properly.

Checking the Routing Table

Purpose Make sure that the **no-readvertise** statement is working.

- Action**
1. On Device A, run the **show route protocol ospf** command to make sure that the 192.168.0.0/24 route does not appear in Device A's routing table.

```
user@A> show route protocols ospf  
inet.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)  
+ = Active Route, - = Last Active, * = Both  
  
0.0.0.0/0          *[OSPF/150] 00:03:15, metric 0, tag 0  
                  > to 10.0.2.1 via fe-1/2/0.4  
224.0.0.5/32      *[OSPF/10] 00:04:07, metric 1  
                  MultiRecv
```

2. On Device B, deactivate the **no-readvertise** statement.

```
user@B# deactivate routing-options static route 192.168.0.0/24 no-readvertise
```

3. On Device A, rerun the **show route protocol ospf** command to make sure that the 192.168.0.0/24 route appears in Device A's routing table.

```
user@A> show route protocols ospf  
inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)  
+ = Active Route, - = Last Active, * = Both  
  
0.0.0.0/0          *[OSPF/150] 00:04:24, metric 0, tag 0  
                  > to 10.0.2.1 via fe-1/2/0.4  
192.168.0.0/24    *[OSPF/150] 00:00:15, metric 0, tag 0  
                  > to 10.0.2.1 via fe-1/2/0.4  
224.0.0.5/32      *[OSPF/10] 00:05:16, metric 1  
                  MultiRecv
```

Meaning The **no-readvertise** statement is working as expected.

Related Documentation

- [Examples: Configuring Static Routes on page 9](#)
- [Example: Configuring Static Routing on Logical Systems on page 19](#)
- [Example: Configuring Static Route Preferences and Qualified Next Hops on page 26](#)

Examples: Creating a Routing Table and Populating It with Routes

- [Understanding Junos OS Routing Tables on page 39](#)
- [Example: Creating Routing Tables on page 40](#)
- [Example: Importing Direct and Static Routes Into a Routing Instance on page 42](#)
- [Example: Exporting Specific Routes from One Routing Table Into Another Routing Table on page 46](#)

Understanding Junos OS Routing Tables

Junos OS automatically creates and maintains several routing tables. Each routing table is used for a specific purpose. In addition to these automatically created routing tables, you can create your own routing tables.

Each routing table populates a portion of the forwarding table. Thus, the forwarding table is partitioned based on routing tables. This allows for specific forwarding behavior for each routing table. For example, for VPNs, each VPN-based routing table has its own VPN-specific partition in the forwarding table.

It is common for the routing software to maintain unicast routes and multicast routes in different routing tables. You also might have policy considerations that would lead you to create separate routing tables to manage the propagation of routing information.

Creating routing tables is optional. If you do not create any, Junos OS uses its default routing tables, which are as follows:

- **inet.0**—For IP version 4 (IPv4) unicast routes. This table stores interface local and direct routes, static routes, and dynamically learned routes.
- **inet.1**—For the IPv4 multicast forwarding cache. This table stores the IPv4 (S,G) group entries that are dynamically created as a result of join state information.
- **inet.2**—For subsequent address family indicator (SAFI) 2 routes, when multiprotocol BGP (MBGP) is enabled. This table stores unicast routes that are used for multicast reverse-path-forwarding (RPF) lookup. The routes in this table can be used by the Distance Vector Multicast Routing Protocol (DVMRP), which requires a specific RPF table. In contrast, Protocol Independent Multicast (PIM) does not need this table because it can perform RPF checks against the inet.0 table. You can import routes from inet.0 into inet.2 using routing information base (RIB) groups, or install routes directly into inet.2 from a multicast routing protocol.
- **inet.3**—For IPv4 MPLS. This table stores the egress address of an MPLS label-switched path (LSP), the LSP name, and the outgoing interface name. This routing table is used only when the local device is the ingress node to an LSP.
- **inet6.0**—For IP version 6 (IPv6) unicast routes. This table stores interface local and direct routes, static routes, and dynamically learned routes.
- **instance-name.inet.0**—If you configure a routing instance, Junos OS creates the default unicast routing table **instance-name.inet.0**.

- ***instance-name.inet.2***—If you configure **routing-instances *instance-name* protocols bgp family inet multicast** in a routing instance of type VRF, Junos OS creates the ***instance-name.inet.2*** table.

Another way to create the ***instance-name.inet.2*** table is to use the **rib-group** statement. See [“Example: Exporting Specific Routes from One Routing Table Into Another Routing Table”](#) on page 46.



NOTE: Importing **inet-vpn** multicast routes from the **bgp.l3vpn.2** table into the ***instance-name.inet.2*** table does not create the ***instance-name.inet.2*** table. The import operation works only if the ***instance-name.inet.2*** table already exists.

- ***instance-name.inetflow.0***—If you configure a flow route, Junos OS creates the flow routing table ***instance-name.inetflow.0***.
- **bgp.l2vpn.0**—For Layer 2 VPN routes learned from BGP. This table stores routes learned from other provider edge (PE) routers. The Layer 2 routing information is copied into Layer 2 VPN routing and forwarding instances (VRFs) based on target communities.
- **bgp.l3vpn.0**—For Layer 3 VPN routes learned from BGP. This table stores routes learned from other PE routers. Routes in this table are copied into a Layer 3 VRF when there is a matching route table.
- **mpls.0**—For MPLS label switching operations. This table is used when the local device is a transit router.
- **iso.0**—For IS-IS routes. When you are using IS-IS to support IP routing, this table contains only the local device's network entity title (NET).
- **juniper_private**—For Junos OS to communicate internally between the Routing Engine and PIC hardware.

Example: Creating Routing Tables

This example shows how to create a custom routing table.

- [Requirements on page 40](#)
- [Overview on page 40](#)
- [Configuration on page 41](#)
- [Verification on page 42](#)

Requirements

In this example, no special configuration beyond device initialization is required.

Overview

Creating routing tables is optional. You might have policy considerations that would lead you to create separate routing tables to manage the propagation of routing information. This capability is rarely used, but it is demonstrated here for completeness.

If you do not create any routing tables, Junos OS uses its default routing tables.



NOTE: If you want to add static, aggregate, generated, or martian routes only to the default IPv4 unicast routing table (`inet.0`), you do not have to create any routing tables because, by default, these routes are added to `inet.0`. You can add these routes by including the `static`, `aggregate`, `generate`, and `martians` statements.

To explicitly create a routing table, include the `rib` statement and child statements under the `rib` statement.

The routing table name, *routing-table-name*, includes the protocol family, optionally followed by a period and a number. The protocol family can be `inet` for the IPv4 family, `inet6` for the IPv6 family, or `iso` for the International Standards Organization (ISO) protocol family. The number represents the routing instance. The first instance is 0.

This example shows how to configure a custom IPv4 routing table called `inet.14`. The example also shows how to populate the routing table with a single static route.



NOTE: On EX Series switches, only dynamically learned routes can be imported from one routing table group to another.

Configuration

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.

```
set routing-options rib inet.14 static route 10.2.0.0/16 discard
```

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 create a routing table:

1. Configure the routing table.

```
[edit routing-options]
user@host# set rib inet.14 static route 10.2.0.0/16 discard
```
2. If you are done configuring the device, commit the configuration.

```
[edit]
user@host# commit
```

Results

Confirm your configuration by issuing the **show routing-options** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show routing-options
rib inet.14 {
  static {
    route 10.2.0.0/16 discard;
  }
}
```

Verification

Confirm that the configuration is working properly.

- [Checking the Routing Table on page 42](#)

Checking the Routing Table

Purpose Make sure that the static route appears in the custom routing table.

Action

```
user@host> show route table inet.14
inet.14: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

10.2.0.0/16          *[Static/5] 00:00:09
                    Discard
```

Meaning The static route is in the custom routing table.

Example: Importing Direct and Static Routes Into a Routing Instance

This example shows how to populate the routing table that is created when you configure a virtual router.

- [Requirements on page 42](#)
- [Overview on page 42](#)
- [Configuration on page 43](#)
- [Verification on page 46](#)

Requirements

In this example, no special configuration beyond device initialization is required.

Overview

You can install routes into more than one routing table. For example, you might want a simple configuration that allows you to install a static route into the default routing table **inet.0**, as well as a second routing table **vpna.inet.0**. Instead of configuring the same

static route for each routing table, you can use routing table groups to insert the route into multiple tables. To create a routing table group, include the **rib-groups** statement.

This example shows how to export static routes, direct routes, and local routes from the default IPv4 unicast routing table (**inet.0**) and import them into the IPv4 unicast routing table of a virtual router called **vpna** (**vpna.inet.0**).



NOTE: To explicitly create a routing table, include the **rib** statement. In this case, you do not need to use the **rib** statement because when you configure a routing instance, Junos OS automatically creates the routing table **instance-name.inet.0**.

In this example, Device A and Device B are directly connected to each other. Device A also has a virtual router configured called **vpna**. Device A's **inet.0** routing table has direct and local routes (also known as interface routes). These routes are imported into **vpna**'s **inet.0** routing table (**vpna.inet.0**). Device A also has a static route configured. This static route is also imported into **vpna.inet.0**.

Configuration

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 A

```
set interfaces fe-1/2/0 unit 4 description A->B
set interfaces fe-1/2/0 unit 4 family inet address 10.0.2.2/30
set interfaces lo0 unit 1 family inet address 1.1.1.1/32
set routing-instances vpna instance-type virtual-router
set routing-options interface-routes rib-group inet group1
set routing-options static rib-group group1
set routing-options static route 192.168.1.0/24 discard
set routing-options rib-groups group1 import-rib inet.0
set routing-options rib-groups group1 import-rib vpna.inet.0
```

Device B

```
set interfaces fe-1/2/0 unit 3 description B->A
set interfaces fe-1/2/0 unit 3 family inet address 10.0.2.1/30
set interfaces lo0 unit 2 family inet address 2.2.2.2/32
```

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 this example:

1. Configure the routing instance.

```
[edit routing-instances]
user@A# set vpna instance-type virtual-router
```
2. Configure the interfaces.

```
[edit interfaces]
```

```
user@A# set fe-1/2/0 unit 4 description A->B
user@A# set fe-1/2/0 unit 4 family inet address 10.0.2.2/30
user@A# set lo0 unit 1 family inet address 1.1.1.1/32
```

3. Configure one or more static routes.

```
[edit routing-options]
user@A# set static route 192.168.1.0/24 discard
```

4. Include the direct and local routes in a routing table group called group1.

The **interface-routes** statement specifies the direct and local routes to match against.

```
[edit routing-options]
user@A# set interface-routes rib-group inet group1
```

5. Include all static routes in the group1 routing table group.

The **static** statement specifies the protocol (static) to match against.

```
[edit routing-options]
user@A# set static rib-group group1
```

6. Configure the primary routing table for group1.

The primary routing table determines the address family of the routing table group. To configure an IPv4 group, specify **inet.0** as the primary table. To configure an IPv6 group, specify **inet6.0** as the primary routing table.

```
[edit routing-options]
user@A# set rib-groups group1 import-rib inet.0
```

7. Configure the secondary routing table for group1.

```
[edit routing-options]
user@A# set rib-groups group1 import-rib vpna.inet.0
```

8. If you are done configuring the device, commit the configuration.

```
[edit routing-options]
user@A# commit
```

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 B:

1. Configure the interfaces.

```
[edit interfaces]
user@B# set fe-1/2/0 unit 3 description B->A
user@B# set fe-1/2/0 unit 3 family inet address 10.0.2.1/30

user@B# set lo0 unit 2 family inet address 2.2.2.2/32
```

2. If you are done configuring the device, commit the configuration.

```
[edit]
user@B# commit
```


Results

Confirm your configuration by issuing the **show interfaces**, **show routing-instances**, 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@A# show interfaces
fe-1/2/0 {
  unit 4 {
    description A->B;
    family inet {
      address 10.0.2.2/30;
    }
  }
}
lo0 {
  unit 1 {
    family inet {
      address 1.1.1.1/32;
    }
  }
}

user@A# show routing-instances
vpna {
  instance-type virtual-router;
}

user@A# show routing-options
interface-routes {
  rib-group inet group1;
}
static {
  rib-group group1;
  route 192.168.1.0/24 discard;
}
rib-groups {
  group1 {
    import-rib [ inet.0 vpna.inet.0 ];
  }
}

user@B# show interfaces
fe-1/2/0 {
  unit 3 {
    description B->A;
    family inet {
      address 10.0.2.1/30;
    }
  }
}
lo0 {
  unit 2 {
    family inet {
      address 2.2.2.2/32;
    }
  }
}

```

```
}  
}
```

Verification

Confirm that the configuration is working properly.

Checking the Routing Tables

Purpose Make sure that the expected routes appear in the routing tables.

Action user@A> show route table inet.0

```
inet.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)  
+ = Active Route, - = Last Active, * = Both
```

```
1.1.1.1/32      *[Direct/0] 02:51:24  
                > via lo0.1  
10.0.2.0/30     *[Direct/0] 03:19:06  
                > via fe-1/2/0.4  
10.0.2.2/32     *[Local/0] 03:19:07  
                Local via fe-1/2/0.4  
192.168.1.0/24  *[Static/5] 00:44:21  
                Discard
```

user@A> show route table vpn.0

```
vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)  
+ = Active Route, - = Last Active, * = Both
```

```
1.1.1.1/32      *[Direct/0] 02:35:39  
                > via lo0.1  
10.0.2.0/30     *[Direct/0] 02:35:39  
                > via fe-1/2/0.4  
10.0.2.2/32     *[Local/0] 02:35:39  
                Local via fe-1/2/0.4  
192.168.1.0/24  *[Static/5] 00:44:28  
                Discard
```

Meaning The static route and the interface routes appear in both routing tables.

Example: Exporting Specific Routes from One Routing Table Into Another Routing Table

This example shows how to duplicate specific routes from one routing table into another routing table within the same routing instance.

- [Requirements on page 46](#)
- [Overview on page 47](#)
- [Configuration on page 47](#)
- [Verification on page 51](#)

Requirements

No special configuration beyond device initialization is required before configuring this example.

Overview

This example uses the **auto-export** statement and the **rib-group** statement to accomplish the goal of exporting specific routes from one routing table to another.

Consider the following points:

- When **auto-export** is configured in a routing instance, the **vrf-import** and **vrf-export** policies are examined. Based on the route target and community information in the policies, the **auto-export** function performs route leaking among the local routing instance inet.0 tables.
- You can use the **rib-group** statement if it is necessary to import routes into tables other than *instance.inet.0*. To use a RIB group with **auto-export**, the routing instance should specify explicit **vrf-import** and **vrf-export** policies. The **vrf-import** and **vrf-export** policies can be extended to contain additional terms to filter routes as needed for the RIB group.

In this example, access-internal routes are added into the *vpna.inet.0* routing table. The access-internal routes are also duplicated into the *vpna.inet.2* routing table.

Configuration

- [Configuring Specific Route Export Between Routing Tables on page 48](#)

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.

```
set interfaces fe-1/3/1 vlan-tagging
set interfaces fe-1/3/1 unit 0 vlan-id 512
set interfaces fe-1/3/1 unit 0 family inet address 10.168.100.3/24
set interfaces lo0 unit 0 family inet address 192.168.3.3/32
set routing-options rib-groups rib-group-vpna-access-internal import-rib vpna.inet.2
set routing-options autonomous-system 63000
set policy-options policy-statement vpna-export term a from protocol bgp
set policy-options policy-statement vpna-export term a then community add vpna-comm
set policy-options policy-statement vpna-export term b from protocol access-internal
set policy-options policy-statement vpna-export term b then accept
set policy-options policy-statement vpna-export term c then reject
set policy-options policy-statement vpna-import term a from protocol bgp
set policy-options policy-statement vpna-import term a from community vpna-comm
set policy-options policy-statement vpna-import term a then accept
set policy-options policy-statement vpna-import term b from instance vpna
set policy-options policy-statement vpna-import term b from protocol access-internal
set policy-options policy-statement vpna-import term b then accept
set policy-options policy-statement vpna-import term c then reject
set policy-options community vpna-comm members target:63000:100
set routing-instances vpna instance-type vrf
set routing-instances vpna interface fe-1/3/1.1
set routing-instances vpna route-distinguisher 100:1
set routing-instances vpna vrf-import vpna-import
set routing-instances vpna vrf-export vpna-export
```

```
set routing-instances vpna routing-options auto-export family inet unicast rib-group
  rib-group-vpna-access-internal
set routing-instances vpna protocols bgp group bgp-vpna type external
set routing-instances vpna protocols bgp group bgp-vpna family inet multicast
set routing-instances vpna protocols bgp group bgp-vpna peer-as 100
set routing-instances vpna protocols bgp group bgp-vpna neighbor 10.0.0.10
```

Configuring Specific Route Export Between Routing Tables

Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure the device:

1. Configure the interfaces.

```
[edit interfaces fe-1/3/1]
user@host# set vlan-tagging
user@host# set unit 0 vlan-id 512
user@host# set unit 0 family inet address 10.168.100.3/24
[edit interfaces lo0 unit 0]
user@host# set family inet address 192.168.3.3/32
```
2. Configure the routing policy that specifies particular routes for import into `vpna.inet.0` and export from `vpna.inet.0`.

```
[edit policy-options policy-statement vpna-export]
user@host# set term a from protocol bgp
user@host# set term a then community add vpna-comm
user@host# set term a then accept
user@host# set term b from protocol access-internal
user@host# set term b then accept
user@host# set term c then reject
[edit policy-options policy-statement vpna-import]
user@host# set term a from protocol bgp
user@host# set term a from community vpna-comm
user@host# set term a then accept
user@host# set term b from instance vpna
user@host# set term b from protocol access-internal
user@host# set term b then accept
user@host# set term c then reject
[edit policy-options]
user@host# set community vpna-comm members target:63000:100
```
3. Configure the routing instance.

```
[edit routing-instances vpna]
user@host# set instance-type vrf
user@host# set interface fe-1/3/1.1
user@host# set route-distinguisher 100:1
user@host# set vrf-import vpna-import
user@host# set vrf-export vpna-export
```

The `vrf-import` and `vrf-export` statements are used to apply the `vpna-import` and `vpna-export` routing policies configured in 2.

4. Configure the RIB group, and import routes into the `vpna.inet.2` routing table.

```
[edit routing-options]
user@host# set rib-groups rib-group-vpna-access-internal import-rib vpna.inet.2
```

5. Configure the **auto-export** statement to enable the routes to be exported from one routing table into another.

```
[edit routing-options]
user@host# set auto-export family inet unicast rib-group
rib-group-vpna-access-internal
```

6. Configure BGP.

```
[edit routing-instances vpna protocols bgp group bgp-vpna]
user@host# set type external
user@host# set family inet multicast
user@host# set peer-as 100
user@host# set neighbor 100.0.0.10
```

7. Configure the autonomous system (AS) number.

```
[edit routing-options]
user@host# set autonomous-system 63000
```

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

```
user@host# show interfaces
fe-1/3/1 {
  vlan-tagging;
  unit 0 {
    vlan-id 512;
    family inet {
      address 10.168.100.3/24;
    }
  }
}
lo0 {
  unit 0 {
    family inet {
      address 192.168.3.3/32;
    }
  }
}

user@host# show policy-options
policy-statement vpna-export {
  term a {
    from {
      protocol bgp;
    }
    then {
      community add vpna-comm;
      accept;
    }
  }
}
```

```
term b {
    from protocol access-internal;
    then accept;
}
term c {
    then reject;
}
}
policy-statement vpna-import {
    term a {
        from {
            protocol bgp;
            community vpna-comm;
        }
        then accept;
    }
    term b {
        from {
            instance vpna;
            protocol access-internal;
        }
        then accept;
    }
    term c {
        then reject;
    }
}
community vpna-comm members target:63000:100;

user@host# show routing-options
rib-groups {
    rib-group-vpna-access-internal {
        import-rib vpna.inet.2;
    }
}
autonomous-system 63000;

user@host# show routing-instances
vpna {
    instance-type vrf;
    interface fe-1/3/1.1;
    route-distinguisher 100:1;
    vrf-import vpna-import;
    vrf-export vpna-export;
    routing-options {
        auto-export {
            family inet {
                unicast {
                    rib-group rib-group-vpna-access-internal;
                }
            }
        }
    }
}
protocols {
    bgp {
        group bgp-vpna {
            type external;
        }
    }
}
```

```

        family inet {
            multicast;
        }
        peer-as 100;
        neighbor 100.0.0.10;
    }
}
}

```

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

Verification

Confirm that the configuration is working properly by running the **show table route vpn.a.inet.0** and **show route table vpn.a.inet.2** commands.

Related Documentation

- [Examples: Configuring Static Routes on page 9](#)

Example: Configuring Point-to-Multipoint LSPs with Static Routes

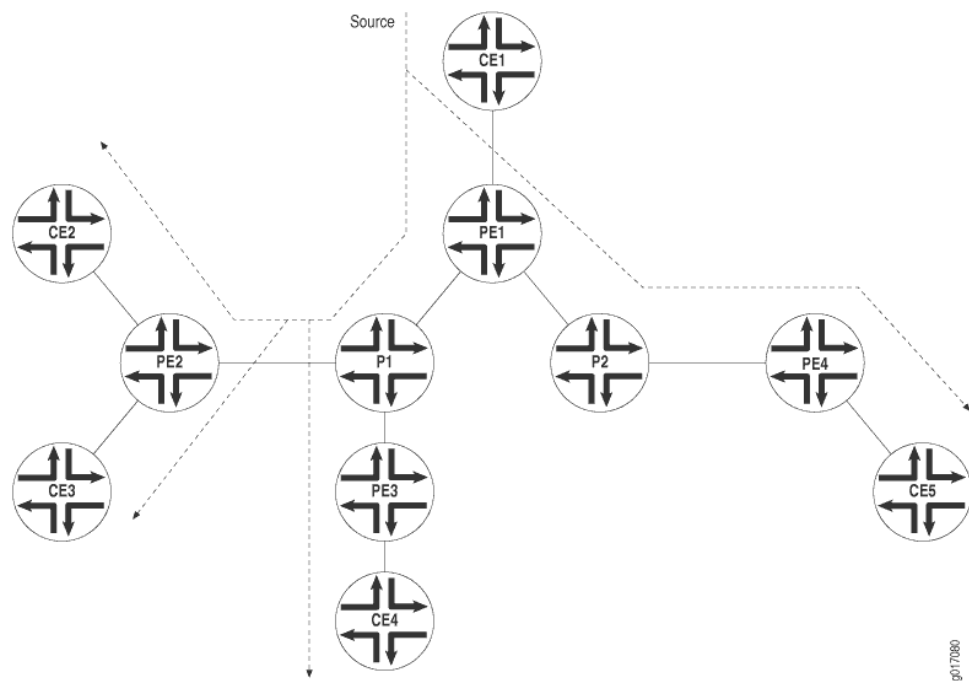
- [Understanding Point-to-Multipoint LSPs on page 51](#)
- [Point-to-Multipoint LSP Configuration Overview on page 52](#)
- [Example: Configuring an RSVP-Signaled Point-to-Multipoint LSP on page 53](#)

Understanding Point-to-Multipoint LSPs

A point-to-multipoint MPLS label-switched path (LSP) is an LDP-signaled or RSVP-signaled LSP with a single source and multiple destinations. By taking advantage of the MPLS packet replication capability of the network, point-to-multipoint LSPs avoid unnecessary packet replication at the inbound (ingress) router. Packet replication takes place only when packets are forwarded to two or more different destinations requiring different network paths.

This process is illustrated in [Figure 6 on page 52](#). Device PE1 is configured with a point-to-multipoint LSP to Routers PE2, PE3, and PE4. When Device PE1 sends a packet on the point-to-multipoint LSP to Routers P1 and P2, Device P1 replicates the packet and forwards it to Routers PE2 and PE3. Device P2 sends the packet to Device PE4.

Figure 6: Point-to-Multipoint LSPs



Following are some of the properties of point-to-multipoint LSPs:

- A point-to-multipoint LSP allows you to use MPLS for point-to-multipoint data distribution. This functionality is similar to that provided by IP multicast.
- You can add and remove branch LSPs from a main point-to-multipoint LSP without disrupting traffic. The unaffected parts of the point-to-multipoint LSP continue to function normally.
- You can configure a node to be both a transit and an outbound (egress) router for different branch LSPs of the same point-to-multipoint LSP.
- You can enable link protection on a point-to-multipoint LSP. Link protection can provide a bypass LSP for each of the branch LSPs that make up the point-to-multipoint LSP. If any primary paths fail, traffic can be quickly switched to the bypass.
- You can configure subpaths either statically or dynamically.
- You can enable graceful restart on point-to-multipoint LSPs.

Point-to-Multipoint LSP Configuration Overview

To set up a point-to-multipoint LSP:

1. Configure the primary LSP from the ingress router and the branch LSPs that carry traffic to the egress routers.
2. Specify a pathname on the primary LSP and this same path name on each branch LSP.



NOTE: By default, the branch LSPs are dynamically signaled by means of Constrained Shortest Path First (CSPF) and require no configuration. You can alternatively configure the branch LSPs as static paths.

Example: Configuring an RSVP-Signaled Point-to-Multipoint LSP

This example shows how to configure a collection of paths to create an RSVP-signaled point-to-multipoint label-switched path (LSP).

- [Requirements on page 53](#)
- [Overview on page 53](#)
- [Configuration on page 54](#)
- [Verification on page 69](#)

Requirements

In this example, no special configuration beyond device initialization is required.

Overview

In this example, multiple routing devices serve as the transit, branch, and leaf nodes of a single point-to-multipoint LSP. On the provider edge (PE), Device PE1 is the ingress node. The branches go from PE1 to PE2, PE1 to PE3, and PE1 to PE4. Static unicast routes on the ingress node (PE1) point to the egress nodes.

This example also demonstrates static routes with a next hop that is a point-to-multipoint LSP, using the `p2mp-lsp-next-hop` statement. This is useful when implementing filter-based forwarding.

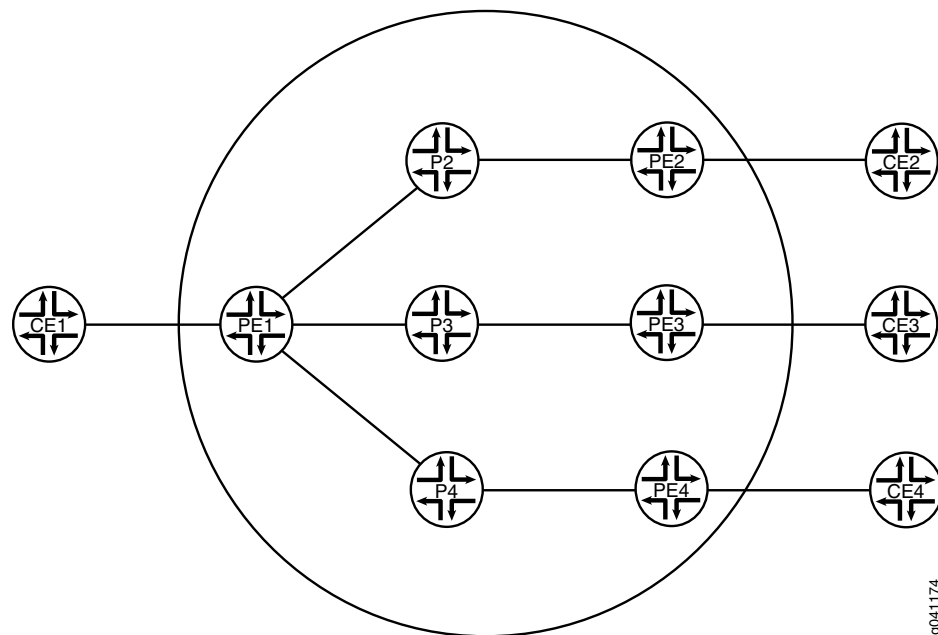


NOTE: Another option is to use the `lsp-next-hop` statement to configure a regular point-to-point LSP to be the next hop. Though not shown in this example, you can optionally assign an independent preference and metric to the next hop.

Topology Diagram

[Figure 7 on page 54](#) shows the topology used in this example.

Figure 7: RSVP-Signaled Point-to-Multipoint LSP



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Configuration

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 PE1

```
set interfaces ge-2/0/2 unit 0 description PE1-to-CE1
set interfaces ge-2/0/2 unit 0 family inet address 10.0.244.10/30
set interfaces fe-2/0/10 unit 1 description PE1-to-P2
set interfaces fe-2/0/10 unit 1 family inet address 2.2.2.1/24
set interfaces fe-2/0/10 unit 1 family mpls
set interfaces fe-2/0/9 unit 8 description PE1-to-P3
set interfaces fe-2/0/9 unit 8 family inet address 6.6.6.1/24
set interfaces fe-2/0/9 unit 8 family mpls
set interfaces fe-2/0/8 unit 9 description PE1-to-P4
set interfaces fe-2/0/8 unit 9 family inet address 3.3.3.1/24
set interfaces fe-2/0/8 unit 9 family mpls
set interfaces lo0 unit 1 family inet address 100.10.10.10/32
set protocols rsvp interface fe-2/0/10.1
set protocols rsvp interface fe-2/0/9.8
set protocols rsvp interface fe-2/0/8.9
set protocols rsvp interface lo0.1
set protocols mpls traffic-engineering bgp-igp
set protocols mpls label-switched-path PE1-PE2 to 100.50.50.50
set protocols mpls label-switched-path PE1-PE2 link-protection
set protocols mpls label-switched-path PE1-PE2 p2mp p2mp1
set protocols mpls label-switched-path PE1-PE3 to 100.70.70.70
set protocols mpls label-switched-path PE1-PE3 link-protection
set protocols mpls label-switched-path PE1-PE3 p2mp p2mp1
set protocols mpls label-switched-path PE1-PE4 to 100.40.40.40
set protocols mpls label-switched-path PE1-PE4 link-protection
```

```

set protocols mpls label-switched-path PE1-PE4 p2mp p2mp1
set protocols mpls interface fe-2/0/10.1
set protocols mpls interface fe-2/0/9.8
set protocols mpls interface fe-2/0/8.9
set protocols mpls interface lo0.1
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface ge-2/0/2.0
set protocols ospf area 0.0.0.0 interface fe-2/0/10.1
set protocols ospf area 0.0.0.0 interface fe-2/0/9.8
set protocols ospf area 0.0.0.0 interface fe-2/0/8.9
set protocols ospf area 0.0.0.0 interface lo0.1
set routing-options static route 5.5.5.0/24 p2mp-lsp-next-hop p2mp1
set routing-options static route 7.7.7.0/24 p2mp-lsp-next-hop p2mp1
set routing-options static route 4.4.4.0/24 p2mp-lsp-next-hop p2mp1
set routing-options router-id 100.10.10.10

```

Device CE1	<pre> set interfaces ge-1/3/2 unit 0 family inet address 10.0.244.9/30 set interfaces ge-1/3/2 unit 0 description CE1-to-PE1 set routing-options static route 10.0.104.8/30 next-hop 10.0.244.10 set routing-options static route 10.0.134.8/30 next-hop 10.0.244.10 set routing-options static route 10.0.224.8/30 next-hop 10.0.244.10 </pre>
Device CE2	<pre> set interfaces ge-1/3/3 unit 0 family inet address 10.0.224.9/30 set interfaces ge-1/3/3 unit 0 description CE2-to-PE2 set routing-options static route 10.0.244.8/30 next-hop 10.0.224.10 </pre>
Device CE3	<pre> set interfaces ge-2/0/1 unit 0 family inet address 10.0.134.9/30 set interfaces ge-2/0/1 unit 0 description CE3-to-PE3 set routing-options static route 10.0.244.8/30 next-hop 10.0.134.10 </pre>
Device CE4	<pre> set interfaces ge-3/1/3 unit 0 family inet address 10.0.104.10/30 set interfaces ge-3/1/3 unit 0 description CE4-to-PE4 set routing-options static route 10.0.244.8/30 next-hop 10.0.104.9 </pre>

Configuring the Ingress Label-Switched Router (LSR) (Device PE1)

Step-by-Step To configure Device PE1:

Procedure

1. Configure the interfaces, interface encapsulation, and protocol families.

```

[edit interfaces]
user@PE1# set ge-2/0/2 unit 0 description PE1-to-CE1
user@PE1# set ge-2/0/2 unit 0 family inet address 10.0.244.10/30
user@PE1# set fe-2/0/10 unit 1 description PE1-to-P2
user@PE1# set fe-2/0/10 unit 1 family inet address 2.2.2.1/24
user@PE1# set fe-2/0/10 unit 1 family mpls
user@PE1# set fe-2/0/9 unit 8 description PE1-to-P3
user@PE1# set fe-2/0/9 unit 8 family inet address 6.6.6.1/24
user@PE1# set fe-2/0/9 unit 8 family mpls
user@PE1# set fe-2/0/8 unit 9 description PE1-to-P4
user@PE1# set fe-2/0/8 unit 9 family inet address 3.3.3.1/24
user@PE1# set fe-2/0/8 unit 9 family mpls
user@PE1# set lo0 unit 1 family inet address 100.10.10.10/32

```

2. Enable RSVP, MPLS, and OSPF on the interfaces.

```
[edit protocols]
user@PE1# set rsvp interface fe-2/0/10.1
user@PE1# set rsvp interface fe-2/0/9.8
user@PE1# set rsvp interface fe-2/0/8.9
user@PE1# set rsvp interface lo0.1
user@PE1# set mpls interface fe-2/0/10.1
user@PE1# set mpls interface fe-2/0/9.8
user@PE1# set mpls interface fe-2/0/8.9
user@PE1# set mpls interface lo0.1
user@PE1# set ospf area 0.0.0.0 interface ge-2/0/2.0
user@PE1# set ospf area 0.0.0.0 interface fe-2/0/10.1
user@PE1# set ospf area 0.0.0.0 interface fe-2/0/9.8
user@PE1# set ospf area 0.0.0.0 interface fe-2/0/8.9
user@PE1# set ospf area 0.0.0.0 interface lo0.1
```

3. Configure the MPLS point-to-multipoint LSPs.

```
[edit protocols]
user@PE1# set mpls label-switched-path PE1-PE2 to 100.50.50.50
user@PE1# set mpls label-switched-path PE1-PE2 p2mp p2mp1
user@PE1# set mpls label-switched-path PE1-PE3 to 100.70.70.70
user@PE1# set mpls label-switched-path PE1-PE3 p2mp p2mp1
user@PE1# set mpls label-switched-path PE1-PE4 to 100.40.40.40
user@PE1# set mpls label-switched-path PE1-PE4 p2mp p2mp1
```

4. (Optional) Enable link protection on the LSPs.

Link protection helps to ensure that traffic sent over a specific interface to a neighboring router can continue to reach the router if that interface fails.

```
[edit protocols]
user@PE1# set mpls label-switched-path PE1-PE2 link-protection
user@PE1# set mpls label-switched-path PE1-PE3 link-protection
user@PE1# set mpls label-switched-path PE1-PE4 link-protection
```

5. Enable MPLS to perform traffic engineering for OSPF.

```
[edit protocols]
user@PE1# set mpls traffic-engineering bgp-igp
```

This causes the ingress routes to be installed in the inet.0 routing table. By default, MPLS performs traffic engineering for BGP only. You need to enable MPLS traffic engineering on the ingress LSR only.

6. Enable traffic engineering for OSPF.

```
[edit protocols]
user@PE1# set ospf traffic-engineering
```

This causes the shortest-path first (SPF) algorithm to take into account the LSPs configured under MPLS.

7. Configure the router ID.

```
[edit routing-options]
user@PE1# set router-id 100.10.10.10
```

8. Configure static IP unicast routes with the point-to-multipoint LSP name as the next hop for each route.

```
[edit routing-options]
user@PE1# set static route 5.5.5.0/24 p2mp-lsp-next-hop p2mp1
user@PE1# set static route 7.7.7.0/24 p2mp-lsp-next-hop p2mp1
user@PE1# set static route 4.4.4.0/24 p2mp-lsp-next-hop p2mp1
```

9. If you are done configuring the device, commit the configuration.

```
[edit]
user@PE1# commit
```

Configuring the Transit and Egress LSRs (Devices P2, P3, P4, PE2, PE3, and PE4)

Step-by-Step Procedure To configure the transit and egress LSRs:

1. Configure the interfaces, interface encapsulation, and protocol families.

```
[edit]
user@P2# set interfaces fe-2/0/10 unit 2 description P2-to-PE1
user@P2# set interfaces fe-2/0/10 unit 2 family inet address 2.2.2.2/24
user@P2# set interfaces fe-2/0/10 unit 2 family mpls
user@P2# set interfaces fe-2/0/9 unit 10 description P2-to-PE2
user@P2# set interfaces fe-2/0/9 unit 10 family inet address 5.5.5.1/24
user@P2# set interfaces fe-2/0/9 unit 10 family mpls
user@P2# set interfaces lo0 unit 2 family inet address 100.20.20.20/32
user@PE2# set interfaces ge-2/0/3 unit 0 description PE2-to-CE2
user@PE2# set interfaces ge-2/0/3 unit 0 family inet address 10.0.224.10/30
user@PE2# set interfaces fe-2/0/10 unit 5 description PE2-to-P2
user@PE2# set interfaces fe-2/0/10 unit 5 family inet address 5.5.5.2/24
user@PE2# set interfaces fe-2/0/10 unit 5 family mpls
user@PE2# set interfaces lo0 unit 5 family inet address 100.50.50.50/32
user@P3# set interfaces fe-2/0/10 unit 6 description P3-to-PE1
user@P3# set interfaces fe-2/0/10 unit 6 family inet address 6.6.6.2/24
user@P3# set interfaces fe-2/0/10 unit 6 family mpls
user@P3# set interfaces fe-2/0/9 unit 11 description P3-to-PE3
user@P3# set interfaces fe-2/0/9 unit 11 family inet address 7.7.7.1/24
user@P3# set interfaces fe-2/0/9 unit 11 family mpls
user@P3# set interfaces lo0 unit 6 family inet address 100.60.60.60/32
user@PE3# set interfaces ge-2/0/1 unit 0 description PE3-to-CE3
user@PE3# set interfaces ge-2/0/1 unit 0 family inet address 10.0.134.10/30
user@PE3# set interfaces fe-2/0/10 unit 7 description PE3-to-P3
user@PE3# set interfaces fe-2/0/10 unit 7 family inet address 7.7.7.2/24
user@PE3# set interfaces fe-2/0/10 unit 7 family mpls
user@PE3# set interfaces lo0 unit 7 family inet address 100.70.70.70/32
user@P4# set interfaces fe-2/0/10 unit 3 description P4-to-PE1
user@P4# set interfaces fe-2/0/10 unit 3 family inet address 3.3.3.2/24
user@P4# set interfaces fe-2/0/10 unit 3 family mpls
user@P4# set interfaces fe-2/0/9 unit 12 description P4-to-PE4
user@P4# set interfaces fe-2/0/9 unit 12 family inet address 4.4.4.1/24
user@P4# set interfaces fe-2/0/9 unit 12 family mpls
user@P4# set interfaces lo0 unit 3 family inet address 100.30.30.30/32
user@PE4# set interfaces ge-2/0/0 unit 0 description PE4-to-CE4
user@PE4# set interfaces ge-2/0/0 unit 0 family inet address 10.0.104.9/30
user@PE4# set interfaces fe-2/0/10 unit 4 description PE4-to-P4
```

```
user@PE4# set interfaces fe-2/0/10 unit 4 family inet address 4.4.4.2/24
user@PE4# set interfaces fe-2/0/10 unit 4 family mpls
user@PE4# set interfaces lo0 unit 4 family inet address 100.40.40.40/32
```

2. Enable RSVP, MPLS, and OSPF on the interfaces.

```
[edit]
user@P2# set protocols rsvp interface fe-2/0/10.2
user@P2# set protocols rsvp interface fe-2/0/9.10
user@P2# set protocols rsvp interface lo0.2
user@P2# set protocols mpls interface fe-2/0/10.2
user@P2# set protocols mpls interface fe-2/0/9.10
user@P2# set protocols mpls interface lo0.2
user@P2# set protocols ospf area 0.0.0.0 interface fe-2/0/10.2
user@P2# set protocols ospf area 0.0.0.0 interface fe-2/0/9.10
user@P2# set protocols ospf area 0.0.0.0 interface lo0.2
user@PE2# set protocols rsvp interface fe-2/0/10.5
user@PE2# set protocols rsvp interface lo0.5
user@PE2# set protocols mpls interface fe-2/0/10.5
user@PE2# set protocols mpls interface lo0.5
user@PE2# set protocols ospf area 0.0.0.0 interface ge-2/0/3.0
user@PE2# set protocols ospf area 0.0.0.0 interface fe-2/0/10.5
user@PE2# set protocols ospf area 0.0.0.0 interface lo0.5
user@P3# set protocols rsvp interface fe-2/0/10.6
user@P3# set protocols rsvp interface fe-2/0/9.11
user@P3# set protocols rsvp interface lo0.6
user@P3# set protocols mpls interface fe-2/0/10.6
user@P3# set protocols mpls interface fe-2/0/9.11
user@P3# set protocols mpls interface lo0.6
user@P3# set protocols ospf area 0.0.0.0 interface fe-2/0/10.6
user@P3# set protocols ospf area 0.0.0.0 interface fe-2/0/9.11
user@P3# set protocols ospf area 0.0.0.0 interface lo0.6
user@PE3# set protocols rsvp interface fe-2/0/10.7
user@PE3# set protocols rsvp interface lo0.7
user@PE3# set protocols mpls interface fe-2/0/10.7
user@PE3# set protocols mpls interface lo0.7
user@PE3# set protocols ospf area 0.0.0.0 interface ge-2/0/1.0
user@PE3# set protocols ospf area 0.0.0.0 interface fe-2/0/10.7
user@PE3# set protocols ospf area 0.0.0.0 interface lo0.7
user@P4# set protocols rsvp interface fe-2/0/10.3
user@P4# set protocols rsvp interface fe-2/0/9.12
user@P4# set protocols rsvp interface lo0.3
user@P4# set protocols mpls interface fe-2/0/10.3
user@P4# set protocols mpls interface fe-2/0/9.12
user@P4# set protocols mpls interface lo0.3
user@P4# set protocols ospf area 0.0.0.0 interface fe-2/0/10.3
user@P4# set protocols ospf area 0.0.0.0 interface fe-2/0/9.12
user@P4# set protocols ospf area 0.0.0.0 interface lo0.3
user@PE4# set protocols rsvp interface fe-2/0/10.4
user@PE4# set protocols rsvp interface lo0.4
user@PE4# set protocols mpls interface fe-2/0/10.4
user@PE4# set protocols mpls interface lo0.4
user@PE4# set protocols ospf area 0.0.0.0 interface ge-2/0/0.0
user@PE4# set protocols ospf area 0.0.0.0 interface fe-2/0/10.4
user@PE4# set protocols ospf area 0.0.0.0 interface lo0.4
```

3. Enable traffic engineering for OSPF.

```
[edit]
user@P2# set protocols ospf traffic-engineering
user@P2# set protocols ospf traffic-engineering
user@P3# set protocols ospf traffic-engineering
user@PE2# set protocols ospf traffic-engineering
user@PE3# set protocols ospf traffic-engineering
user@PE4# set protocols ospf traffic-engineering
```

This causes the shortest-path first (SPF) algorithm to take into account the LSPs configured under MPLS.

4. Configure the router IDs.

```
[edit]
user@P2# set routing-options router-id 100.20.20.20
user@P3# set routing-options router-id 100.60.60.60
user@P4# set routing-options router-id 100.30.30.30
user@PE2# set routing-options router-id 100.50.50.50
user@PE3# set routing-options router-id 100.70.70.70
user@PE4# set routing-options router-id 100.40.40.40
```

5. If you are done configuring the devices, commit the configuration.

```
[edit]
user@host# commit
```

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

```
Device PE1 user@PE1# show interfaces
ge-2/0/2 {
  unit 0 {
    description R1-to-CE1;
    family inet {
      address 10.0.244.10/30;
    }
  }
}
fe-2/0/10 {
  unit 1 {
    description PE1-to-P2;
    family inet {
      address 2.2.2.1/24;
    }
    family mpls;
  }
}
fe-2/0/9 {
  unit 8 {
    description PE1-to-P2;
    family inet {
      address 6.6.6.1/24;
    }
    family mpls;
  }
}
```

```
    }
  }
  fe-2/0/8 {
    unit 9 {
      description PE1-to-P3;
      family inet {
        address 3.3.3.1/24;
      }
      family mpls;
    }
  }
  lo0 {
    unit 1 {
      family inet {
        address 100.10.10.10/32;
      }
    }
  }
}

user@PE1# show protocols
rsvp {
  interface fe-2/0/10.1;
  interface fe-2/0/9.8;
  interface fe-2/0/8.9;
  interface lo0.1;
}
mpls {
  traffic-engineering bgp-igp;
  label-switched-path PE1-to-PE2 {
    to 100.50.50.50;
    link-protection;
    p2mp p2mpl;
  }
  label-switched-path PE1-to-PE3 {
    to 100.70.70.70;
    link-protection;
    p2mp p2mpl;
  }
  label-switched-path PE1-to-PE4 {
    to 100.40.40.40;
    link-protection;
    p2mp p2mpl;
  }
  interface fe-2/0/10.1;
  interface fe-2/0/9.8;
  interface fe-2/0/8.9;
  interface lo0.1;
}
ospf {
  traffic-engineering;
  area 0.0.0.0 {
    interface ge-2/0/2.0;
    interface fe-2/0/10.1;
    interface fe-2/0/9.8;
    interface fe-2/0/8.9;
    interface lo0.1;
```



```

    }
  }
user@PE1# show routing-options
static {
  route 5.5.5.0/24 {
    p2mp-lsp-next-hop p2mp1;
  }
  route 7.7.7.0/24 {
    p2mp-lsp-next-hop p2mp1;
  }
  route 4.4.4.0/24 {
    p2mp-lsp-next-hop p2mp1;
  }
}
router-id 100.10.10.10;

```

Device P2

```

user@P2# show interfaces
fe-2/0/10 {
  unit 2 {
    description P2-to-PE1;
    family inet {
      address 2.2.2.2/24;
    }
    family mpls;
  }
}
fe-2/0/9 {
  unit 10 {
    description P2-to-PE2;
    family inet {
      address 5.5.5.1/24;
    }
    family mpls;
  }
}
lo0 {
  unit 2 {
    family inet {
      address 100.20.20.20/32;
    }
  }
}

```

```

user@P2# show protocols
rsvp {
  interface fe-2/0/10.2;
  interface fe-2/0/9.10;
  interface lo0.2;
}
mpls {
  interface fe-2/0/10.2;
  interface fe-2/0/9.10;
  interface lo0.2;
}
ospf {
  traffic-engineering;
}

```

```
        area 0.0.0.0 {
            interface fe-2/0/10.2;
            interface fe-2/0/9.10;
            interface lo0.2;
        }
    }

user@P2# show routing-options
router-id 100.20.20.20;

Device P3 user@P3# show interfaces
fe-2/0/10 {
    unit 6 {
        description P3-to-PE1;
        family inet {
            address 6.6.6.2/24;
        }
        family mpls;
    }
}
fe-2/0/9 {
    unit 11 {
        description P3-to-PE3;
        family inet {
            address 7.7.7.1/24;
        }
        family mpls;
    }
}
lo0 {
    unit 6 {
        family inet {
            address 100.60.60.60/32;
        }
    }
}

user@P3# show protocols
rsvp {
    interface fe-2/0/10.6;
    interface fe-2/0/9.11;
    interface lo0.6;
}
mpls {
    interface fe-2/0/10.6;
    interface fe-2/0/9.11;
    interface lo0.6;
}
ospf {
    traffic-engineering;
    area 0.0.0.0 {
        interface fe-2/0/10.6;
        interface fe-2/0/9.11;
        interface lo0.6;
    }
}
```

```

user@P2# show routing-options
router-id 100.60.60.60;

Device P4 user@P4# show interfaces
fe-2/0/10 {
  unit 3 {
    description P4-to-PE1;
    family inet {
      address 3.3.3.2/24;
    }
    family mpls;
  }
}
fe-2/0/9 {
  unit 12 {
    description P4-to-PE4;
    family inet {
      address 4.4.4.1/24;
    }
    family mpls;
  }
}
lo0 {
  unit 3 {
    family inet {
      address 100.30.30.30/32;
    }
  }
}

user@P4# show protocols
rsvp {
  interface fe-2/0/10.3;
  interface fe-2/0/9.12;
  interface lo0.3;
}
mpls {
  interface fe-2/0/10.3;
  interface fe-2/0/9.12;
  interface lo0.3;
}
ospf {
  traffic-engineering;
  area 0.0.0.0 {
    interface fe-2/0/10.3;
    interface fe-2/0/9.12;
    interface lo0.3;
  }
}

user@P3# show routing-options
router-id 100.30.30.30;

Device PE2 user@PE2# show interfaces
ge-2/0/3 {
  unit 0 {
    description PE2-to-CE2;
  }
}

```

```
        family inet {
            address 10.0.224.10/30;
        }
    }
}
fe-2/0/10 {
    unit 5 {
        description PE2-to-P2;
        family inet {
            address 5.5.5.2/24;
        }
        family mpls;
    }
}
lo0 {
    unit 5 {
        family inet {
            address 100.50.50.50/32;
        }
    }
}
}
```

user@PE2# show protocols

```
rsvp {
    interface fe-2/0/10.5;
    interface lo0.5;
}
mpls {
    interface fe-2/0/10.5;
    interface lo0.5;
}
ospf {
    traffic-engineering;
    area 0.0.0.0 {
        interface ge-2/0/3.0;
        interface fe-2/0/10.5;
        interface lo0.5;
    }
}
```

user@PE2# show routing-options
router-id 100.50.50.50;

Device PE3

user@PE3# show interfaces

```
ge-2/0/1 {
    unit 0 {
        description PE3-to-CE3;
        family inet {
            address 10.0.134.10/30;
        }
    }
}
fe-2/0/10 {
    unit 7 {
        description PE3-to-P3;
```

```

        family inet {
            address 7.7.2/24;
        }
        family mpls;
    }
}
lo0 {
    unit 7 {
        family inet {
            address 100.70.70.70/32;
        }
    }
}
}

```

```

user@PE3# show protocols
rsvp {
    interface fe-2/0/10.7;
    interface lo0.7;
}
mpls {
    interface fe-2/0/10.7;
    interface lo0.7;
}
ospf {
    traffic-engineering;
    area 0.0.0.0 {
        interface ge-2/0/1.0;
        interface fe-2/0/10.7;
        interface lo0.7;
    }
}

```

```

user@PE3# show routing-options
router-id 100.70.70.70;

```

Device PE4

```

user@PE4# show interfaces
ge-2/0/0 {
    unit 0 {
        description PE4-to-CE4;
        family inet {
            address 10.0.104.9/30;
        }
    }
}
fe-2/0/10 {
    unit 4 {
        description PE4-to-P4;
        family inet {
            address 4.4.4.2/24;
        }
        family mpls;
    }
}
lo0 {
    unit 4 {

```

```

        family inet {
            address 100.40.40.40/32;
        }
    }
}

```

```

user@PE4# show protocols
rsvp {
    interface fe-2/0/10.4;
    interface lo0.4;
}
mpls {
    interface fe-2/0/10.4;
    interface lo0.4;
}
ospf {
    traffic-engineering;
    area 0.0.0.0 {
        interface ge-2/0/0.0;
        interface fe-2/0/10.4;
        interface lo0.4;
    }
}

user@PE4# show routing-options
router-id 100.40.40.40;

```

Configuring Device CE1

Step-by-Step Procedure

To configure Device CE1:

1. Configure an interface to Device PE1.

```

[edit interfaces]
user@CE1# set ge-1/3/2 unit 0 family inet address 10.0.244.9/30
user@CE1# set ge-1/3/2 unit 0 description CE1-to-PE1

```

2. Configure static routes from Device CE1 to the three other customer networks, with Device PE1 as the next hop.

```

[edit routing-options]
user@CE1# set static route 10.0.104.8/30 next-hop 10.0.244.10
user@CE1# set static route 10.0.134.8/30 next-hop 10.0.244.10
user@CE1# set static route 10.0.224.8/30 next-hop 10.0.244.10

```

3. If you are done configuring the device, commit the configuration.

```

[edit]
user@CE1# commit

```

Results From configuration mode, confirm your configuration by entering the **show interfaces** 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
ge-1/3/2 {

```

```

unit 0 {
  family inet {
    address 10.0.244.9/30;
    description CE1-to-PE1;
  }
}

user@CE1# show routing-options
static {
  route 10.0.104.8/30 next-hop 10.0.244.10;
  route 10.0.134.8/30 next-hop 10.0.244.10;
  route 10.0.224.8/30 next-hop 10.0.244.10;
}

```

Configuring Device CE2

Step-by-Step Procedure

To configure Device CE2:

1. Configure an interface to Device PE2.

```

[edit interfaces]
user@CE2# set ge-1/3/3 unit 0 family inet address 10.0.224.9/30
user@CE2# set ge-1/3/3 unit 0 description CE2-to-PE2

```
2. Configure a static route from Device CE2 to CE1, with Device PE2 as the next hop.

```

[edit routing-options]
user@CE2# set static route 10.0.244.8/30 next-hop 10.0.224.10

```
3. If you are done configuring the device, commit the configuration.

```

[edit]
user@CE2# commit

```

Results From configuration mode, confirm your configuration by entering the **show interfaces** 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@CE2# show interfaces
ge-1/3/3 {
  unit 0 {
    family inet {
      address 10.0.224.9/30;
      description CE2-to-PE2;
    }
  }
}

user@CE2# show routing-options
static {
  route 10.0.244.8/30 next-hop 10.0.224.10;
}

```

Configuring Device CE3

Step-by-Step Procedure

To configure Device CE3:

1. Configure an interface to Device PE3.

[edit interfaces]
user@CE3# set ge-2/0/1 unit 0 family inet address 10.0.134.9/30
user@CE3# set ge-2/0/1 unit 0 description CE3-to-PE3
2. Configure a static route from Device CE3 to CE1, with Device PE3 as the next hop.

[edit routing-options]
user@CE3# set static route 10.0.244.8/30 next-hop 10.0.134.10
3. If you are done configuring the device, commit the configuration.

[edit]
user@CE3# commit

Results From configuration mode, confirm your configuration by entering the **show interfaces** 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@CE3# show interfaces
ge-2/0/1 {
  unit 0 {
    family inet {
      address 10.0.134.9/30;
      description CE3-to-PE3;
    }
  }
}

user@CE3# show routing-options
static {
  route 10.0.244.8/30 next-hop 10.0.134.10;
}
```

Configuring Device CE4

Step-by-Step Procedure

To configure Device CE4:

1. Configure an interface to Device PE4.

[edit interfaces]
user@CE4# set ge-3/1/3 unit 0 family inet address 10.0.104.10/30
user@CE4# set ge-3/1/3 unit 0 description CE4-to-PE4
2. Configure a static route from Device CE4 to CE1, with Device PE4 as the next hop.

[edit routing-options]
user@CE4# set static route 10.0.244.8/30 next-hop 10.0.104.9
3. If you are done configuring the device, commit the configuration.

[edit]
user@CE4# commit

Results From configuration mode, confirm your configuration by entering the **show interfaces** 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@CE4# show interfaces
ge-3/1/3 {
  unit 0 {
    family inet {
      address 10.0.104.10/30;
      description CE4-to-PE4;
    }
  }
}

user@CE4# show routing-options
static {
  route 10.0.244.8/30 next-hop 10.0.104.9;
}
```

Verification

Confirm that the configuration is working properly.

- [Verifying Connectivity on page 69](#)
- [Verifying the State of the Point-to-Multipoint LSP on page 70](#)
- [Checking the Forwarding Table on page 71](#)

Verifying Connectivity

Purpose Make sure that the devices can ping each other.

Action Run the **ping** command from CE1 to the interface on CE2 connecting to PE2.

```
user@CE1> ping 10.0.224.9
PING 10.0.224.9 (10.0.224.9): 56 data bytes
64 bytes from 10.0.224.9: icmp_seq=0 ttl=61 time=1.387 ms
64 bytes from 10.0.224.9: icmp_seq=1 ttl=61 time=1.394 ms
64 bytes from 10.0.224.9: icmp_seq=2 ttl=61 time=1.506 ms
^C
--- 10.0.224.9 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.387/1.429/1.506/0.055 ms
```

Run the **ping** command from CE1 to the interface on CE3 connecting to PE3.

```
user@CE1> ping 10.0.134.9
PING 10.0.134.9 (10.0.134.9): 56 data bytes
64 bytes from 10.0.134.9: icmp_seq=0 ttl=61 time=1.068 ms
64 bytes from 10.0.134.9: icmp_seq=1 ttl=61 time=1.062 ms
64 bytes from 10.0.134.9: icmp_seq=2 ttl=61 time=1.053 ms
^C
--- 10.0.134.9 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.053/1.061/1.068/0.006 ms
```

Run the **ping** command from CE1 to the interface on CE4 connecting to PE4.

```
user@CE1> ping 10.0.104.10
PING 10.0.104.10 (10.0.104.10): 56 data bytes
64 bytes from 10.0.104.10: icmp_seq=0 ttl=61 time=1.079 ms
64 bytes from 10.0.104.10: icmp_seq=1 ttl=61 time=1.048 ms
64 bytes from 10.0.104.10: icmp_seq=2 ttl=61 time=1.070 ms
^C
--- 10.0.104.10 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.048/1.066/1.079/0.013 ms
```

Verifying the State of the Point-to-Multipoint LSP

Purpose Make sure that the ingress, transit, and egress LSRs are in the Up state.

Action Run the `show mpls lsp p2mp` command on all of the LSRs. Only the ingress LSR is shown here.

```
user@PE1> show mpls lsp p2mp
Ingress LSP: 1 sessions
P2MP name: p2mp1, P2MP branch count: 3
To          From          State Rt P    ActivePath    LSPname
100.40.40.40 100.10.10.10 Up    0 *          PE1-PE4
100.70.70.70 100.10.10.10 Up    0 *          PE1-PE3
100.50.50.50 100.10.10.10 Up    0 *          PE1-PE2
Total 3 displayed, Up 3, Down 0
...
```

Checking the Forwarding Table

Purpose Make sure that the routes are set up as expected by running the `show route forwarding-table` command. Only the routes to the remote customer networks are shown here.

Action user@PE1> show route forwarding-table

```
Routing table: default.inet
Internet:
Destination          Type RtRef Next hop          Type Index NhRef Netif
...
10.0.104.8/30         user    0 3.3.3.2          ucst  1006    6 fe-2/0/8.9
10.0.134.8/30         user    0 6.6.6.2          ucst  1010    6 fe-2/0/9.8
10.0.224.8/30         user    0 2.2.2.2          ucst  1008    6 fe-2/0/10.1
...
```

Related Documentation

- [Example: Configuring RSVP-Signaled Point-to-Multipoint LSPs on Logical Systems](#)

Example: Configuring Static Routes for CLNS

- [Understanding Static Routes for CLNS on page 71](#)
- [Example: Configuring Static Routes for CLNS on page 71](#)

Understanding Static Routes for CLNS

The Connectionless Network Service (CLNS) is an ISO Layer 3 protocol that uses network service access point (NSAP) reachability information instead of IPv4 or IPv6 prefixes.

You can configure static routes to exchange CLNS routes within a CLNS island. A *CLNS island* is typically an IS-IS level 1 area that is part of a single IGP routing domain. An island can contain more than one area. CLNS islands can be connected by VPNs.

Example: Configuring Static Routes for CLNS

This example shows how to configure static routes for CLNS.

- [Requirements on page 72](#)
- [Overview on page 72](#)

- [Configuration on page 72](#)
- [Verification on page 73](#)

Requirements

Before you begin, configure the network interfaces. See the *Junos OS Interfaces Configuration Guide for Security Devices*.

Overview

In this example, you configure static routes for CLNS. In the absence of an interior gateway protocol (IGP) on a certain link, a routing device might need to be configured with static routes for CLNS prefixes to be reachable by way of that link. This might be useful, for example, at an autonomous system (AS) boundary.

When you configure static routes for CLNS, consider the following tasks:

- Specify the **iso.0** routing table option to configure a primary instance CLNS static route.
- Specify the **instance-name.iso.0** routing table option to configure a CLNS static route for a particular routing instance.
- Specify the **route nsap-prefix** statement to configure the destination for the CLNS static route.
- Specify the **next-hop (interface-name | iso-net)** statement to configure the next hop, specified as an ISO network entity title (NET) or interface name.
- Include the **qualified-next-hop (interface-name | iso-net)** statement to configure a secondary backup next hop, specified as an ISO network entity title or interface name.

Configuration

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.

```
set routing-options rib iso.0 static iso-route 47.0005.80ff.f800.0000.ffff.ffff/152 next-hop
  47.0005.80ff.f800.0000.0108.0001.1921.6800.4212
set routing-options rib iso.0 static iso-route
  47.0005.80ff.f800.0000.0108.0001.1921.6800.4212/152 next-hop t1-0/2/2.0
set routing-options rib iso.0 static iso-route 47.0005.80ff.f800.0000.eee0/152
  qualified-next-hop 47.0005.80ff.f800.0000.0108.0001.1921.6800.4002 preference
  20
set routing-options rib iso.0 static iso-route 47.0005.80ff.f800.0000.eee0/152
  qualified-next-hop 47.0005.80ff.f800.0000.0108.0001.1921.6800.4002 metric 10
```

Step-by-Step Procedure

To configure static routes for CLNS:

1. Configure the routes.

```
[edit routing-options rib iso.0 static]
user@host# set iso-route 47.0005.80ff.f800.0000.ffff.ffff/152 next-hop
  47.0005.80ff.f800.0000.0108.0001.1921.6800.4212
```

```

user@host# set iso-route 47.0005.80ff.f800.0000.0108.0001.1921.6800.4212/152
next-hop t1-0/2/2.0
user@host# set iso-route 47.0005.80ff.f800.0000.0108.0001.1921.6800.4002 preference 20
user@host# set iso-route 47.0005.80ff.f800.0000.0108.0001.1921.6800.4002 metric 10

```

2. If you are done configuring the device, commit the configuration.

```

[edit]
user@host# commit

```

Results Confirm your configuration by issuing the **show routing-options** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```

user@host# show routing-options
rib iso.0 {
  static {
    iso-route 47.0005.80ff.f800.0000.ffff.ffff/152 next-hop
      47.0005.80ff.f800.0000.0108.0001.1921.6800.4212;
    iso-route 47.0005.80ff.f800.0000.0108.0001.1921.6800.4212/152 next-hop t1-0/2/2.0;
    iso-route 47.0005.80ff.f800.0000.0108.0001.1921.6800.4002 {
      qualified-next-hop 47.0005.80ff.f800.0000.0108.0001.1921.6800.4002 {
        preference 20;
        metric 10;
      }
    }
  }
}

```

Verification

Confirm that the configuration is working properly.

Checking the Routing Table

Purpose Make sure that the expected routes appear in the routing table.

Action user@host> show route table iso.0

```

iso.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

47.0005.80ff.f800.0000.0108.0001.1921.6800.4212/152
    *[Static/5] 00:00:25
    > via t1-0/2/2.0
47.0005.80ff.f800.0000.0108.0001.1921.6800.4002/152
    *[Static/20] 00:04:01, metric 10, metric2 10
    > to #75 0.12.0.34.0.56 via fe-0/0/1.0
47.0005.80ff.f800.0000.ffff.ffff/104
    *[Static/5] 00:04:01, metric2 0
    > via t1-0/2/2.0

```

Meaning The static routes appear in the routing table.

Verifying the Static Route Configuration

Purpose Verify that the static routes are in the routing table and that those routes are active.

Action From the CLI, enter the **show route terse** command.

Sample Output

```
user@host> show route terse
inet.0: 20 destinations, 20 routes (20 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

A Destination      P Prf  Metric 1   Metric 2   Next hop      AS path
* 192.168.47.5/32   S   5           Reject
* 172.16.0.0/12     S   5         >192.168.71.254
* 192.168.0.0/18    S   5         >192.168.71.254
* 192.168.40.0/22   S   5         >192.168.71.254
* 192.168.64.0/18   S   5         >192.168.71.254
* 192.168.64.0/21   D   0         >fxp0.0
* 192.168.71.246/32 L   0          Local
* 192.168.220.4/30  D   0         >ge-0/0/1.0
* 192.168.220.5/32  L   0          Local
* 192.168.220.8/30  D   0         >ge-0/0/2.0
* 192.168.220.9/32  L   0          Local
* 192.168.220.12/30 D   0         >ge-0/0/3.0
* 192.168.220.13/32 L   0          Local
* 192.168.220.17/32 L   0          Reject
* 192.168.220.21/32 L   0          Reject
* 192.168.220.24/30 D   0         >at-1/0/0.0
* 192.168.220.25/32 L   0          Local
* 192.168.220.28/30 D   0         >at-1/0/1.0
* 192.168.220.29/32 L   0          Local
* 224.0.0.9/32      R 100          1      MultiRecv
```

Meaning The output shows a list of the routes that are currently in the **inet.0** routing table. Verify the following information:

- Each configured static route is present. Routes are listed in ascending order by IP address. Static routes are identified with an **S** in the protocol (**P**) column of the output.
- Each static route is active. Routes that are active show the next-hop IP address in the **Next hop** column. If a route's next-hop address is unreachable, the next-hop address is identified as **Reject**. These routes are not active routes, but they appear in the routing table because the **passive** attribute is set.
- The preference for each static route is correct. The preference for a particular route is listed in the **Prf** column of the output.

Related Documentation • [show route terse on page 417](#) in the [CLI Explorer](#)

CHAPTER 3

Aggregate and Generated Routes

- [Example: Summarizing Static Routes Through Route Aggregation on page 75](#)
- [Example: Conditionally Generating Static Routes on page 88](#)

Example: Summarizing Static Routes Through Route Aggregation

- [Understanding Aggregate Routes on page 75](#)
- [Example: Summarizing Routes Through Route Aggregation on page 82](#)

Understanding Aggregate Routes

Route aggregation allows you to combine groups of routes with common addresses into a single entry in the routing table. This decreases the size of the routing table as well as the number of route advertisements sent by the routing device.

An aggregate route becomes active when it has one or more *contributing routes*. A contributing route is an active route that is a more specific match for the aggregate destination. For example, for the aggregate destination **128.100.0.0/16**, routes to **128.100.192.0/19** and **128.100.67.0/24** are contributing routes, but routes to **128.0.0.0/8** and **128.0.0.0/16** are not.

A route can contribute only to a single aggregate route. However, an active aggregate route can recursively contribute to a less specific matching aggregate route. For example, an aggregate route to the destination **128.100.0.0/16** can contribute to an aggregate route to **128.96.0.0/13**.

When an aggregate route becomes active, it is installed in the routing table with the following information:

- Reject next hop—If a more-specific packet does not match a more-specific route, the packet is rejected and an ICMP unreachable message is sent to the packet's originator.
- Metric value as configured with the **aggregate** statement.
- Preference value that results from the policy filter on the primary contributor, if a filter is specified.
- AS path as configured in the **aggregate** statement, if any. Otherwise, the path is computed by aggregating the paths of all contributing routes.
- Community as configured in the **aggregate** statement, if any is specified.



NOTE: You can configure only one aggregate route for each destination prefix.

To configure aggregate routes in the default routing table (**inet.0**), include the **aggregate** statement:

```
aggregate {
  defaults {
    ... aggregate-options ...
  }
  route destination-prefix {
    policy policy-name;
    ... aggregate-options ...
  }
}
```

To configure aggregate routes in one of the other routing tables, or to explicitly configure aggregate routes in the default routing table (**inet.0**), include the **aggregate** statement:

```
rib routing-table-name {
  aggregate {
    defaults {
      ... aggregate-options ...
    }
    route destination-prefix {
      policy policy-name;
      ... aggregate-options ...
    }
  }
}
```



NOTE: You cannot configure aggregate routes for the IPv4 multicast routing table (**inet.1**) nor the IPv6 multicast routing table (**inet6.1**).

The **aggregate** statement consists of two parts:

- **defaults**—(Optional) Here you specify global aggregate route options. These are treated as global defaults and apply to all the aggregate routes you configure in the **aggregate** statement.
- **route**—Here you configure individual aggregate routes. In this part of the **aggregate** statement, you optionally can configure aggregate route options. These options apply to the individual destination only and override any options you configured in the **defaults** part of the **aggregate** statement.

When you configure an individual aggregate route in the **route** part of the **aggregate** statement, specify the destination of the route (in **route destination-prefix**) in one of the following ways:

- **network/mask-length**, where **network** is the network portion of the IP address and **mask-length** is the destination prefix length.
- **default** if this is the default route to the destination. This is equivalent to specifying an IP address of **0.0.0.0/0**.

After you have configured aggregate routes, you can have a protocol advertise the routes by configuring a policy that is then exported by a routing protocol.

You can associate a routing policy when configuring an aggregate route's destination prefix in the **routes** part of the **aggregate** statement. Doing so provides the equivalent of an import routing policy filter for the destination prefix. That is, each potential contributor to an aggregate route, along with any aggregate options, is passed through the policy filter. The policy then can accept or reject the route as a contributor to the aggregate route and, if the contributor is accepted, the policy can modify the default preferences.

The following algorithm is used to compare two aggregate contributing routes in order to determine which one is the primary or preferred contributor:

1. Compare the protocol's **preferences** of the contributing routes. The lower the preference, the better the route. This is similar to the comparison that is done while determining the best route for the routing table.
2. Compare the protocol's **preferences2** of the contributing routes. The lower preference2 value is better. If only one route has **preferences2**, then this route is preferred.
3. The preference values are the same. Proceed with a numerical comparison of the prefix values.
 - a. The primary contributor is the numerically smallest prefix value.
 - b. If the two prefixes are numerically equal, the primary contributor is the route that has the smallest prefix length value.
4. At this point, the two routes are the same. The primary contributor does not change. An additional next hop is available for the existing primary contributor.

A rejected contributor still can contribute to a less specific aggregate route. If you do not specify a policy filter, all candidate routes contribute to an aggregate route.

To associate a routing policy with an aggregate route, include the **policy** statement when configuring the route:

```
aggregate (defaults | route) {
  policy policy-name;
}
```

In the **defaults** and **route** parts of the **aggregate** statement, you can specify **aggregate-options**, which define additional information about aggregate routes that is included with the route when it is installed in the routing table. All aggregate options are optional. Aggregate options that you specify in the **defaults** part of the **aggregate** statement are treated as global defaults and apply to all the aggregate routes you configure in the **aggregate** statement. Aggregate options that you specify in the **route**

part of the **aggregate** statement override any global aggregate options and apply to that destination only.

To configure aggregate route options, include one or more of them in the **defaults** or **route** part of the **aggregate** statement:

```
[edit]
routing-options {
  aggregate {
    (defaults | route) {
      (active | passive);
      as-path <as-path> <origin (egp | igp | incomplete)> <atomic-aggregate> <aggregator
        as-number in-address>;
      community [ community-ids ];
      discard;
      (brief | full);
      (metric | metric2 | metric3 | metric4) metric <type type>;
      (preference | preference2 | color | color2) preference <type type>;
      tag metric type number;
    }
  }
}
```

Configuring a Metric Value for Aggregate Routes

You can specify up to four metric values, starting with **metric** (for the first metric value) and continuing with **metric2**, **metric3**, and **metric4** by including one or more of the following statements:

```
aggregate (defaults | route) {
  (metric | metric2 | metric3 | metric4) metric <type type>;
}
```

For a list of hierarchy levels at which you can include these statements, see the statement summary sections for these statements.

In the **type** option, you can specify the type of route.

Configuring a Preference Value for Aggregate Routes

By default, aggregate routes have a preference value of 130. If the routing table contains a dynamic route to a destination that has a better (lower) preference value than this, the dynamic route is chosen as the active route and is installed in the forwarding table.

To modify the default preference value, specify a primary preference value (**preference**). You also can specify secondary preference value (**preference2**); and colors, which are even finer-grained preference values (**color** and **color2**). To do this, include one or more of the following statements:

```
aggregate (defaults | route) {
  (preference | preference2 | color | color2) preference <type type>;
}
```

For a list of hierarchy levels at which you can include these statements, see the statement summary sections for these statements.

The preference value can be a number in the range from 0 through 4,294,967,295 ($2^{32} - 1$) with a lower number indicating a more preferred route. For more information about preference values, see *Route Preferences Overview*.

In the **type** option, you can specify the type of route.

Configuring the Next Hop for Aggregate Routes

By default, when aggregate routes are installed in the routing table, the next hop is configured as a reject route. That is, the packet is rejected and an ICMP unreachable message is sent to the packet's originator.

When you configure an individual route in the **route** part of the **aggregate** statement, or when you configure the defaults for aggregate routes, you can specify a discard next hop. This means that if a more specific packet does not match a more specific route, the packet is rejected and a reject route for this destination is installed in the routing table, but ICMP unreachable messages are not sent.

Being able to discard next hops allows you to originate a summary route, which can be advertised through dynamic routing protocols, and allows you to discard received traffic that does not match a more specific route than the summary route. To discard next hops, include the **discard** option:

discard;

For a list of hierarchy levels at which you can include this statement, see the statement summary section for this statement.

Associating BGP Communities with Aggregate Routes

By default, no BGP community information is associated with aggregate routes. To associate community information with the routes, include the **community** option:

```
aggregate (defaults | route) {
  community [ community-ids ];
}
```

For a list of hierarchy levels at which you can include this statement, see the statement summary section for this statement. **community-value** is the community identifier and can be a number in the range from 0 through 65,535.

community-ids is one or more community identifiers for either communities or extended communities.

The format for community identifiers is:

as-number:community-value

as-number is the AS number and can be a value in the range from 1 through 65,534.

You also can specify **community-ids** for communities as one of the following well-known community names, which are defined in RFC 1997:

- **no-export**—Routes containing this community name are not advertised outside a BGP confederation boundary.

- **no-advertise**—Routes containing this community name are not advertised to other BGP peers.
- **no-export-subconfed**—Routes containing this community name are not advertised to external BGP peers, including peers in other members' ASs inside a BGP confederation.

You can explicitly exclude BGP community information with an aggregate route using the **none** option. Include **none** when configuring an individual route in the **route** portion of the **aggregate** statement to override a **community** option specified in the **defaults** portion of the statement.



NOTE: Extended community attributes are not supported at the [edit routing-options] hierarchy level. You must configure extended communities at the [edit policy-options] hierarchy level. For information about configuring extended communities information, see the “Configuring the Extended Communities Attribute” section in the *Routing Policy Feature Guide for Routing Devices*. For information about configuring 4-byte AS numbers and extended communities, see *Using 4-Byte Autonomous System Numbers in BGP Networks*.

Associating AS Paths with Aggregate Routes

By default, the AS path for aggregate routes is built from the component routes. To manually specify the AS path and associate AS path information with the routes, include the **as-path** option:

```
aggregate (defaults | route) {  
  as-path <as-path> <origin (egp | igp | incomplete)> <atomic-aggregate> <aggregator  
    as-number in-address>;  
}
```

For a list of hierarchy levels at which you can include this statement, see the statement summary section for this statement.

as-path is the AS path to include with the route. It can include a combination of individual AS path numbers and AS sets. Enclose sets in brackets ([]). The first AS number in the path represents the AS immediately adjacent to the local AS. Each subsequent number represents an AS that is progressively farther from the local AS, heading toward the origin of the path.



NOTE: In Junos OS Release 9.1 and later, the numeric AS range is extended to provide BGP support for 4-byte AS numbers, as defined in RFC 4893, *BGP Support for Four-octet AS Number Space*. For the AS number, you can configure a value from 1 through 4,294,967,295. All releases of Junos OS support 2-byte AS numbers. The 2-byte AS number range is 1 through 65,535 (this is a subset of the 4-byte range).

In Junos OS Release 9.2 and later, you can also configure a 4-byte AS number using the AS-dot notation format of two integer values joined by a period: *<16-bit high-order value in decimal>.<16-bit low-order value in decimal>*. For example, the 4-byte AS number of 65,546 in plain-number format is represented as 1.10 in the AS-dot notation format. You can specify a value in the range from 0.0 through 65535.65535 in AS-dot notation format.

You also can specify the AS path using the BGP origin attribute, which indicates the origin of the AS path information:

- **egp**—Path information originated in another AS.
- **igp**—Path information originated within the local AS.
- **incomplete**—Path information was learned by some other means.

To attach the BGP **ATOMIC_AGGREGATE** path attribute to the aggregate route, specify the **atomic-aggregate** option. This path attribute indicates that the local system selected a less specific route rather than a more specific route.

To attach the BGP **AGGREGATOR** path attribute to the aggregate route, specify the **aggregator** option. When using this option, you must specify the last AS number that formed the aggregate route (encoded as two octets), followed by the IP address of the BGP system that formed the aggregate route.

Including AS Numbers in Aggregate Route Paths

By default, all AS numbers from all contributing paths are included in the aggregate route's path. To include only the longest common leading sequences from the contributing AS paths, include the **brief** option when configuring the route. If doing this results in AS numbers being omitted from the aggregate route, the BGP **ATOMIC_ATTRIBUTE** path attribute is included with the aggregate route.

```
aggregate (defaults | route) {
  brief;
}
```

To explicitly have all AS numbers from all contributing paths be included in the aggregate route's path, include the **full** option when configuring routes. Include this option when configuring an individual route in the **route** portion of the **aggregate** statement to override a **retain** option specified in the **defaults** portion of the statement.

```
aggregate (defaults | route) {
  full;
}
```

For a list of hierarchy levels at which you can include these statements, see the statement summary sections for these statements.

Configuring a Tag Value for Aggregate Routes

By default, no tag values are associated with aggregate routes. You can specify a tag value by including the **tag** option:

```
aggregate (defaults | route) {  
    tag metric type number;  
}
```

For a list of hierarchy levels at which you can include this statement, see the statement summary section for this statement.

Controlling Retention of Inactive Aggregate Routes in the Routing and Forwarding Tables

Static routes are only removed from the routing table if the next hop becomes unreachable, which happens if there are no contributing routes. To have an aggregate route remain continually installed in the routing and forwarding tables, include the **passive** option when configuring the route:

```
aggregate (defaults | route) {  
    passive;  
}
```

Routes that have been configured to remain continually installed in the routing and forwarding tables are marked with **reject** next hops when they are inactive.

To explicitly remove aggregate routes when they become inactive, include the **active** option when configuring routes. Include this option when configuring an individual route in the **route** portion of the **aggregate** statement to override a **passive** option specified in the **defaults** portion of the statement.

```
aggregate (defaults | route) {  
    active;  
}
```

Example: Summarizing Routes Through Route Aggregation

This example shows how to summarize routes by configuring aggregate routes.

- [Requirements on page 82](#)
- [Overview on page 83](#)
- [Configuration on page 83](#)
- [Verification on page 88](#)

Requirements

No special configuration beyond device initialization is required before configuring this example.

Overview

In this example, Device R1 is connected to customer networks 10.200.1.0/24 and 10.200.2.0/24. For demonstration purposes, these routes are represented in this example as loopback interfaces on Device R1.

Device R2 has static routes configured to reach Device R1's customer networks. Device R2 also has a routing policy configured to advertise all static routes to its neighbors in autonomous system (AS) 65001.

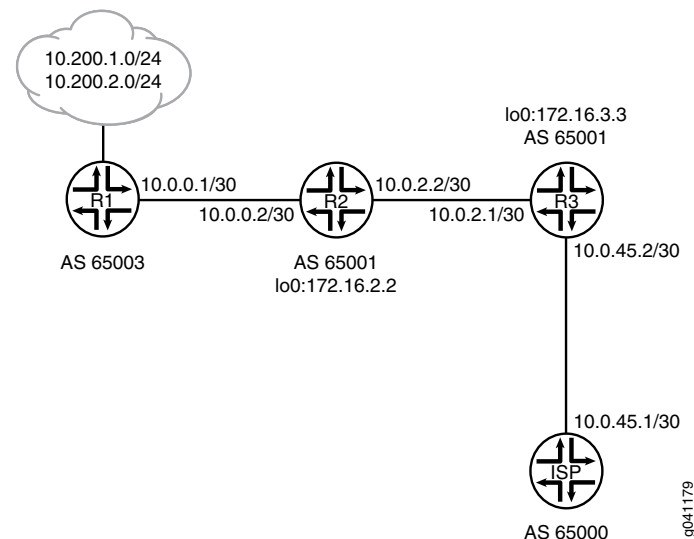
Device R3 is in AS 65001 and receives the static routes from Device R2. When Device R3 sends information about these routes to Device ISP, the information is summarized as a single aggregate route. The aggregate route is 10.200.0.0/16.

Device ISP injects a default route into AS 65001, and Device R3 advertises the default route.

This example shows the configuration for all of the devices and the step-by-step configuration on Device R3.

Figure 8 on page 83 shows the sample network.

Figure 8: Aggregate Route Advertised to an ISP



Configuration

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 R1	<pre> set interfaces ge-1/2/0 unit 2 description R1->R2 set interfaces ge-1/2/0 unit 2 family inet address 10.0.0.1/30 set interfaces lo0 unit 1 family inet address 10.200.1.1/32 set interfaces lo0 unit 1 family inet address 10.200.2.2/32 </pre>

```
set protocols bgp group ext type external
set protocols bgp group ext peer-as 65001
set protocols bgp group ext neighbor 10.0.0.2
set protocols ospf area 0.0.0.0 interface ge-1/2/0.2
set routing-options autonomous-system 65003
```

Device R2

```
set interfaces ge-1/2/0 unit 1 description R2->R1
set interfaces ge-1/2/0 unit 1 family inet address 10.0.0.2/30
set interfaces ge-1/2/1 unit 4 description R2->R3
set interfaces ge-1/2/1 unit 4 family inet address 10.0.2.2/30
set interfaces lo0 unit 2 family inet address 172.16.2.2/32
set protocols bgp group int type internal
set protocols bgp group int local-address 172.16.2.2
set protocols bgp group int export send-customer-routes
set protocols bgp group int neighbor 172.16.3.3
set protocols bgp group ext type external
set protocols bgp group ext peer-as 65003
set protocols bgp group ext neighbor 10.0.0.1
set protocols ospf area 0.0.0.0 interface ge-1/2/0.1
set protocols ospf area 0.0.0.0 interface ge-1/2/1.4
set protocols ospf area 0.0.0.0 interface lo0.2 passive
set policy-options policy-statement send-customer-routes from protocol static
set policy-options policy-statement send-customer-routes then accept
set routing-options static route 10.200.1.0/24 next-hop 10.0.0.1
set routing-options static route 10.200.2.0/24 next-hop 10.0.0.1
set routing-options autonomous-system 65001
```

Device R3

```
set interfaces ge-1/2/0 unit 3 description R3->R2
set interfaces ge-1/2/0 unit 3 family inet address 10.0.2.1/30
set interfaces ge-1/2/1 unit 6 description R3->ISP
set interfaces ge-1/2/1 unit 6 family inet address 10.0.45.2/30
set interfaces lo0 unit 3 family inet address 172.16.3.3/32
set protocols bgp group ext type external
set protocols bgp group ext export send-aggregate
set protocols bgp group ext peer-as 65000
set protocols bgp group ext neighbor 10.0.45.1
set protocols bgp group int type internal
set protocols bgp group int local-address 172.16.3.3
set protocols bgp group int neighbor 172.16.2.2
set protocols ospf export send-default
set protocols ospf area 0.0.0.0 interface ge-1/2/0.3
set protocols ospf area 0.0.0.0 interface lo0.3 passive
set policy-options policy-statement send-aggregate term 1 from protocol aggregate
set policy-options policy-statement send-aggregate term 1 then accept
set policy-options policy-statement send-aggregate term suppress-specific-routes from
  route-filter 10.200.0.0/16 longer
set policy-options policy-statement send-aggregate term suppress-specific-routes then
  reject
set policy-options policy-statement send-default from route-filter 0.0.0.0/0 exact
set policy-options policy-statement send-default then accept
set routing-options aggregate route 10.200.0.0/16
set routing-options autonomous-system 65001
```

Device ISP

```
set interfaces ge-1/2/0 unit 7 family inet address 10.0.45.1/30
set protocols bgp group ext type external
```



```

set protocols bgp group ext export advertise-default
set protocols bgp group ext peer-as 65001
set protocols bgp group ext neighbor 10.0.45.2
set policy-options policy-statement advertise-default term 1 from route-filter 0.0.0.0/0
  exact
set policy-options policy-statement advertise-default term 1 then accept
set routing-options static route 0.0.0.0/0 discard
set routing-options autonomous-system 65000

```

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 R3:

1. Configure the interfaces.

```

[edit interfaces]
user@R3# set ge-1/2/0 unit 3 description R3->R2
user@R3# set ge-1/2/0 unit 3 family inet address 10.0.2.1/30

user@R3# set ge-1/2/1 unit 6 description R3->ISP
user@R3# set ge-1/2/1 unit 6 family inet address 10.0.45.2/30

user@R3# set lo0 unit 3 family inet address 172.16.3.3/32

```

2. Configure the AS number.

```

[edit routing-options]
user@R3# set autonomous-system 65001

```

3. Configure the BGP session with the ISP device.

```

[edit protocols bgp group ext]
user@R3# set type external
user@R3# set peer-as 65000
user@R3# set neighbor 10.0.45.1

```

4. Configure the BGP session with Device R2.

```

[edit protocols bgp group int]
user@R3# set type internal
user@R3# set local-address 172.16.3.3
user@R3# set neighbor 172.16.2.2

```

5. Configure OSPF.

```

[edit protocols ospf area 0.0.0.0]
user@R3# set interface ge-1/2/0.3
user@R3# set interface lo0.3 passive

```

6. Configure the aggregate route.

```

[edit routing-options]
user@R3# set aggregate route 10.200.0.0/16

```

7. Configure the routing policy to advertise the aggregate route.

The first term in this policy advertises the aggregate route. The second term prevents more specific routes from being advertised.

```
[edit policy-options policy-statement send-aggregate]
user@R3# set term 1 from protocol aggregate
user@R3# set term 1 then accept
user@R3# set term suppress-specific-routes from route-filter 10.200.0.0/16 longer
user@R3# set term suppress-specific-routes then reject
```

8. Apply the aggregate route policy to the external BGP session with Device ISP.

```
[edit protocols bgp group ext]
user@R3# set export send-aggregate
```

9. Configure the routing policy to advertise the default route from Device ISP.

```
[edit policy-options policy-statement send-default]
user@R3# set from route-filter 0.0.0.0/0 exact
user@R3# set then accept
```

10. Apply the default routing policy to OSPF.

```
[edit protocols ospf]
user@R3# set export send-default
```

11. If you are done configuring the device, commit the configuration.

```
[edit]
user@R3# commit
```

Results

Confirm your configuration by issuing 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@R3# show interfaces
ge-1/2/0 {
  unit 3 {
    description R3->R2;
    family inet {
      address 10.0.2.1/30;
    }
  }
}
ge-1/2/1 {
  unit 6 {
    description R3->ISP;
    family inet {
      address 10.0.45.2/30;
    }
  }
}
lo0 {
  unit 3 {
    family inet {
```

```
        address 172.16.3.3/32;
    }
}
user@R3# show protocols
bgp {
    group ext {
        type external;
        export send-aggregate;
        peer-as 65000;
        neighbor 10.0.45.1;
    }
    group int {
        type internal;
        local-address 172.16.3.3;
        neighbor 172.16.2.2;
    }
}
ospf {
    export send-default;
    area 0.0.0.0 {
        interface ge-1/2/0.3;
        interface lo0.3 {
            passive;
        }
    }
}
user@R3# show policy-options
policy-statement send-aggregate {
    term 1 {
        from protocol aggregate;
        then accept;
    }
    term suppress-specific-routes {
        from {
            route-filter 10.200.0.0/16 longer;
        }
        then reject;
    }
}
policy-statement send-default {
    from {
        route-filter 0.0.0.0/0 exact;
    }
    then accept;
}
user@R3# show routing-options
aggregate {
    route 10.200.0.0/16;
}
autonomous-system 65001;
```

Verification

Confirm that the configuration is working properly.

- [Verifying That Device R3 Has the Expected Routes on page 88](#)
- [Verifying That Device R3 Advertises the Aggregate Route to Device ISP on page 88](#)

Verifying That Device R3 Has the Expected Routes

Purpose Make sure that Device R3 has the specific static routes.

Action user@R3>show route terse protocol bgp

```
inet.0: 12 destinations, 12 routes (12 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
```

A Destination	P Prf	Metric 1	Metric 2	Next hop	AS path
* 0.0.0.0/0	B 170	100		>10.0.45.1	65000 I
* 10.200.1.0/24	B 170	100		>10.0.2.2	I
* 10.200.2.0/24	B 170	100		>10.0.2.2	I

Meaning The output shows that Device R3 has the specific routes to the 10.200.1.0/24 and 10.200.2.0/24 networks.

Verifying That Device R3 Advertises the Aggregate Route to Device ISP

Purpose Make sure that Device R3 does not send the specific static routes and only sends the summarized aggregate route.

Action user@R3>show route advertising-protocol bgp 10.0.45.1

```
inet.0: 12 destinations, 12 routes (12 active, 0 holddown, 0 hidden)
  Prefix                Nexthop          MED      Lc1pref  AS path
* 10.200.0.0/16         Self              0

```

Meaning The output shows that Device R3 sends only the summarized route to Device ISP.

Related Documentation • [Example: Conditionally Generating Static Routes on page 88](#)

Example: Conditionally Generating Static Routes

- [Understanding Conditionally Generated Routes on page 88](#)
- [Example: Configuring a Conditional Default Route Policy on page 90](#)

Understanding Conditionally Generated Routes

Generated routes are used as the *route of last resort*. A packet is forwarded to the route of last resort when the routing tables have no information about how to reach that packet's destination. One use of route generation is to generate a default route to use if the routing table contains a route from a peer on a neighboring backbone.

A generated route becomes active when it has one or more *contributing routes*. A contributing route is an active route that is a more specific match for the generated destination. For example, for the destination 128.100.0.0/16, routes to 128.100.192.0/19 and 128.100.67.0/24 are contributing routes, but routes to 128.0.0.0/8, 128.0.0.0/16, and 128.100.0.0/16 are not.

A route can contribute only to a single generated route. However, an active generated route can recursively contribute to a less specific matching generated route. For example, a generated route to the destination 128.100.0.0/16 can contribute to a generated route to 128.96.0.0/13.

By default, when generated routes are installed in the routing table, the next hop is chosen from the primary contributing route.



NOTE: You can configure only one generated route for each destination prefix.

To configure generated routes in the default routing table (**inet.0**), include the **generate** statement:

```
generate {
  (defaults | route destination ) {
    (active | passive);
    as-path <as-path> <origin (egp | igp | incomplete)> <atomic-aggregate> <aggregator
      as-number in-address>;
    community [ community-ids ];
    discard;
    (brief | full);
    (metric | metric2 | metric3 | metric4) metric <type type>;
    policy policy-name;
    (preference | preference2 | color | color2) preference <type type>;
    tag metric type number;
  }
}
```



NOTE: You cannot configure generated routes for the IPv4 multicast routing table (**inet.1**) or the IPv6 multicast routing table (**inet6.1**).

The **generate** statement consists of two parts:

- **defaults**—Here you specify global generated route options. These are treated as global defaults and apply to all the generated routes you configure in the **generate** statement. This part of the **generate** statement is optional.
- **route**—Here you configure individual generated routes. In this part of the **generate** statement, you optionally can configure generated route options. These options apply to the individual destination only and override any options you configured in the **defaults** part of the **generate** statement.

Example: Configuring a Conditional Default Route Policy

This example shows how to configure a conditional default route on one routing device and redistribute the default route into OSPF.

- [Requirements on page 90](#)
- [Overview on page 90](#)
- [Configuration on page 91](#)
- [Verification on page 95](#)

Requirements

No special configuration beyond device initialization is required before configuring this example.

Overview

In this example, OSPF area 0 contains three routing devices. Device R3 has a BGP session with an external peer, for example, an Internet service provider (ISP).

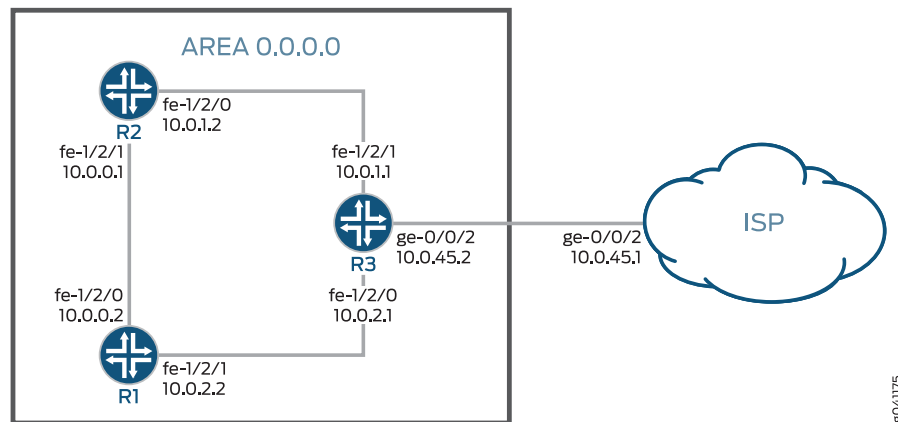
To propagate a static route into BGP, this example includes the **discard** statement when defining the route. The ISP injects a default static route into BGP, which provides the customer network with a default static route to reach external networks. The static route has a discard next hop. This means that if a packet does not match a more specific route, the packet is rejected and a reject route for this destination is installed in the routing table, but Internet Control Message Protocol (ICMP) unreachable messages are not sent. The discard next hop allows you to originate a summary route, which can be advertised through dynamic routing protocols.

Device R3 exports the default route into OSPF. The route policy on Device R3 is conditional such that if the connection to the ISP goes down, the default route is no longer exported into OSPF because it is no longer active in the routing table. This policy prevents packets from being silently dropped without notification (also known as black holing).

This example shows the configuration for all of the devices and the step-by-step configuration on Device R3.

[Figure 9 on page 91](#) shows the sample network.

Figure 9: OSPF with a Conditional Default Route to an ISP



Configuration

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 R1

```

set interfaces fe-1/2/0 unit 0 description R1->R3
set interfaces fe-1/2/0 unit 0 family inet address 10.0.1.2/30
set interfaces fe-1/2/1 unit 2 description R1->R2
set interfaces fe-1/2/1 unit 2 family inet address 10.0.0.1/30
set protocols ospf area 0.0.0.0 interface fe-1/2/0.0
set protocols ospf area 0.0.0.0 interface fe-1/2/1.2

```

Device R2

```

set interfaces fe-1/2/0 unit 1 description R2->R1
set interfaces fe-1/2/0 unit 1 family inet address 10.0.0.2/30
set interfaces fe-1/2/1 unit 4 description R2->R3
set interfaces fe-1/2/1 unit 4 family inet address 10.0.2.2/30
set protocols ospf area 0.0.0.0 interface fe-1/2/0.1
set protocols ospf area 0.0.0.0 interface fe-1/2/1.4

```

Device R3

```

set interfaces fe-1/2/0 unit 3 description R3->R2
set interfaces fe-1/2/0 unit 3 family inet address 10.0.2.1/30
set interfaces fe-1/2/1 unit 5 description R3->R1
set interfaces fe-1/2/1 unit 5 family inet address 10.0.1.1/30
set interfaces ge-0/0/2 unit 0 description R3->ISP
set interfaces ge-0/0/2 unit 0 family inet address 10.0.45.2/30
set protocols bgp group ext type external
set protocols bgp group ext peer-as 65000
set protocols bgp group ext neighbor 10.0.45.1
set protocols ospf export gendefault
set protocols ospf area 0.0.0.0 interface fe-1/2/1.4
set protocols ospf area 0.0.0.0 interface fe-1/2/0.3
set policy-options policy-statement gendefault term upstreamroutes from protocol bgp
set policy-options policy-statement gendefault term upstreamroutes from as-path upstream
set policy-options policy-statement gendefault term upstreamroutes from route-filter 0.0.0.0/0 upto /16

```

```
set policy-options policy-statement gendefault term upstreamroutes then next-hop
  10.0.45.1
set policy-options policy-statement gendefault term upstreamroutes then accept
set policy-options policy-statement gendefault term end then reject
set policy-options as-path upstream "^65000 "
set routing-options generate route 0.0.0.0/0 policy gendefault
set routing-options autonomous-system 65001
```

Device ISP

```
set interfaces ge-0/0/2 unit 0 family inet address 10.0.45.1/30
set protocols bgp group ext type external
set protocols bgp group ext export advertise-default
set protocols bgp group ext peer-as 65001
set protocols bgp group ext neighbor 10.0.45.2
set policy-options policy-statement advertise-default term 1 from route-filter 0.0.0.0/0
  exact
set policy-options policy-statement advertise-default term 1 then accept
set routing-options static route 0.0.0.0/0 discard
set routing-options autonomous-system 65000
```

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 R3:

1. Configure the device interfaces.

```
[edit interfaces]
user@R3# set fe-1/2/0 unit 3 description R3->R2
user@R3# set fe-1/2/0 unit 3 family inet address 10.0.2.1/30

user@R3# set fe-1/2/1 unit 5 description R3->R1
user@R3# set fe-1/2/1 unit 5 family inet address 10.0.1.1/30

user@R3# set ge-0/0/2 unit 0 description R3->ISP
user@R3# set ge-0/0/2 unit 0 family inet address 10.0.45.2/30
```

2. Configure the autonomous system (AS) number.

```
[edit routing-options]
user@R3# set autonomous-system 65001
```

3. Configure the BGP session with the ISP device.

```
[edit protocols bgp group ext]
user@R3# set type external
user@R3# set peer-as 65000
user@R3# set neighbor 10.0.45.1
```

4. Configure OSPF.

```
[edit protocols ospf area 0.0.0.0]
user@R3# set interface fe-1/2/1.4
user@R3# set interface fe-1/2/0.3
```


5. Configure the routing policy.

```
[edit policy-options policy-statement gendefault]
user@R3# set term upstreamroutes from protocol bgp
user@R3# set term upstreamroutes from as-path upstream
user@R3# set term upstreamroutes from route-filter 0.0.0.0/0 upto /16
user@R3# set term upstreamroutes then next-hop 10.0.45.1
user@R3# set term upstreamroutes then accept
```

```
user@R3# set term end then reject
```

```
[edit policy-options]
user@R3# set as-path upstream "^65000 "
```

6. Configure the generated route, associating the routing policy with the generated route.

```
[edit routing-options]
user@R3# set generate route 0.0.0.0/0 policy gendefault
```

7. Apply the export policy to OSPF.

```
[edit protocols ospf]
user@R3# set export gendefault
```

8. If you are done configuring the device, commit the configuration.

```
[edit]
user@R3# commit
```

Results

Confirm your configuration by issuing the **show** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R3# show
interfaces {
  fe-1/2/0 {
    unit 3 {
      description R3->R2;
      family inet {
        address 10.0.2.1/30;
      }
    }
  }
  fe-1/2/1 {
    unit 5 {
      description R3->R1;
      family inet {
        address 10.0.1.1/30;
      }
    }
  }
  ge-1/2/0 {
    unit 0 {
```

```
        description R3->ISP;
        family inet {
            address 10.0.45.2/30;
        }
    }
}
protocols {
    bgp {
        group ext {
            type external;
            peer-as 65000;
            neighbor 10.0.45.1;
        }
    }
    ospf {
        export gendefault;
        area 0.0.0.0 {
            interface fe-1/2/1.4;
            interface fe-1/2/0.3;
        }
    }
}
policy-options {
    policy-statement gendefault {
        term upstreamroutes {
            from {
                protocol bgp;
                as-path upstream;
                route-filter 0.0.0.0/0 upto /16;
            }
            then {
                next-hop 10.0.45.1;
                accept;
            }
        }
        term end {
            then reject;
        }
    }
    as-path upstream "^65000 ";
}
routing-options {
    generate {
        route 0.0.0.0/0 policy gendefault;
    }
    autonomous-system 65001;
}
```

Verification

Confirm that the configuration is working properly.

- [Verifying That the Route to the ISP Is Working on page 95](#)
- [Verifying That the Static Route Is Redistributed on page 95](#)
- [Testing the Policy Condition on page 96](#)

Verifying That the Route to the ISP Is Working

Purpose Make sure connectivity is established between Device R3 and the ISP's router.

Action user@R3> ping 10.0.45.1
PING 10.0.45.1 (10.0.45.1): 56 data bytes
64 bytes from 10.0.45.1: icmp_seq=0 ttl=64 time=1.185 ms
64 bytes from 10.0.45.1: icmp_seq=1 ttl=64 time=1.199 ms
64 bytes from 10.0.45.1: icmp_seq=2 ttl=64 time=1.186 ms

Meaning The ping command confirms reachability.

Verifying That the Static Route Is Redistributed

Purpose Make sure that the BGP policy is redistributing the static route into Device R3's routing table. Also make sure that the OSPF policy is redistributing the static route into the routing tables of Device R1 and Device R2.

Action user@R3> show route protocol bgp

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

```
0.0.0.0/0          *[BGP/170] 00:00:25, localpref 100
                   AS path: 65000 I
                   > to 10.0.45.1 via ge-0/0/2.6
```

user@R1> show route protocol ospf

```
inet.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
```

```
0.0.0.0/0          *[OSPF/150] 00:03:58, metric 0, tag 0
                   > to 10.0.1.1 via fe-1/2/0.0
10.0.2.0/30        *[OSPF/10] 03:37:45, metric 2
                   to 10.0.1.1 via fe-1/2/0.0
                   > to 10.0.0.2 via fe-1/2/1.2
224.0.0.5/32       *[OSPF/10] 03:38:41, metric 1
                   MultiRecv
```

user@R2> show route protocol ospf

```
inet.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
```

```
0.0.0.0/0          *[OSPF/150] 00:04:04, metric 0, tag 0
                   > to 10.0.2.1 via fe-1/2/1.4
10.0.1.0/30        *[OSPF/10] 03:37:46, metric 2
                   to 10.0.0.1 via fe-1/2/0.1
                   > to 10.0.2.1 via fe-1/2/1.4
224.0.0.5/32       *[OSPF/10] 03:38:47, metric 1
                   MultiRecv
```

Meaning The routing tables contain the default 0.0.0.0/0 route. If Device R1 and Device R2 receive packets destined for networks not specified in their routing tables, those packets will be sent to Device R3 for further processing. If Device R3 receives packets destined for networks not specified in its routing table, those packets will be sent to the ISP for further processing.

Testing the Policy Condition

Purpose Deactivate the interface to make sure that the route is removed from the routing tables if the external network becomes unreachable.

Action user@R3> deactivate interfaces ge-0/0/2 unit 0 family inet address 10.0.45.2/30
user@R3> commit

user@R1> show route protocol ospf

inet.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```
10.0.2.0/30      *[OSPF/10] 03:41:48, metric 2
                  to 10.0.1.1 via fe-1/2/0.0
                  > to 10.0.0.2 via fe-1/2/1.2
224.0.0.5/32    *[OSPF/10] 03:42:44, metric 1
                  MultiRecv
```

user@R2> show route protocol ospf

inet.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```
10.0.1.0/30      *[OSPF/10] 03:42:10, metric 2
                  to 10.0.0.1 via fe-1/2/0.1
                  > to 10.0.2.1 via fe-1/2/1.4
224.0.0.5/32    *[OSPF/10] 03:43:11, metric 1
                  MultiRecv
```

Meaning The routing tables on Device R1 and Device R2 do not contain the default 0.0.0.0/0 route. This verifies that the default route is no longer present in the OSPF domain. To reactivate the ge-0/0/2.6 interface, issue the **activate interfaces ge-0/0/2 unit 0 family inet address 10.0.45.2/30** configuration mode command.

Related Documentation • [Example: Summarizing Static Routes Through Route Aggregation on page 75](#)

CHAPTER 4

Bidirectional Forwarding Detection for Static Routes

- [Examples: Configuring BFD for Static Routes on page 99](#)
- [Example: Configuring BFD Authentication for Static Routes on page 114](#)

Examples: Configuring BFD for Static Routes

- [Understanding BFD for Static Routes on page 99](#)
- [Example: Configuring BFD for Static Routes on page 103](#)
- [Example: Enabling BFD on Qualified Next Hops in Static Routes on page 108](#)

Understanding BFD for Static Routes

The Bidirectional Forwarding Detection (BFD) protocol is a simple hello mechanism that detects failures in a network. BFD works with a wide variety of network environments and topologies. A pair of routing devices exchanges BFD packets. Hello packets are sent at a specified, regular interval. A neighbor failure is detected when the routing device stops receiving a reply after a specified interval. The BFD failure detection timers have shorter time limits than the static route failure detection mechanisms, so they provide faster detection.

The BFD failure detection timers are adaptive and can be adjusted to be faster or slower. The lower the BFD failure detection timer value, the faster the failure detection and vice versa. For example, the timers can adapt to a higher value if the adjacency fails (that is, the timer detects failures more slowly). Or a neighbor can negotiate a higher value for a timer than the configured value. The timers adapt to a higher value when a BFD session flap occurs more than three times in a span of 15 seconds. A back-off algorithm increases the receive (Rx) interval by two if the local BFD instance is the reason for the session flap. The transmission (Tx) interval is increased by two if the remote BFD instance is the reason for the session flap. You can use the **clear bfd adaptation** command to return BFD interval timers to their configured values. The **clear bfd adaptation** command is hitless, meaning that the command does not affect traffic flow on the routing device.

By default, BFD is supported on single-hop static routes. In Junos OS Release 8.2 and later, BFD also supports multihop static routes.

To enable failure detection, include the **bfd-liveness-detection** statement in the static route configuration.

In Junos OS Release 9.1 and later, the BFD protocol is supported for IPv6 static routes. Global unicast and link-local IPv6 addresses are supported for static routes. The BFD protocol is not supported on multicast or anycast IPv6 addresses. For IPv6, the BFD protocol supports only static routes and only in Junos OS Release 9.3 and later. IPv6 for BFD is not supported for any other protocol.

To configure the BFD protocol for IPv6 static routes, include the **bfd-liveness-detection** statement at the **[edit routing-options rib inet6.0 static route destination-prefix]** hierarchy level.

In Junos OS Release 8.5 and later, you can configure a hold-down interval to specify how long the BFD session must remain up before a state change notification is sent.

To specify the hold-down interval, include the **holddown-interval** statement in the BFD configuration.

You can configure a number in the range from 0 through 255,000 milliseconds. The default is 0. If the BFD session goes down and then comes back up during the hold-down interval, the timer is restarted.



NOTE: If a single BFD session includes multiple static routes, the hold-down interval with the highest value is used.

To specify the minimum transmit and receive intervals for failure detection, include the **minimum-interval** statement in the BFD configuration.

This value represents both the minimum interval after which the local routing device transmits hello packets and the minimum interval after which the routing device expects to receive a reply from the neighbor with which it has established a BFD session. You can configure a number in the range from 1 through 255,000 milliseconds. Optionally, instead of using this statement, you can configure the minimum transmit and receive intervals separately using the **transmit-interval**, **minimum-interval**, and **minimum-receive-interval** statements.



NOTE: BFD is an intensive protocol that consumes system resources. Specifying a minimum interval for BFD of less than 100 ms for Routing Engine-based sessions and 10 ms for distributed BFD sessions can cause undesired BFD flapping.

Depending on your network environment, these additional recommendations might apply:

- For large-scale network deployments with a large number of BFD sessions, specify a minimum interval of 300 ms for Routing Engine-based sessions and 100 ms for distributed BFD sessions.
- For very large-scale network deployments with a large number of BFD sessions, contact Juniper Networks customer support for more information.
- For BFD sessions to remain up during a Routing Engine switchover event when nonstop active routing (NSR) is configured, specify a minimum interval of 2500 ms for Routing Engine-based sessions. For distributed BFD sessions with NSR configured, the minimum interval recommendations are unchanged and depend only on your network deployment.



NOTE: SRX Series devices do not support distributed BFD.

To specify the minimum receive interval for failure detection, include the **minimum-receive-interval** statement in the BFD configuration. This value represents the minimum interval after which the routing device expects to receive a reply from a neighbor with which it has established a BFD session. You can configure a number in the range from 1 through 255,000 milliseconds. Optionally, instead of using this statement, you can configure the minimum receive interval using the **minimum-interval** statement at the **[edit routing-options static route destination-prefix bfd-liveness-detection]** hierarchy level.

To specify the number of hello packets not received by the neighbor that causes the originating interface to be declared down, include the **multiplier** statement in the BFD configuration.

The default value is 3. You can configure a number in the range from 1 through 255.

To specify a threshold for detecting the adaptation of the detection time, include the **threshold** statement in the BFD configuration.

When the BFD session detection time adapts to a value equal to or higher than the threshold, a single trap and a system log message are sent. The detection time is based on the multiplier of the **minimum-interval** or the **minimum-receive-interval** value. The threshold must be a higher value than the multiplier for either of these configured values. For example if the **minimum-receive-interval** is 300 ms and the **multiplier** is 3, the total detection time is 900 ms. Therefore, the detection time threshold must have a value higher than 900.

To specify the minimum transmit interval for failure detection, include the **transmit-interval** **minimum-interval** statement in the BFD configuration.

This value represents the minimum interval after which the local routing device transmits hello packets to the neighbor with which it has established a BFD session. You can configure a value in the range from 1 through 255,000 milliseconds. Optionally, instead of using this statement, you can configure the minimum transmit interval using the **minimum-interval** statement at the **[edit routing-options static route destination-prefix bfd-liveness-detection]** hierarchy level.

To specify the threshold for the adaptation of the transmit interval, include the **transmit-interval threshold** statement in the BFD configuration.

The threshold value must be greater than the transmit interval. When the BFD session transmit time adapts to a value greater than the threshold, a single trap and a system log message are sent. The detection time is based on the multiplier of the value for the **minimum-interval** or the **minimum-receive-interval** statement at the **[edit routing-options static route destination-prefix bfd-liveness-detection]** hierarchy level. The threshold must be a higher value than the multiplier for either of these configured values.

To specify the BFD version, include the **version** statement in the BFD configuration. The default is to have the version detected automatically.

To include an IP address for the next hop of the BFD session, include the **neighbor** statement in the BFD configuration.



NOTE: You must configure the **neighbor** statement if the next hop specified is an interface name. If you specify an IP address as the next hop, that address is used as the neighbor address for the BFD session.

In Junos OS Release 9.0 and later, you can configure BFD sessions not to adapt to changing network conditions.

To disable BFD adaptation, include the **no-adaptation** statement in the BFD configuration.



NOTE: We recommend that you not disable BFD adaptation unless it is preferable not to have BFD adaptation in your network.



NOTE: If BFD is configured only on one end of a static route, the route is removed from the routing table. BFD establishes a session when BFD is configured on both ends of the static route.

BFD is not supported on ISO address families in static routes. BFD does support IS-IS.

If you configure graceful Routing Engine switchover (GRES) at the same time as BFD, GRES does not preserve the BFD state information during a failover.

Junos OS also supports BFD over multihop static routes. For example, you can configure BFD over a Layer 3 path to provide path integrity over that path. You can limit the number of hops by specifying the time to live (TTL).

To configure BFD over multihop static routes, include the following statements:

```
static route destination-prefix {
  bfd-liveness-detection {
    local-address ip-address;
    minimum-receive-ttl number;
  }
}
```

To specify the source address for the multihop static route and to enable multihop BFD support, include the **local-address** statement.

To specify the number of hops, include the **minimum-receive-ttl** statement. You must configure this statement for a multihop BFD session. You can configure a value in the range from 1 through 255. It is optional for a single-hop BFD session. If you configure the **minimum-receive-ttl** statement for a single-hop session, the value must be 255.

On M Series and T Series platforms only, starting in Junos OS Release 12.3, multihop BFD runs on the CPU in the FPC, DPC, or MPC. This is referred to as *distributed BFD*. Previously, multihop BFD ran from the Routing Engine.

Example: Configuring BFD for Static Routes

This example shows how to configure Bidirectional Forwarding Detection (BFD) for static routes.

- [Requirements on page 103](#)
- [Overview on page 103](#)
- [Configuration on page 104](#)
- [Verification on page 107](#)

Requirements

In this example, no special configuration beyond device initialization is required.

Overview

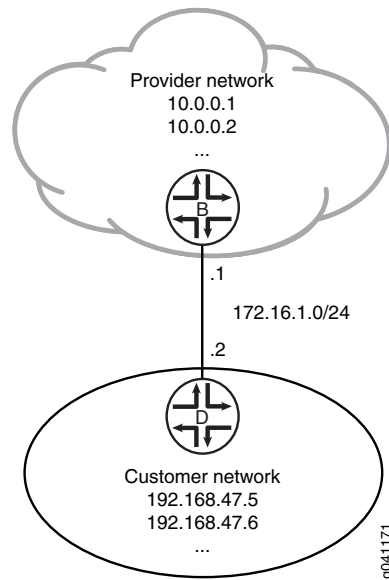
There are many practical applications for static routes. Static routing is often used at the network edge to support attachment to stub networks, which, given their single point of entry and egress, are well suited to the simplicity of a static route. In Junos OS, static routes have a global preference of 5. Static routes are activated if the specified next hop is reachable.

In this example, you configure the static route 192.168.47.0/24 from the provider network to the customer network, using the next-hop address of 172.16.1.2. You also configure a static default route of 0.0.0.0/0 from the customer network to the provider network, using a next-hop address of 172.16.1.1.

For demonstration purposes, some loopback interfaces are configured on Device B and Device D. These loopback interfaces provide addresses to ping and thus verify that the static routes are working.

Figure 10 on page 104 shows the sample network.

Figure 10: Customer Routes Connected to a Service Provider



Configuration

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 B

```

set interfaces ge-1/2/0 unit 0 description B->D
set interfaces ge-1/2/0 unit 0 family inet address 172.16.1.1/24
set interfaces lo0 unit 57 family inet address 10.0.0.1/32
set interfaces lo0 unit 57 family inet address 10.0.0.2/32
set routing-options static route 192.168.47.0/24 next-hop 172.16.1.2
set routing-options static route 192.168.47.0/24 bfd-liveness-detection minimum-interval 1000
set protocols bfd traceoptions file bfd-trace
set protocols bfd traceoptions flag all

```

Device D

```

set interfaces ge-1/2/0 unit 1 description D->B
set interfaces ge-1/2/0 unit 1 family inet address 172.16.1.2/24
set interfaces lo0 unit 2 family inet address 192.168.47.5/32
set interfaces lo0 unit 2 family inet address 192.168.47.6/32
set routing-options static route 0.0.0.0/0 next-hop 172.16.1.1
set routing-options static route 0.0.0.0/0 bfd-liveness-detection minimum-interval 1000
set protocols bfd traceoptions file bfd-trace
set protocols bfd traceoptions flag all

```

Step-by-Step Procedure The following example requires that you 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 BFD for static routes:

1. On Device B, configure the interfaces.

```
[edit interfaces]
user@B# set ge-1/2/0 unit 0 description B->D
user@B# set ge-1/2/0 unit 0 family inet address 172.16.1.1/24
user@B# set lo0 unit 57 family inet address 10.0.0.1/32
user@B# set lo0 unit 57 family inet address 10.0.0.2/32
```
2. On Device B, create a static route and set the next-hop address.

```
[edit routing-options]
user@B# set static route 192.168.47.0/24 next-hop 172.16.1.2
```
3. On Device B, configure BFD for the static route.

```
[edit routing-options]
user@B# set static route 192.168.47.0/24 bfd-liveness-detection minimum-interval 1000
```
4. On Device B, configure tracing operations for BFD.

```
[edit protocols]
user@B# set bfd traceoptions file bfd-trace
user@B# set bfd traceoptions flag all
```
5. If you are done configuring Device B, commit the configuration.

```
[edit]
user@B# commit
```
6. On Device D, configure the interfaces.

```
[edit interfaces]
user@D# set ge-1/2/0 unit 1 description D->B
user@D# set ge-1/2/0 unit 1 family inet address 172.16.1.2/24
user@D# set lo0 unit 2 family inet address 192.168.47.5/32
user@D# set lo0 unit 2 family inet address 192.168.47.6/32
```
7. On Device D, create a static route and set the next-hop address.

```
[edit routing-options]
user@D# set static route 0.0.0.0/0 next-hop 172.16.1.1
```
8. On Device D, configure BFD for the static route.

```
[edit routing-options]
user@D# set static route 0.0.0.0/0 bfd-liveness-detection minimum-interval 1000
```
9. On Device D, configure tracing operations for BFD.

```
[edit protocols]
user@D# set bfd traceoptions file bfd-trace
user@D# set bfd traceoptions flag all
```
10. If you are done configuring Device D, commit the configuration.

```
[edit]
```

```
user@D# commit
```

Results

Confirm your configuration by issuing the **show interfaces**, **show protocols**, and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
Device B user@B# show interfaces
ge-1/2/0 {
  unit 0 {
    description B->D;
    family inet {
      address 172.16.1.1/24;
    }
  }
}
lo0 {
  unit 57 {
    family inet {
      address 10.0.0.1/32;
      address 10.0.0.2/32;
    }
  }
}

user@D# show protocols
bfd {
  traceoptions {
    file bfd-trace;
    flag all;
  }
}

user@B# show routing-options
static {
  route 192.168.47.0/24 {
    next-hop 172.16.1.2;
    bfd-liveness-detection {
      minimum-interval 1000;
    }
  }
}

Device D user@D# show interfaces
ge-1/2/0 {
  unit 1 {
    description D->B;
    family inet {
      address 172.16.1.2/24;
    }
  }
}
lo0 {
  unit 2 {
    family inet {
```

```

        address 192.168.47.5/32;
        address 192.168.47.6/32;
    }
}

user@D# show routing-options
static {
    route 0.0.0.0/0 {
        next-hop 172.16.1.1;
        bfd-liveness-detection {
            minimum-interval 1000;
        }
    }
}

```

Verification

Confirm that the configuration is working properly.

- [Verifying That BFD Sessions Are Up on page 107](#)
- [Viewing Detailed BFD Events on page 108](#)

Verifying That BFD Sessions Are Up

Purpose Verify that the BFD sessions are up, and view details about the BFD sessions.

Action From operational mode, enter the `show bfd session extensive` command.

```
user@B> show bfd session extensive
```

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
172.16.1.2	Up	lt-1/2/0.0	3.000	1.000	3

Client Static, TX interval 1.000, RX interval 1.000
 Session up time 00:14:30
 Local diagnostic None, remote diagnostic None
 Remote state Up, version 1
 Replicated, routing table index 172
 Min async interval 1.000, min slow interval 1.000
 Adaptive async TX interval 1.000, RX interval 1.000
 Local min TX interval 1.000, minimum RX interval 1.000, multiplier 3
 Remote min TX interval 1.000, min RX interval 1.000, multiplier 3
 Local discriminator 2, remote discriminator 1
 Echo mode disabled/inactive

1 sessions, 1 clients

Cumulative transmit rate 1.0 pps, cumulative receive rate 1.0 pps

```
user@D> show bfd session extensive
```

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
172.16.1.1	Up	lt-1/2/0.1	3.000	1.000	3

Client Static, TX interval 1.000, RX interval 1.000
 Session up time 00:14:35
 Local diagnostic None, remote diagnostic None
 Remote state Up, version 1
 Replicated, routing table index 170
 Min async interval 1.000, min slow interval 1.000

```
Adaptive async TX interval 1.000, RX interval 1.000
Local min TX interval 1.000, minimum RX interval 1.000, multiplier 3
Remote min TX interval 1.000, min RX interval 1.000, multiplier 3
Local discriminator 1, remote discriminator 2
Echo mode disabled/inactive
```

```
1 sessions, 1 clients
```

```
Cumulative transmit rate 1.0 pps, cumulative receive rate 1.0 pps
```

Meaning The TX interval 1.000, RX interval 1.000 output represents the setting configured with the **minimum-interval** statement. All of the other output represents the default settings for BFD. To modify the default settings, include the optional statements under the **bfd-liveness-detection** statement.

Viewing Detailed BFD Events

Purpose View the contents of the BFD trace file to assist in troubleshooting, if needed.

Action From operational mode, enter the **file show /var/log/bfd-trace** command.

```
user@B> file show /var/log/bfd-trace
Nov 23 14:26:55 Data (9) len 35: (hex) 42 46 44 20 70 65 72 69 6f 64 69 63 20
78 6d 69 74 20 72
Nov 23 14:26:55 PPM Trace: BFD periodic xmit rt tbl index 172
Nov 23 14:26:55 Received Downstream TraceMsg (22) len 108:
Nov 23 14:26:55 IfIndex (3) len 4: 0
Nov 23 14:26:55 Protocol (1) len 1: BFD
Nov 23 14:26:55 Data (9) len 83: (hex) 70 70 6d 64 5f 62 66 64 5f 73 65 6e 64
6d 73 67 20 3a 20
Nov 23 14:26:55 PPM Trace: ppmd_bfd_sendmsg : socket 12 len 24, ifl 78 src
172.16.1.1 dst 172.16.1.2 errno 65
Nov 23 14:26:55 Received Downstream TraceMsg (22) len 93:
Nov 23 14:26:55 IfIndex (3) len 4: 0
Nov 23 14:26:55 Protocol (1) len 1: BFD
Nov 23 14:26:55 Data (9) len 68: (hex) 42 46 44 20 70 65 72 69 6f 64 69 63 20
78 6d 69 74 20 74
```

Meaning BFD messages are being written to the trace file.

Example: Enabling BFD on Qualified Next Hops in Static Routes

This example shows how to configure a static route with multiple possible next hops. Each next hop has Bidirectional Forwarding Detection (BFD) enabled.

- [Requirements on page 108](#)
- [Overview on page 109](#)
- [Configuration on page 109](#)
- [Verification on page 112](#)

Requirements

In this example, no special configuration beyond device initialization is required.

Overview

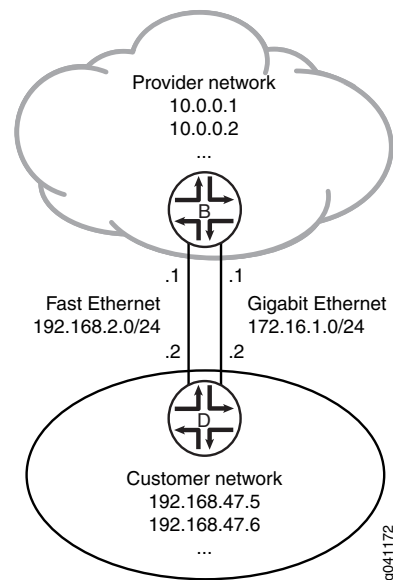
In this example, Device B has the static route **192.168.47.0/24** with two possible next hops. The two next hops are defined using two **qualified-next-hop** statements. Each next hop has BFD enabled.

BFD is also enabled on Device D because BFD must be enabled on both ends of the connection.

A next hop is included in the routing table if the BFD session is up. The next hop is removed from the routing table if the BFD session is down.

See [Figure 11 on page 109](#).

Figure 11: BFD Enabled on Qualified Next Hops



Configuration

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 B

```
set interfaces fe-0/1/0 unit 2 description secondary-B->D
set interfaces fe-0/1/0 unit 2 family inet address 192.168.2.1/24
set interfaces ge-1/2/0 unit 0 description B->D
set interfaces ge-1/2/0 unit 0 family inet address 172.16.1.1/24
set routing-options static route 192.168.47.0/24 qualified-next-hop 192.168.2.2
  bfd-liveness-detection minimum-interval 60
set routing-options static route 192.168.47.0/24 qualified-next-hop 172.16.1.2
  bfd-liveness-detection minimum-interval 60
```

Device D

```
set interfaces fe-0/1/0 unit 3 description secondary-D->B
set interfaces fe-0/1/0 unit 3 family inet address 192.168.2.2/24
```

```

set interfaces ge-1/2/0 unit 1 description D->B
set interfaces ge-1/2/0 unit 1 family inet address 172.16.1.2/24
set routing-options static route 0.0.0.0/0 qualified-next-hop 192.168.2.1
set routing-options static route 0.0.0.0/0 qualified-next-hop 172.16.1.1
set routing-options static route 0.0.0.0/0 bfd-liveness-detection minimum-interval 60

```

Step-by-Step Procedure The following example requires that you navigate various levels in the configuration hierarchy. For instructions on how to do that, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure a static route with two possible next hops, both with BFD enabled:

1. On Device B, configure the interfaces.

```

[edit interfaces fe-0/1/0]
user@B# set unit 2 description secondary-B->D
user@B# set unit 2 family inet address 192.168.2.1/24

```

```

[edit interfaces ge-1/2/0]
user@B# set unit 0 description B->D
user@B# set unit 0 family inet address 172.16.1.1/24

```

2. On Device B, configure the static route with two next hops, both with BFD enabled.

```

[edit routing-options static route 192.168.47.0/24]
user@B# set qualified-next-hop 192.168.2.2 bfd-liveness-detection minimum-interval
60
user@B# set qualified-next-hop 172.16.1.2 bfd-liveness-detection minimum-interval
60

```

3. On Device D, configure the interfaces.

```

[edit interfaces fe-0/1/0]
user@D# set unit 3 description secondary-D->B
user@D# set unit 3 family inet address 192.168.2.2/24

```

```

[edit interfaces ge-1/2/0]
user@D# set unit 1 description D->B
user@D# set unit 1 family inet address 172.16.1.2/24

```

4. On Device D, configure a BFD-enabled default static route with two next hops to the provider network.

In this case, BFD is enabled on the route, not on the next hops.

```

[edit routing-options static route 0.0.0.0/0]
user@D# set qualified-next-hop 192.168.2.1
user@D# set qualified-next-hop 172.16.1.1
user@D# set bfd-liveness-detection minimum-interval 60

```

Results Confirm your configuration by issuing the **show interfaces** 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@B# show interfaces
fe-0/1/0 {
  unit 2 {

```

```

        description secondary-B->D;
        family inet {
            address 192.168.2.1/24;
        }
    }
}
ge-1/2/0 {
    unit 0 {
        description B->D;
        family inet {
            address 172.16.1.1/24;
        }
    }
}

user@B# show routing-options
static {
    route 192.168.47.0/24 {
        qualified-next-hop 192.168.2.2 {
            bfd-liveness-detection {
                minimum-interval 60;
            }
        }
        qualified-next-hop 172.16.1.2 {
            bfd-liveness-detection {
                minimum-interval 60;
            }
        }
    }
}

user@D# show interfaces
fe-0/1/0 {
    unit 3 {
        description secondary-D->B;
        family inet {
            address 192.168.2.2/24;
        }
    }
}
ge-1/2/0 {
    unit 1 {
        description D->B;
        family inet {
            address 172.16.1.2/24;
        }
    }
}

user@D# show routing-options
static {
    route 0.0.0.0/0 {
        qualified-next-hop 192.168.2.1;
        qualified-next-hop 172.16.1.1;
        bfd-liveness-detection {
            minimum-interval 60;
        }
    }
}

```

```
    }
  }
```

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

Verification

Confirm that the configuration is working properly.

- [Checking the Routing Tables on page 112](#)
- [Verifying the BFD Sessions on page 112](#)
- [Removing BFD from Device D on page 113](#)
- [Removing BFD from One Next Hop on page 113](#)

Checking the Routing Tables

Purpose Make sure that the static route appears in the routing table on Device B with two possible next hops.

Action user@B> show route 192.168.47.0 extensive
 inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
 192.168.47.0/24 (1 entry, 1 announced)
 TSI:
 KRT in-kernel 192.168.47.0/24 -> {192.168.2.2}
 *Static Preference: 5
 Next hop type: Router
 Address: 0x9334010
 Next-hop reference count: 1
 Next hop: 172.16.1.2 via ge-1/2/0.0
 Next hop: 192.168.2.2 via fe-0/1/0.2, selected
 State: <Active Int Ext>
 Age: 9
 Task: RT
 Announcement bits (1): 3-KRT
 AS path: I

Meaning Both next hops are listed. The next hop 192.168.2.2 is the selected route.

Verifying the BFD Sessions

Purpose Make sure that the BFD sessions are up.

Action user@B> show bfd session

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
172.16.1.2	Up	ge-1/2/0.0	0.720	0.240	3
192.168.2.2	Up	fe-0/1/0.2	0.720	0.240	3

2 sessions, 2 clients
 Cumulative transmit rate 8.3 pps, cumulative receive rate 8.3 pps

Meaning The output shows that the BFD sessions are up.

Removing BFD from Device D

Purpose Demonstrate what happens when the BFD session is down for both next hops.

Action 1. Deactivate BFD on Device D.

```
[edit routing-options static route 0.0.0.0/0]
user@D# deactivate bfd-liveness-detection
user@D# commit
```

2. Rerun the **show bfd session** command on Device B.

```
user@B> show bfd session
```

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
172.16.1.2	Down	ge-1/2/0.0	3.000	1.000	3
192.168.2.2	Down	fe-0/1/0.2	3.000	1.000	3

```
2 sessions, 2 clients
```

```
Cumulative transmit rate 2.0 pps, cumulative receive rate 2.0 pps
```

3. Rerun the **show route 192.168.47.0** command on Device B.

```
user@B> show route 192.168.47.0
```

Meaning As expected, when the BFD sessions are down, the static route is removed from the routing table.

Removing BFD from One Next Hop

Purpose Demonstrate what happens when only one next hop has BFD enabled.

Action 1. If it is not already deactivated, deactivate BFD on Device D.

```
[edit routing-options static route 0.0.0.0/0]
user@D# deactivate bfd-liveness-detection
user@D# commit
```

2. Deactivate BFD on one of the next hops on Device B.

```
[edit routing-options static route 192.168.47.0/24 qualified-next-hop 172.16.1.2]
user@B# deactivate bfd-liveness-detection
user@B# commit
```

3. Rerun the **show bfd session** command on Device B.

```
user@B> show bfd session
```

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
192.168.2.2	Down	fe-0/1/0.2	3.000	1.000	3

4. Rerun the **show route 192.168.47.0 extensive** command on Device B.

```
user@B> show route 192.168.47.0 extensive
```

```
inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
192.168.47.0/24 (1 entry, 1 announced)
TSI:
```

```
KRT in-kerne1 192.168.47.0/24 -> {172.16.1.2}
  *Static Preference: 5
    Next hop type: Router, Next hop index: 624
    Address: 0x92f0178
    Next-hop reference count: 3
    Next hop: 172.16.1.2 via ge-1/2/0.0, selected
    State: <Active Int Ext>
    Age: 2:36
    Task: RT
    Announcement bits (1): 3-KRT
    AS path: I
```

Meaning As expected, the BFD session is down for the 192.168.2.2 next hop. The 172.16.1.2 next hop remains in the routing table, and the route remains active, because BFD is not a condition for this next hop to remain valid.

**Related
Documentation**

- [Example: Configuring BFD Authentication for Static Routes on page 114](#)
- [Example: Configuring BFD for OSPF](#)
- [Example: Configuring BFD for BGP](#)
- [Example: Configuring BFD for IS-IS](#)
- [Configuring PIM and the Bidirectional Forwarding Detection \(BFD\) Protocol](#)

Example: Configuring BFD Authentication for Static Routes

- [Understanding BFD Authentication for Static Routes on page 114](#)
- [Example: Configuring BFD Authentication for Static Routes on page 116](#)

Understanding BFD Authentication for Static Routes

Bidirectional Forwarding Detection (BFD) enables rapid detection of communication failures between adjacent systems. By default, authentication for BFD sessions is disabled. However, when you run BFD over Network Layer protocols, the risk of service attacks can be significant.



NOTE: We strongly recommend using authentication if you are running BFD over multiple hops or through insecure tunnels.

Beginning with Junos OS Release 9.6, Junos OS supports authentication for BFD sessions running over IPv4 and IPv6 static routes. BFD authentication is not supported on MPLS OAM sessions. BFD authentication is only supported in the Canada and United States version of the Junos OS image and is not available in the export version.

You authenticate BFD sessions by specifying an authentication algorithm and keychain, and then associating that configuration information with a security authentication keychain using the keychain name.

The following sections describe the supported authentication algorithms, security keychains, and level of authentication that can be configured:

- [BFD Authentication Algorithms on page 115](#)
- [Security Authentication Keychains on page 116](#)
- [Strict Versus Loose Authentication on page 116](#)

BFD Authentication Algorithms

Junos OS supports the following algorithms for BFD authentication:

- **simple-password**—Plain-text password. One to 16 bytes of plain text are used to authenticate the BFD session. One or more passwords can be configured. This method is the least secure and should be used only when BFD sessions are not subject to packet interception.
- **keyed-md5**—Keyed Message Digest 5 hash algorithm for sessions with transmit and receive intervals greater than 100 ms. To authenticate the BFD session, keyed MD5 uses one or more secret keys (generated by the algorithm) and a sequence number that is updated periodically. With this method, packets are accepted at the receiving end of the session if one of the keys matches and the sequence number is greater than or equal to the last sequence number received. Although more secure than a simple password, this method is vulnerable to replay attacks. Increasing the rate at which the sequence number is updated can reduce this risk.
- **meticulous-keyed-md5**—Meticulous keyed Message Digest 5 hash algorithm. This method works in the same manner as keyed MD5, but the sequence number is updated with every packet. Although more secure than keyed MD5 and simple passwords, this method might take additional time to authenticate the session.
- **keyed-sha-1**—Keyed Secure Hash Algorithm I for sessions with transmit and receive intervals greater than 100 ms. To authenticate the BFD session, keyed SHA uses one or more secret keys (generated by the algorithm) and a sequence number that is updated periodically. The key is not carried within the packets. With this method, packets are accepted at the receiving end of the session if one of the keys matches and the sequence number is greater than the last sequence number received.
- **meticulous-keyed-sha-1**—Meticulous keyed Secure Hash Algorithm I. This method works in the same manner as keyed SHA, but the sequence number is updated with every packet. Although more secure than keyed SHA and simple passwords, this method might take additional time to authenticate the session.



NOTE: Nonstop active routing (NSR) is not supported with meticulous-keyed-md5 and meticulous-keyed-sha-1 authentication algorithms. BFD sessions using these algorithms might go down after a switchover.

Security Authentication Keychains

The security authentication keychain defines the authentication attributes used for authentication key updates. When the security authentication keychain is configured and associated with a protocol through the keychain name, authentication key updates can occur without interrupting routing and signaling protocols.

The authentication keychain contains one or more keychains. Each keychain contains one or more keys. Each key holds the secret data and the time at which the key becomes valid. The algorithm and keychain must be configured on both ends of the BFD session, and they must match. Any mismatch in configuration prevents the BFD session from being created.

BFD allows multiple clients per session, and each client can have its own keychain and algorithm defined. To avoid confusion, we recommend specifying only one security authentication keychain.

Strict Versus Loose Authentication

By default, strict authentication is enabled, and authentication is checked at both ends of each BFD session. Optionally, to smooth migration from nonauthenticated sessions to authenticated sessions, you can configure *loose checking*. When loose checking is configured, packets are accepted without authentication being checked at each end of the session. This feature is intended for transitional periods only.

Example: Configuring BFD Authentication for Static Routes

This example shows how to configure Bidirectional Forwarding Detection (BFD) authentication for static routes.

- [Requirements on page 116](#)
- [Overview on page 116](#)
- [Configuration on page 117](#)
- [Verification on page 120](#)

Requirements

Junos OS Release 9.6 or later (Canda and United States version).

BFD authentication is only supported in the Canada and United States version of the Junos OS image and is not available in the export version.

Overview

You can configure authentication for BFD sessions running over IPv4 and IPv6 static routes. Routing instances and logical systems are also supported.

The following steps are needed to configure authentication on a BFD session:

1. Specify the BFD authentication algorithm for the static route.
2. Associate the authentication keychain with the static route.

3. Configure the related security authentication keychain. This must be configured on the main router.



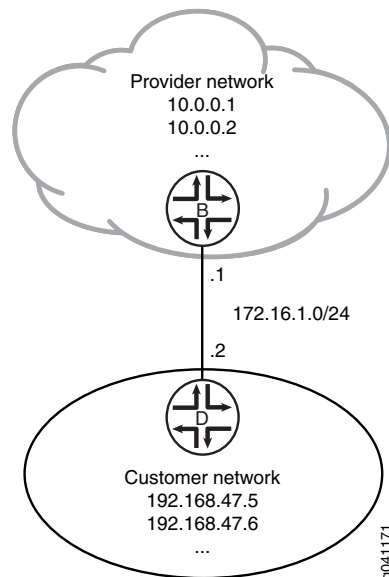
TIP: We recommend that you specify loose authentication checking if you are transitioning from nonauthenticated sessions to authenticated sessions.

[edit]

```
user@host> set routing-options static route ipv4 bfd-liveness-detection
authentication loose-check
```

Figure 12 on page 117 shows the sample network.

Figure 12: Customer Routes Connected to a Service Provider



Configuration

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 B

```
set interfaces ge-1/2/0 unit 0 description B->D
set interfaces ge-1/2/0 unit 0 family inet address 172.16.1.1/24
set interfaces lo0 unit 57 family inet address 10.0.0.1/32
set interfaces lo0 unit 57 family inet address 10.0.0.2/32
set routing-options static route 192.168.47.0/24 next-hop 172.16.1.2
set routing-options static route 192.168.47.0/24 bfd-liveness-detection minimum-interval
1000
set routing-options static route 192.168.47.0/24 bfd-liveness-detection authentication
key-chain bfd-kc4
set routing-options static route 192.168.47.0/24 bfd-liveness-detection authentication
algorithm keyed-sha-1
```

```

set security authentication-key-chains key-chain bfd-kc4 key 5 secret
"$9$JhZHmn6Ap0In/9ApOcSs24oaZikPfT3wY24ZG.mz36AtOIEyMWxSrlKvM-dbs2a
DkP5FtOIQFclv7N"
set security authentication-key-chains key-chain bfd-kc4 key 5 start-time
"2011-1-1.12:00:00 -0800"

```

Device D

```

set interfaces ge-1/2/0 unit 1 description D->B
set interfaces ge-1/2/0 unit 1 family inet address 172.16.1.2/24
set interfaces lo0 unit 2 family inet address 192.168.47.5/32
set interfaces lo0 unit 2 family inet address 192.168.47.6/32
set routing-options static route 0.0.0.0/0 next-hop 172.16.1.1
set routing-options static route 0.0.0.0/0 bfd-liveness-detection minimum-interval 1000
set routing-options static route 0.0.0.0/0 bfd-liveness-detection authentication key-chain
bfd-kc4
set routing-options static route 0.0.0.0/0 bfd-liveness-detection authentication algorithm
keyed-sha-1
set security authentication-key-chains key-chain bfd-kc4 key 5 secret
"$9$JhZHmn6Ap0In/9ApOcSs24oaZikPfT3wY24ZG.mz36AtOIEyMWxSrlKvM-dbs2a
DkP5FtOIQFclv7N"
set security authentication-key-chains key-chain bfd-kc4 key 5 start-time
"2011-1-1.12:00:00 -0800"

```

Step-by-Step Procedure The following example requires that you 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 BFD for static routes:

1. On Device B, configure the interfaces.

```

[edit interfaces]
user@B# set ge-1/2/0 unit 0 description B->D
user@B# set ge-1/2/0 unit 0 family inet address 172.16.1.1/24

user@B# set lo0 unit 57 family inet address 10.0.0.1/32
user@B# set lo0 unit 57 family inet address 10.0.0.2/32

```

2. On Device B, create a static route and set the next-hop address.

```

[edit routing-options]
user@B# set static route 192.168.47.0/24 next-hop 172.16.1.2

```

3. On Device B, configure BFD for the static route.

```

[edit routing-options]
user@B# set static route 192.168.47.0/24 bfd-liveness-detection minimum-interval
1000

```

4. On Device B, specify the algorithm (**keyed-md5**, **keyed-sha-1**, **meticulous-keyed-md5**, **meticulous-keyed-sha-1**, or **simple-password**) to use for BFD authentication on the static route.

```

[edit routing-options]
user@B# set static route 192.168.47.0/24 bfd-liveness-detection authentication
algorithm keyed-sha-1

```



NOTE: Nonstop active routing (NSR) is not supported with the meticulous-keyed-md5 and meticulous-keyed-sha-1 authentication algorithms. BFD sessions using these algorithms might go down after a switchover.

5. On Device B, specify the keychain to be used to associate BFD sessions on the specified route with the unique security authentication keychain attributes.

This should match the keychain name configured at the **[edit security authentication key-chains]** hierarchy level.

```
[edit routing-options]
user@B# set static route 192.168.47.0/24 bfd-liveness-detection authentication
key-chain bfd-kc4
```

6. On Device B, specify the unique security authentication information for BFD sessions:

- The matching keychain name as specified in Step 5.
- At least one key, a unique integer between 0 and 63. Creating multiple keys allows multiple clients to use the BFD session.
- The secret data used to allow access to the session.
- The time at which the authentication key becomes active, in the format *yyy-mm-dd.hh:mm:ss*.

```
[edit security authentication-key-chains key-chain bfd-kc4]
user@B# set key 5 secret
"$9$JhZHmn6Ap0In/9ApOcSs24oaZikPfT3wY24ZG.mz36AtOIEyMWxSrlKvM-dbs2a
DkP5Ft0IQFclev7N"
user@B# set key 5 start-time "2011-1-1.12:00:00 -0800"
```

7. If you are done configuring Device B, commit the configuration.

```
[edit]
user@B# commit
```

8. Repeat the configuration on Device D.

The algorithm and keychain must be configured on both ends of the BFD session, and they must match. Any mismatch in configuration prevents the BFD session from being created.

Results

Confirm your configuration by issuing the **show interfaces**, **show routing-options**, and **show security** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
Device B user@B# show interfaces
ge-1/2/0 {
  unit 0 {
    description B->D;
    family inet {
```

```

        address 172.16.1.1/24;
    }
}
lo0 {
    unit 57 {
        family inet {
            address 10.0.0.1/32;
            address 10.0.0.2/32;
        }
    }
}

user@B# show routing-options
static {
    route 192.168.47.0/24 {
        next-hop 172.16.1.2;
        bfd-liveness-detection {
            minimum-interval 1000;
            authentication {
                key-chain bfd-kc4;
                algorithm keyed-sha-1;
            }
        }
    }
}

user@B# show security
authentication-key-chains {
    key-chain bfd-kc4 {
        key 5 {
            secret
            "$9$JhZHmn6Ap0ln/9ApOcSs24oaZikPfT3wY24ZG.mz36AtOIEyMWxSrlKvM-dbs2a
            DkP5FtOIQFclev7N"; ## SECRET-DATA
            start-time "2011-1-1.12:00:00 -0800";
        }
    }
}

```

Verification

Confirm that the configuration is working properly.

- [Verifying That BFD Sessions Are Up on page 120](#)
- [Viewing Details About the BFD Session on page 121](#)
- [Viewing Extensive BFD Session Information on page 121](#)

Verifying That BFD Sessions Are Up

Purpose Verify that the BFD sessions are up.

Action From operational mode, enter the `show bfd session` command.

```
user@B> show bfd session
```

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
---------	-------	-----------	----------------	----------------------	------------

```

172.16.1.2          Up          ge-1/2/0.0      3.000    1.000    3

1 sessions, 1 clients
Cumulative transmit rate 1.0 pps, cumulative receive rate 1.0 pps

```

Meaning The command output shows that the BFD session is up.

Viewing Details About the BFD Session

Purpose View details about the BFD sessions and make sure that authentication is configured.

Action From operational mode, enter the `show bfd session detail` command.

```

user@B> show bfd session detail

Address          State      Interface    Detect   Transmit
172.16.1.2       Up         ge-1/2/0.0   3.000   1.000    3
Client Static, TX interval 1.000, RX interval 1.000, Authenticate
Session up time 00:53:58
Local diagnostic NbrSignal, remote diagnostic None
Remote state Up, version 1
Logical system 9, routing table index 22

1 sessions, 1 clients
Cumulative transmit rate 1.0 pps, cumulative receive rate 1.0 pps

```

Meaning In the command output, **Authenticate** is displayed to indicate that BFD authentication is configured.

Viewing Extensive BFD Session Information

Purpose View more detailed information about the BFD sessions.

Action From operational mode, enter the `show bfd session extensive` command.

```

user@B> show bfd session extensive

Address          State      Interface    Time     Interval  Multiplier
172.16.1.2       Up         ge-1/2/0.0   3.000    1.000     3
Client Static, TX interval 1.000, RX interval 1.000, Authenticate
keychain bfd-kc4, algo keyed-sha-1, mode strict
Session up time 01:39:45
Local diagnostic NbrSignal, remote diagnostic None
Remote state Up, version 1
Logical system 9, routing table index 22
Min async interval 1.000, min slow interval 1.000
Adaptive async TX interval 1.000, RX interval 1.000
Local min TX interval 1.000, minimum RX interval 1.000, multiplier 3
Remote min TX interval 1.000, min RX interval 1.000, multiplier 3
Local discriminator 3, remote discriminator 4
Echo mode disabled/inactive
Authentication enabled/active, keychain bfd-kc4, algo keyed-sha-1, mode strict

1 sessions, 1 clients
Cumulative transmit rate 1.0 pps, cumulative receive rate 1.0 pps

```

Meaning In the command output, **Authenticate** is displayed to indicate that BFD authentication is configured. The output for the **extensive** command provides the keychain name, the authentication algorithm, and the mode for each client in the session.

Related Documentation • [Examples: Configuring BFD for Static Routes on page 99](#)

CHAPTER 5

Packet Forwarding Behavior

- [Example: Enabling Indirect Next Hops on the Packet Forwarding Engine on page 123](#)
- [Example: Configuring Unicast Reverse-Path-Forwarding Check on page 133](#)
- [Understanding the Default Routing Table Groups for Interface Routes on Packet Transport Routers on page 142](#)

Example: Enabling Indirect Next Hops on the Packet Forwarding Engine

- [Understanding Indirect Next Hops on page 123](#)
- [Example: Optimizing Route Reconvergence by Enabling Indirect Next Hops on the Packet Forwarding Engine on page 124](#)

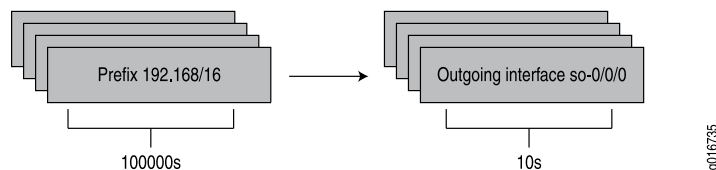
Understanding Indirect Next Hops

Junos OS supports the concept of an indirect next hop for all routing protocols that support indirectly connected next hops, also known as third-party next hops.

Because routing protocols such as internal BGP (IBGP) can send routing information about indirectly connected routes, Junos OS relies on routes from intra-AS routing protocols (OSPF, IS-IS, RIP, and static) to resolve the best directly connected next hop. The Routing Engine performs route resolution to determine the best directly connected next hop and installs the route to the Packet Forwarding Engine.

By default, Junos OS does not maintain the route for indirect next hop to forwarding next-hop binding on the Packet Forwarding Engine forwarding table. As a result, when a rerouting event occurs, potentially thousands of route to forwarding next-hop bindings must be updated, which increases the route convergence time. [Figure 13 on page 123](#) illustrates the route to forwarding next-hop bindings with indirect next hop disabled.

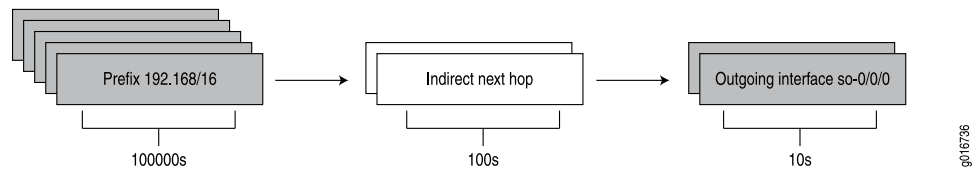
Figure 13: Route to Forwarding Next-Hop Bindings



You can enable Junos OS to maintain the indirect next hop to forwarding next-hop binding on the Packet Forwarding Engine forwarding table. As a result, fewer route to forwarding

next-hop bindings need to be updated, which improves the route convergence time. [Figure 14 on page 124](#) illustrates the route to forwarding next-hop bindings with indirect next hop enabled.

Figure 14: Route to Forwarding Indirect Next-Hop Bindings



Example: Optimizing Route Reconvergence by Enabling Indirect Next Hops on the Packet Forwarding Engine

This example shows how to use indirect next hops to promote faster network convergence (for example, in BGP networks) by decreasing the number of forwarding table changes required when a change in the network topology occurs.

- [Requirements on page 124](#)
- [Overview on page 124](#)
- [Configuration on page 125](#)
- [Verification on page 132](#)

Requirements

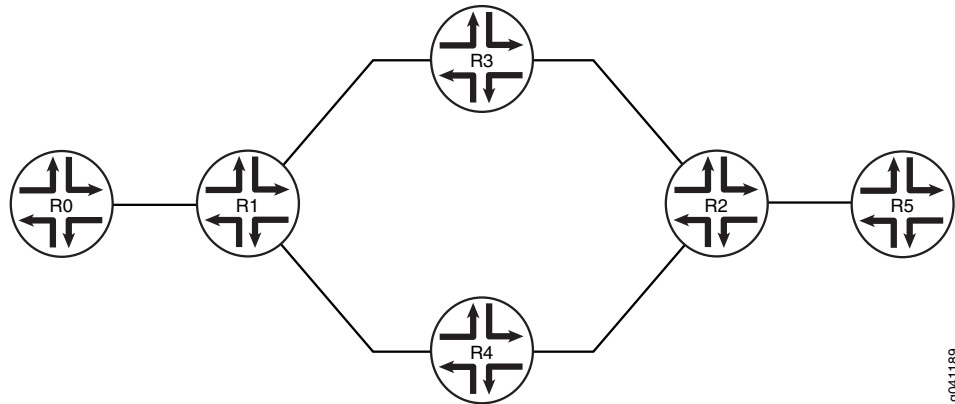
No special configuration beyond device initialization is required before configuring this example.

Overview

In this example, several devices are connected over unequal-cost paths. From Device R1 to Device R2, the path through Device R3 has a higher IGP metric than the path through Device R4. Device R1 has an internal BGP connection to Device R2. Device R0 injects multiple routes into the network, and Device R1 advertises those routes to Device R2. Because Device R2 is not directly connected to Device R1, Device R2's forwarding table contains indirect next hops. An interior gateway protocol, in this case OSPF, is running on the internal links among Devices R1, R2, R3, and R4. Each router is advertising its loopback interface IPv4 address.

On Device R2, the **indirect-next-hop** statement enables Junos OS to maintain the indirect next hop to forwarding next-hop binding on the Packet Forwarding Engine forwarding table. As a result, fewer route to forwarding next-hop bindings need to be updated, which improves the route convergence time if a path fails.

[Figure 15 on page 125](#) shows the sample network.



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The “CLI Quick Configuration” on page 125 section shows the full configuration on all of the devices in Figure 15 on page 125. Otherwise, the example focuses on Device R0, Device R1, and Device R2.

Configuration

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 R0

```

set interfaces fe-1/2/0 unit 1 family inet address 10.0.0.1/30
set interfaces lo0 unit 1 family inet address 1.1.0.1/32
set interfaces lo0 unit 1 family inet address 1.1.0.2/32
set interfaces lo0 unit 1 family inet address 1.1.0.3/32
set interfaces lo0 unit 1 family inet address 1.1.0.4/32
set interfaces lo0 unit 1 family inet address 1.1.0.5/32
set interfaces lo0 unit 1 family inet address 1.1.0.6/32
set interfaces lo0 unit 1 family inet address 1.1.0.7/32
set interfaces lo0 unit 1 family inet address 1.1.0.8/32
set interfaces lo0 unit 1 family inet address 1.1.0.9/32
set routing-options static route 0.0.0.0/0 next-hop 10.0.0.2

```

Device R1

```

set interfaces fe-1/2/0 unit 2 family inet address 10.0.0.2/30
set interfaces fe-1/2/1 unit 5 family inet address 10.0.0.5/30
set interfaces fe-1/2/2 unit 9 family inet address 10.0.0.9/30
set interfaces lo0 unit 2 family inet address 1.1.1.1/32
set protocols bgp export send-local
set protocols bgp export send-static
set protocols bgp group int type internal
set protocols bgp group int local-address 1.1.1.1
set protocols bgp group int neighbor 2.2.2.2
set protocols ospf area 0.0.0.0 interface fe-1/2/1.5
set protocols ospf area 0.0.0.0 interface fe-1/2/2.9
set protocols ospf area 0.0.0.0 interface lo0.2
set policy-options policy-statement send-local from protocol local
set policy-options policy-statement send-local from protocol direct
set policy-options policy-statement send-local then accept
set policy-options policy-statement send-static from protocol static
set policy-options policy-statement send-static then accept
set routing-options static route 1.1.0.2/32 next-hop 10.0.0.1

```

```
set routing-options static route 1.1.0.1/32 next-hop 10.0.0.1
set routing-options static route 1.1.0.3/32 next-hop 10.0.0.1
set routing-options static route 1.1.0.4/32 next-hop 10.0.0.1
set routing-options static route 1.1.0.5/32 next-hop 10.0.0.1
set routing-options static route 1.1.0.6/32 next-hop 10.0.0.1
set routing-options static route 1.1.0.7/32 next-hop 10.0.0.1
set routing-options static route 1.1.0.8/32 next-hop 10.0.0.1
set routing-options static route 1.1.0.9/32 next-hop 10.0.0.1
set routing-options autonomous-system 65500
```

Device R2

```
set interfaces fe-1/2/0 unit 14 family inet address 10.0.0.14/30
set interfaces fe-1/2/1 unit 18 family inet address 10.0.0.18/30
set interfaces fe-1/2/2 unit 21 family inet
set interfaces lo0 unit 3 family inet address 2.2.2.2/32
set protocols bgp export send-local
set protocols bgp group int type internal
set protocols bgp group int local-address 2.2.2.2
set protocols bgp group int family inet unicast
set protocols bgp group int family inet-vpn unicast
set protocols bgp group int neighbor 1.1.1.1
set protocols ospf area 0.0.0.0 interface fe-1/2/0.14
set protocols ospf area 0.0.0.0 interface fe-1/2/1.18
set protocols ospf area 0.0.0.0 interface lo0.3
set policy-options policy-statement send-local from protocol local
set policy-options policy-statement send-local from protocol direct
set policy-options policy-statement send-local then accept
set routing-options autonomous-system 65500
set routing-options forwarding-table indirect-next-hop
```

Device R3

```
set interfaces fe-1/2/0 unit 6 family inet address 10.0.0.6/30
set interfaces fe-1/2/1 unit 13 family inet address 10.0.0.13/30
set interfaces lo0 unit 4 family inet address 3.3.3.3/32
set protocols ospf area 0.0.0.0 interface fe-1/2/0.6 metric 5000
set protocols ospf area 0.0.0.0 interface fe-1/2/1.13 metric 5000
set protocols ospf area 0.0.0.0 interface lo0.4
```

Device R4

```
set interfaces fe-1/2/0 unit 10 family inet address 10.0.0.10/30
set interfaces fe-1/2/1 unit 17 family inet address 10.0.0.17/30
set interfaces lo0 unit 5 family inet address 4.4.4.4/32
set protocols ospf area 0.0.0.0 interface fe-1/2/0.10
set protocols ospf area 0.0.0.0 interface fe-1/2/1.17
set protocols ospf area 0.0.0.0 interface lo0.5
```

Device R5

```
set interfaces fe-1/2/0 unit 22 family inet address 10.0.0.22/30
set interfaces lo0 unit 6 family inet address 5.5.5.5/32
```

Configuring Device R0

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 R0:

1. Configure the interfaces, including multiple routes that can be injected into the network for demonstration purposes.

```
[edit interfaces]
user@R0# set interfaces fe-1/2/0 unit 1 family inet address 10.0.0.1/30
```

```
user@R0# set interfaces lo0 unit 1 family inet address 1.1.0.1/32
user@R0# set interfaces lo0 unit 1 family inet address 1.1.0.2/32
user@R0# set interfaces lo0 unit 1 family inet address 1.1.0.3/32
user@R0# set interfaces lo0 unit 1 family inet address 1.1.0.4/32
user@R0# set interfaces lo0 unit 1 family inet address 1.1.0.5/32
user@R0# set interfaces lo0 unit 1 family inet address 1.1.0.6/32
user@R0# set interfaces lo0 unit 1 family inet address 1.1.0.7/32
user@R0# set interfaces lo0 unit 1 family inet address 1.1.0.8/32
user@R0# set interfaces lo0 unit 1 family inet address 1.1.0.9/32
```

2. Configure a static default route for network reachability.

```
[edit routing-options]
user@R0# set routing-options static route 0.0.0.0/0 next-hop 10.0.0.2
```

3. If you are done configuring the device, commit the configuration.

```
[edit]
user@R0# commit
```

Configuring Device R1

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 R1:

1. Configure the interfaces, including multiple routes that can be injected into the network for demonstration purposes.

```
[edit interfaces]
user@R1# set interfaces fe-1/2/0 unit 2 family inet address 10.0.0.2/30
user@R1# set interfaces fe-1/2/1 unit 5 family inet address 10.0.0.5/30
user@R1# set interfaces fe-1/2/2 unit 9 family inet address 10.0.0.9/30

user@R1# set interfaces lo0 unit 2 family inet address 1.1.1.1/32
```

2. Configure BGP.

```
[edit routing-options]
user@R1# set protocols bgp export send-local
```

```

user@R1# set protocols bgp export send-static
user@R1# set protocols bgp group int type internal
user@R1# set protocols bgp group int local-address 1.1.1.1
user@R1# set protocols bgp group int neighbor 2.2.2.2

```

3. Configure OSPF.

```

[edit protocols]
user@R1# set protocols ospf area 0.0.0.0 interface fe-1/2/1.5
user@R1# set protocols ospf area 0.0.0.0 interface fe-1/2/2.9
user@R1# set protocols ospf area 0.0.0.0 interface lo0.2

```

4. Configure the routing policies.

```

user@R1# set policy-options policy-statement send-local from protocol local
user@R1# set policy-options policy-statement send-local from protocol direct
user@R1# set policy-options policy-statement send-local then accept

user@R1# set policy-options policy-statement send-static from protocol static
user@R1# set policy-options policy-statement send-static then accept

```

5. Configure a set of static routes to the set of interfaces configured on Device R0.

```

user@R1# set routing-options static route 1.1.0.2/32 next-hop 10.0.0.1
user@R1# set routing-options static route 1.1.0.1/32 next-hop 10.0.0.1
user@R1# set routing-options static route 1.1.0.3/32 next-hop 10.0.0.1
user@R1# set routing-options static route 1.1.0.4/32 next-hop 10.0.0.1
user@R1# set routing-options static route 1.1.0.5/32 next-hop 10.0.0.1
user@R1# set routing-options static route 1.1.0.6/32 next-hop 10.0.0.1
user@R1# set routing-options static route 1.1.0.7/32 next-hop 10.0.0.1
user@R1# set routing-options static route 1.1.0.8/32 next-hop 10.0.0.1
user@R1# set routing-options static route 1.1.0.9/32 next-hop 10.0.0.1

```

6. Configure the autonomous system (AS) identifier.

```

user@R1# set routing-options autonomous-system 65500

```

7. If you are done configuring the device, commit the configuration.

```

[edit]
user@R1# commit

```

Configuring Device R2

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 R2:

1. Configure the interfaces, including multiple routes that can be injected into the network for demonstration purposes.

```

[edit interfaces]
user@R2# set interfaces fe-1/2/0 unit 14 family inet address 10.0.0.14/30
user@R2# set interfaces fe-1/2/1 unit 18 family inet address 10.0.0.18/30
user@R2# set interfaces fe-1/2/2 unit 21 family inet address 10.0.0.21/30;

```

```
user@R2# set interfaces lo0 unit 3 family inet address 2.2.2.2/32
```

2. Configure BGP.

```
[edit routing-options]
user@R2# set protocols bgp export send-local
user@R2# set protocols bgp group int type internal
user@R2# set protocols bgp group int local-address 2.2.2.2
user@R2# set protocols bgp group int family inet unicast
user@R2# set protocols bgp group int family inet-vpn unicast
user@R2# set protocols bgp group int neighbor 1.1.1.1
```

3. Configure OSPF.

```
[edit protocols]
user@R2# set protocols ospf area 0.0.0.0 interface fe-1/2/0.14
user@R2# set protocols ospf area 0.0.0.0 interface fe-1/2/1.18
user@R2# set protocols ospf area 0.0.0.0 interface lo0.3
```

4. Configure the routing policies.

```
user@R2# set policy-options policy-statement send-local from protocol local
user@R2# set policy-options policy-statement send-local from protocol direct
user@R2# set policy-options policy-statement send-local then accept
```

5. Configure the AS identifier.

```
user@R2# set routing-options autonomous-system 65500
```

6. Enable indirect next hops in the forwarding plane.

```
user@R2# set routing-options forwarding-table indirect-next-hop
```

7. If you are done configuring the device, commit the configuration.

```
[edit]
user@R2# commit
```

Results

Confirm your configuration by issuing 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.

```
Device R0 user@R0# show interfaces
fe-1/2/0 {
  unit 1 {
    family inet {
      address 10.0.0.1/30;
    }
  }
}
lo0 {
  unit 1 {
    family inet {
      address 1.1.0.1/32;
      address 1.1.0.2/32;
      address 1.1.0.3/32;
      address 1.1.0.4/32;
      address 1.1.0.5/32;
```

```
        address 1.1.0.6/32;
        address 1.1.0.7/32;
        address 1.1.0.8/32;
        address 1.1.0.9/32;
    }
}

user@R0# show routing-options
static {
    route 0.0.0.0/0 next-hop 10.0.0.2;
}

Device R1 user@R1# show interfaces
fe-1/2/0 {
    unit 2 {
        family inet {
            address 10.0.0.2/30;
        }
    }
}
fe-1/2/1 {
    unit 5 {
        family inet {
            address 10.0.0.5/30;
        }
    }
}
fe-1/2/2 {
    unit 9 {
        family inet {
            address 10.0.0.9/30;
        }
    }
}
lo0 {
    unit 2 {
        family inet {
            address 1.1.1.1/32;
        }
    }
}

user@R1# show protocols
bgp {
    export [ send-local send-static ];
    group int {
        type internal;
        local-address 1.1.1.1;
        neighbor 2.2.2.2;
    }
}
ospf {
    area 0.0.0.0 {
        interface fe-1/2/1.5;
        interface fe-1/2/2.9;
```

```

        interface lo0.2;
    }
}

user@R1# show policy-options
policy-statement send-local {
    from protocol [ local direct ];
    then accept;
}
policy-statement send-static {
    from protocol static;
    then accept;
}

user@R1# show routing-options
static {
    route 1.1.0.2/32 next-hop 10.0.0.1;
    route 1.1.0.1/32 next-hop 10.0.0.1;
    route 1.1.0.3/32 next-hop 10.0.0.1;
    route 1.1.0.4/32 next-hop 10.0.0.1;
    route 1.1.0.5/32 next-hop 10.0.0.1;
    route 1.1.0.6/32 next-hop 10.0.0.1;
    route 1.1.0.7/32 next-hop 10.0.0.1;
    route 1.1.0.8/32 next-hop 10.0.0.1;
    route 1.1.0.9/32 next-hop 10.0.0.1;
}
autonomous-system 65500;

Device R2 user@R2# show interfaces
fe-1/2/0 {
    unit 14 {
        family inet {
            address 10.0.0.14/30;
        }
    }
}
fe-1/2/1 {
    unit 18 {
        family inet {
            address 10.0.0.18/30;
        }
    }
}
fe-1/2/2 {
    unit 21 {
        family inet {
            address 10.0.0.21/30;
        }
    }
}
lo0 {
    unit 3 {
        family inet {
            address 2.2.2.2/32;
        }
    }
}

```

```
user@R2# show protocols
bgp {
  export send-local;
  group int {
    type internal;
    local-address 2.2.2.2;
    family inet {
      unicast;
    }
    family inet-vpn {
      unicast;
    }
    neighbor 1.1.1.1;
  }
}
ospf {
  area 0.0.0.0 {
    interface fe-1/2/0.14;
    interface fe-1/2/1.18;
    interface lo0.3;
  }
}

user@R2# show policy-options
policy-statement send-local {
  from protocol [ local direct ];
  then accept;
}

user@R2# show routing-options
autonomous-system 65500;
forwarding-table {
  indirect-next-hop;
}
```

Configure Device R3, Device R4, and Device R5, as shown in [“CLI Quick Configuration” on page 125](#).

Verification

Confirm that the configuration is working properly.

Verifying That the Routes Have the Expected Indirect-Next-Hop Flag

Purpose Make sure that Device R2 is configured to maintain the indirect next hop to forwarding next-hop binding on the Packet Forwarding Engine forwarding table.

Action user@R2> show krt indirect-next-hop
 show krt indirect-next-hop
 Indirect Nexthop:
 Index: 1048575 Protocol next-hop address: 10.255.3.1
 RIB Table: __mpls-oam__.mpls.0
 Label: Swap 299968
 Policy Version: 0 References: 1
 Locks: 2 0x95bc514
 Flags: 0x0
 INH Session ID: 0xa
 INH Version ID: 1
 Ref RIB Table: unknown
 Next hop: 50.50.244.9 via ge-2/0/2.0
 Label operation: Swap 299968, Push 299792(top)
 Label TTL action: no-prop-ttl, no-prop-ttl(top)
 Session Id: 0x9
 IGP FRR Interesting proto count : 0

Meaning The 0x1 flag in the output indicates that Device R2 is configured to maintain the indirect next hop to forwarding next-hop binding on the Packet Forwarding Engine forwarding table. When the **indirect-next-hop** statement is deleted or deactivated, this flag changes to 0x0.



NOTE: The show krt indirect-next-hop command is hidden and is therefore undocumented. The show krt indirect-next-hop command is shown here because this is the only command that verifies the indirect next-hop feature. The best verification method is, of course, monitoring network performance during reconvergence after a path failure.

Related Documentation • [Example: Controlling Static Routes in Routing and Forwarding Tables on page 32](#)

Example: Configuring Unicast Reverse-Path-Forwarding Check

- [Understanding Unicast Reverse Path Forwarding on page 133](#)
- [Example: Configuring Unicast Reverse-Path-Forwarding Check on page 134](#)

Understanding Unicast Reverse Path Forwarding

IP spoofing can occur during a denial-of-service (DoS) attack. IP spoofing allows an intruder to pass IP packets to a destination as genuine traffic, when in fact the packets are not actually meant for the destination. This type of spoofing is harmful because it consumes the destination's resources.

A unicast reverse-path-forwarding (RPF) check is a tool to reduce forwarding of IP packets that might be spoofing an address. A unicast RPF check performs a route table lookup on an IP packet's source address, and checks the incoming interface. The router or switch determines whether the packet is arriving from a path that the sender would use to reach the destination. If the packet is from a valid path, the router or switch forwards the packet

to the destination address. If it is not from a valid path, the router or switch discards the packet. Unicast RPF is supported for the IPv4 and IPv6 protocol families, as well as for the virtual private network (VPN) address family.



NOTE: Reverse path forwarding is not supported on the interfaces you configure as tunnel sources. This affects only the transit packets exiting the tunnel.

Example: Configuring Unicast Reverse-Path-Forwarding Check

Unicast reverse path forwarding (RPF) helps protect against DoS and DDoS attacks by verifying the unicast source address of each packet that arrives on an ingress interface where unicast RPF is enabled.

This example shows how to help defend ingress interfaces against denial-of-service (DoS) and distributed denial-of-service (DDoS) attacks by configuring unicast RPF to filter incoming traffic.

- [Requirements on page 134](#)
- [Overview on page 134](#)
- [Configuration on page 135](#)
- [Verification on page 140](#)

Requirements

In this example, no special configuration beyond device initialization is required.

Overview

Large amounts of unauthorized traffic such as attempts to flood a network with fake (bogus) service requests in a DoS attack can consume network resources and deny service to legitimate users. One way to help prevent DoS and DDoS attacks is to verify that incoming traffic originates from legitimate network sources.

Unicast RPF helps ensure that a traffic source is legitimate (authorized) by comparing the source address of each packet that arrives on an interface to the forwarding table entry for its source address. If the device uses the same interface that the packet arrived on to reply to the packet's source, this verifies that the packet originated from an authorized source, and the device forwards the packet. If the device does not use the same interface that the packet arrived on to reply to the packet's source, the packet might have originated from an unauthorized source, and the device discards the packet.

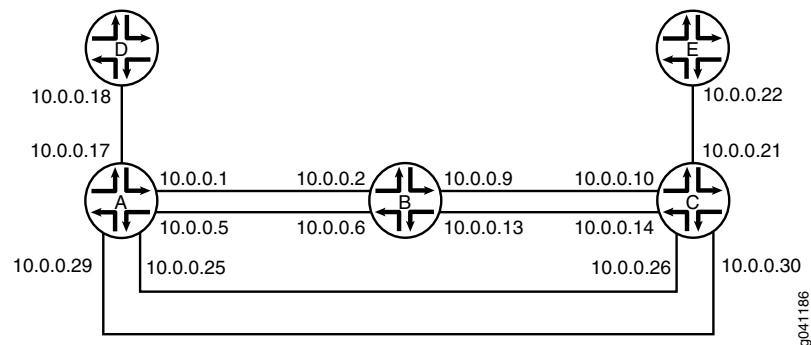
In this example, Device B has unicast RPF configured. Device A is using OSPF to advertise a prefix for the link that connects to Device D. OSPF is enabled on the links between Device B and Device C and the links between Device A and Device C, but not on the links between Device A and Device B. Therefore, Device B learns about the route to Device D through Device C.

If ingress filtering is used in an environment where DHCP or BOOTP is used, it should be ensured that the packets with a source address of 0.0.0.0 and a destination address of 255.255.255.255 are allowed to reach the relay agent in routers when appropriate.

This example also includes a fail filter. When a packet fails the unicast RPF check, the fail filter is evaluated to determine if the packet should be accepted anyway. The fail filter in this example allows Device B's interfaces to accept Dynamic Host Configuration Protocol (DHCP) packets. The filter accepts all packets with a source address of 0.0.0.0 and a destination address of 255.255.255.255.

Figure 16 on page 135 shows the sample network.

Figure 16: Unicast RPF Sample Topoolgy



Configuration

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 A

```
set interfaces fe-1/2/0 unit 1 family inet address 10.0.0.1/30
set interfaces fe-0/0/2 unit 5 family inet address 10.0.0.5/30
set interfaces fe-0/0/1 unit 17 family inet address 10.0.0.17/30
set interfaces fe-0/1/1 unit 25 family inet address 10.0.0.25/30
set interfaces fe-1/1/1 unit 29 family inet address 10.0.0.29/30
set protocols ospf export send-direct
set protocols ospf area 0.0.0.0 interface fe-0/1/1.25
set protocols ospf area 0.0.0.0 interface fe-1/1/1.29
set policy-options policy-statement send-direct from protocol direct
set policy-options policy-statement send-direct from route-filter 10.0.0.16/30 exact
set policy-options policy-statement send-direct then accept
```

Device B

```
set interfaces fe-1/2/0 unit 2 family inet rpf-check fail-filter rpf-special-case-dhcp
set interfaces fe-1/2/0 unit 2 family inet address 10.0.0.2/30
set interfaces fe-1/1/1 unit 6 family inet rpf-check fail-filter rpf-special-case-dhcp
set interfaces fe-1/1/1 unit 6 family inet address 10.0.0.6/30
set interfaces fe-0/1/1 unit 9 family inet rpf-check fail-filter rpf-special-case-dhcp
set interfaces fe-0/1/1 unit 9 family inet address 10.0.0.9/30
set interfaces fe-0/1/0 unit 13 family inet rpf-check fail-filter rpf-special-case-dhcp
set interfaces fe-0/1/0 unit 13 family inet address 10.0.0.13/30
set protocols ospf area 0.0.0.0 interface fe-0/1/1.9
```

```
set protocols ospf area 0.0.0.0 interface fe-0/1/0.13
set routing-options forwarding-table unicast-reverse-path active-paths
set firewall filter rpf-special-case-dhcp term allow-dhcp from source-address 0.0.0.0/32
set firewall filter rpf-special-case-dhcp term allow-dhcp from destination-address
  255.255.255.255/32
set firewall filter rpf-special-case-dhcp term allow-dhcp then count rpf-dhcp-traffic
set firewall filter rpf-special-case-dhcp term allow-dhcp then accept
set firewall filter rpf-special-case-dhcp term default then log
set firewall filter rpf-special-case-dhcp term default then reject
```

Device C

```
set interfaces fe-1/2/0 unit 10 family inet address 10.0.0.10/30
set interfaces fe-0/0/2 unit 14 family inet address 10.0.0.14/30
set interfaces fe-1/0/2 unit 21 family inet address 10.0.0.21/30
set interfaces fe-1/2/2 unit 26 family inet address 10.0.0.26/30
set interfaces fe-1/2/1 unit 30 family inet address 10.0.0.30/30
set protocols ospf area 0.0.0.0 interface fe-1/2/0.10
set protocols ospf area 0.0.0.0 interface fe-0/0/2.14
set protocols ospf area 0.0.0.0 interface fe-1/2/2.26
set protocols ospf area 0.0.0.0 interface fe-1/2/1.30
```

Device D

```
set interfaces fe-1/2/0 unit 18 family inet address 10.0.0.18/30
```

Device E

```
set interfaces fe-1/2/0 unit 22 family inet address 10.0.0.22/30
```

Configuring Device A

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 A:

1. Configure the interfaces.

```
[edit interfaces]
user@A# set fe-1/2/0 unit 1 family inet address 10.0.0.1/30

user@A# set fe-0/0/2 unit 5 family inet address 10.0.0.5/30

user@A# set fe-0/0/1 unit 17 family inet address 10.0.0.17/30

user@A# set fe-0/1/1 unit 25 family inet address 10.0.0.25/30

user@A# set fe-1/1/1 unit 29 family inet address 10.0.0.29/30
```
2. Configure OSPF.

```
[edit protocols ospf]
user@A# set export send-direct
user@A# set area 0.0.0.0 interface fe-0/1/1.25
user@A# set area 0.0.0.0 interface fe-1/1/1.29
```
3. Configure the routing policy.

```
[edit policy-options policy-statement send-direct]
user@A# set from protocol direct
```

```
user@A# set from route-filter 10.0.0.16/30 exact
user@A# set then accept
```

4. If you are done configuring Device A, commit the configuration.

```
[edit]
user@A# commit
```

Configuring Device B

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 B:

1. Configure the interfaces.

```
[edit interfaces]
user@B# set fe-1/2/0 unit 2 family inet address 10.0.0.2/30

user@B# set fe-1/1/1 unit 6 family inet address 10.0.0.6/30

user@B# set fe-0/1/1 unit 9 family inet address 10.0.0.9/30

user@B# set fe-0/1/0 unit 13 family inet address 10.0.0.13/30
```

2. Configure OSPF.

```
[edit protocols ospf area 0.0.0.0]
user@B# set interface fe-0/1/1.9
user@B# set interface fe-0/1/0.13
```

3. Configure unicast RPF, and apply the optional fail filter.

```
[edit interfaces]
user@B# set fe-1/2/0 unit 2 family inet rpf-check fail-filter rpf-special-case-dhcp

user@B# set fe-1/1/1 unit 6 family inet rpf-check fail-filter rpf-special-case-dhcp

user@B# set fe-0/1/1 unit 9 family inet rpf-check fail-filter rpf-special-case-dhcp

user@B# set fe-0/1/0 unit 13 family inet rpf-check fail-filter rpf-special-case-dhcp
```

4. (Optional) Configure the fail filter that gets evaluated if a packet fails the RPF check.

```
[edit firewall filter rpf-special-case-dhcp]
user@B# set term allow-dhcp from source-address 0.0.0.0/32
user@B# set term allow-dhcp from destination-address 255.255.255.255/32
user@B# set term allow-dhcp then count rpf-dhcp-traffic
user@B# set term allow-dhcp then accept
user@B# set term default then log
user@B# set term default then reject
```

5. (Optional) Configure only active paths to be considered in the RPF check.

This is the default behavior.

```
[edit routing-options forwarding-table]
user@B# set unicast-reverse-path active-paths
```

6. If you are done configuring Device B, commit the configuration.

```
[edit]
user@B# commit
```

Results

Confirm your configuration by issuing the **show firewall**, **show interfaces**, **show protocols**, **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.

```
Device A user@A# show interfaces
fe-1/2/0 {
  unit 1 {
    family inet {
      address 10.0.0.1/30;
    }
  }
}
fe-0/0/2 {
  unit 5 {
    family inet {
      address 10.0.0.5/30;
    }
  }
}
fe-0/0/1 {
  unit 17 {
    family inet {
      address 10.0.0.17/30;
    }
  }
}
fe-0/1/1 {
  unit 25 {
    family inet {
      address 10.0.0.25/30;
    }
  }
}
fe-1/1/1 {
  unit 29 {
    family inet {
      address 10.0.0.29/30;
    }
  }
}

user@A# show protocols
ospf {
  export send-direct;
  area 0.0.0.0 {
```

```

        interface fe-0/1/1.25;
        interface fe-1/1/1.29;
    }
}

user@A# show policy-options
policy-statement send-direct {
    from {
        protocol direct;
        route-filter 10.0.0.16/30 exact;
    }
    then accept;
}

Device B user@B# show firewall
filter rpf-special-case-dhcp {
    term allow-dhcp {
        from {
            source-address {
                0.0.0.0/32;
            }
            destination-address {
                255.255.255.255/32;
            }
            destination-address {
                255.255.255.255/32;
            }
        }
        then {
            count rpf-dhcp-traffic;
            accept;
        }
    }
    term default {
        then {
            log;
            reject;
        }
    }
}

user@B# show interfaces
fe-1/2/0 {
    unit 2 {
        family inet {
            rpf-check fail-filter rpf-special-case-dhcp;
            address 10.0.0.2/30;
        }
    }
}
fe-1/1/1 {
    unit 6 {
        family inet {
            rpf-check fail-filter rpf-special-case-dhcp;
            address 10.0.0.6/30;
        }
    }
}

```

```
fe-0/1/1 {  
  unit 9 {  
    family inet {  
      rpf-check fail-filter rpf-special-case-dhcp;  
      address 10.0.0.9/30;  
    }  
  }  
}  
fe-0/1/0 {  
  unit 13 {  
    family inet {  
      rpf-check fail-filter rpf-special-case-dhcp;  
      address 10.0.0.13/30;  
    }  
  }  
}
```

user@B# show protocols

```
ospf {  
  area 0.0.0.0 {  
    interface fe-0/1/1.9;  
    interface fe-0/1/0.13;  
  }  
}
```

user@B# show routing-options

```
forwarding-table {  
  unicast-reverse-path active-paths;  
}
```

Enter the configurations on Device C, Device D, and Device E, as shown in [“CLI Quick Configuration” on page 135](#).

Verification

Confirm that the configuration is working properly.

- [Confirm That Unicast RPF Is Enabled on page 140](#)
- [Confirm That the Source Addresses Are Blocked on page 141](#)
- [Confirm That the Source Addresses Are Unblocked on page 141](#)

Confirm That Unicast RPF Is Enabled

Purpose Make sure that the interfaces on Device B have unicast RPF enabled.

Action user@B> show interfaces fe-0/1/0.13 extensive

```

Logical interface fe-0/1/0.13 (Index 73) (SNMP ifIndex 553) (Generation 208)
Flags: SNMP-Traps 0x4000 Encapsulation: ENET2
Traffic statistics:
  Input bytes :          999390
  Output bytes :        1230122
  Input packets:         12563
  Output packets:        12613
Local statistics:
  Input bytes :          998994
  Output bytes :        1230122
  Input packets:         12563
  Output packets:        12613
Transit statistics:
  Input bytes :           396          0 bps
  Output bytes :           0          0 bps
  Input packets:           0          0 pps
  Output packets:          0          0 pps
Protocol inet, MTU: 1500, Generation: 289, Route table: 22
Flags: Sendbcst-pkt-to-re, uRPF
RPF Failures: Packets: 0, Bytes: 0
Addresses, Flags: Is-Preferred Is-Primary
  Destination: 10.0.0.12/30, Local: 10.0.0.13, Broadcast: 10.0.0.15,
Generation: 241

```

Meaning The uRPF flag confirms that unicast RPF is enabled on this interface.

Confirm That the Source Addresses Are Blocked

Purpose Use the ping command to make sure that Device B blocks traffic from unexpected source addresses.

Action From Device A, ping Device B's interfaces, using 10.0.0.17 as the source address.

```

user@A> ping 10.0.0.6 source 10.0.0.17
PING 10.0.0.6 (10.0.0.6): 56 data bytes
^C
--- 10.0.0.6 ping statistics ---
3 packets transmitted, 0 packets received, 100% packet loss

```

Meaning As expected, the ping operation fails.

Confirm That the Source Addresses Are Unblocked

Purpose Use the ping command to make sure that Device B does not block traffic when the RPF check is deactivated.

Action 1. Deactivate the RPF check on one of the interfaces.
2. Rerun the ping operation.

```

user@B> deactivate interfaces fe-1/1/1.6 family inet rpf-check
user@A> ping 10.0.0.6 source 10.0.0.17
PING 10.0.0.2 (10.0.0.2): 56 data bytes
64 bytes from 10.0.0.2: icmp_seq=0 ttl=63 time=1.316 ms

```

```
64 bytes from 10.0.0.2: icmp_seq=1 ttl=63 time=1.263 ms
^C
--- 10.0.0.2 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.263/1.289/1.316/0.027 ms
```

Meaning As expected, the ping operation succeeds.

Related Documentation

- [Example: Enabling Indirect Next Hops on the Packet Forwarding Engine on page 123](#)

Understanding the Default Routing Table Groups for Interface Routes on Packet Transport Routers

On PTX Series Packet Transport Routers, the default interface-route routing table groups differ from that of other Junos OS routing devices.

The PTX Series routers are MPLS transit platforms that do IP forwarding, typically using interior gateway protocol (IGP) routes. Interface routes are directly connected and local routes.

PTX Series routers are unlike other Junos OS routing devices in that they force an indirect next-hop resolution. PTX Series routers need the indirect next hop be resolved to create the chained composite next hop. This can cause routes to be hidden when the next-hop type is unusable.

To prevent routes from being hidden, PTX Series platforms automatically copy the routes in inet.0 into inet.2 and inet.3, and the routes in inet6.0 into inet6.2 and inet6.3.

The default interface routing table configuration on the PTX Series routers is as follows:

```
user@host# show routing-options | display inheritance defaults
##
## 'interface-routes' was inherited from group 'junos-defaults'
##
interface-routes {
  ##
  ## 'rib-group' was inherited from group 'junos-defaults'
  ##
  rib-group {
    ##
    ## 'junos-ifrg-inet0-to-inet2-and-inet3' was inherited from group 'junos-defaults'
    ##
    inet junos-ifrg-inet0-to-inet2-and-inet3;
    ##
    ## 'junos-ifrg-inet60-to-inet62-and-inet63' was inherited from group 'junos-defaults'
    ##
    inet6 junos-ifrg-inet60-to-inet62-and-inet63;
  }
}
rib-groups {
  ##
  ## 'junos-ifrg-inet0-to-inet2-and-inet3' was inherited from group 'junos-defaults'
  ##
}
```

```
junos-ifrg-inet0-to-inet2-and-inet3 {  
  ##  
  ## 'inet.0' was inherited from group 'junos-defaults'  
  ## 'inet.2' was inherited from group 'junos-defaults'  
  ## 'inet.3' was inherited from group 'junos-defaults'  
  ##  
  import-rib [ inet.0 inet.2 inet.3 ];  
}  
##  
## 'junos-ifrg-inet60-to-inet62-and-inet63' was inherited from group 'junos-defaults'  
##  
junos-ifrg-inet60-to-inet62-and-inet63 {  
  ##  
  ## 'inet6.0' was inherited from group 'junos-defaults'  
  ## 'inet6.2' was inherited from group 'junos-defaults'  
  ## 'inet6.3' was inherited from group 'junos-defaults'  
  ##  
  import-rib [ inet6.0 inet6.2 inet6.3 ];  
}  
}
```

**Related
Documentation**

- *Chained Composite Next Hops for Transit Devices*
- *Example: Overriding the Default BGP Routing Policy on PTX Series Packet Transport Routers*

CHAPTER 6

Martian Addresses

- [Example: Configuring Martian Addresses on page 145](#)

Example: Configuring Martian Addresses

- [Understanding Martian Addresses on page 145](#)
- [Example: Configuring Martian Addresses on page 146](#)

Understanding Martian Addresses

Martian addresses are host or network addresses about which all routing information is ignored. When received by the routing device, these routes are ignored. They commonly are sent by improperly configured systems on the network and have destination addresses that are obviously invalid.

In IPv6, the loopback address and the multicast resolve and discard routes are the default martian addresses.

In Junos OS Release 10.4R5 and later, the reserved IPv6 multicast address space (ff00::/8 and ff02::/16) is added to the list of martian addresses.

In Junos OS Release 9.6 and later, you can configure Class E addresses on interfaces. Class E addresses are treated like any other unicast address for the purpose of forwarding. To allow Class E addresses to be configured on interfaces, you must remove the Class E prefix from the list of martian addresses. To remove the Class E prefix from the list of martian addresses include the **martians 240/4 orlonger allow** statement at the **[edit routing-options]** hierarchy level.

To view the default and configured martian routes, run the **show route martians** command.

IPv4 Martian Addresses

```
user@host> show route martians table inet.
```

```
inet.0:
  0.0.0.0/0 exact -- allowed
  0.0.0.0/8 orlonger -- disallowed
  127.0.0.0/8 orlonger -- disallowed
  192.0.0.0/24 orlonger -- disallowed
  240.0.0.0/4 orlonger -- disallowed
  224.0.0.0/4 exact -- disallowed
  224.0.0.0/24 exact -- disallowed
```

```
inet.1:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- disallowed

inet.2:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- disallowed
    224.0.0.0/4 exact -- disallowed
    224.0.0.0/24 exact -- disallowed

inet.3:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- disallowed
    224.0.0.0/4 exact -- disallowed
    224.0.0.0/24 exact -- disallowed
```

IPv6 Martian Addresses

```
user@host> show route martians table inet6
inet6.0:
    ::1/128 exact -- disallowed
    ff00::/8 exact -- disallowed
    ff02::/16 exact -- disallowed

inet6.1:
    ::1/128 exact -- disallowed

inet6.2:
    ::1/128 exact -- disallowed
    ff00::/8 exact -- disallowed
    ff02::/16 exact -- disallowed

inet6.3:
    ::1/128 exact -- disallowed
    ff00::/8 exact -- disallowed
    ff02::/16 exact -- disallowed
```

Example: Configuring Martian Addresses

This example shows how to remove the Class E prefix from the list of martian addresses.

- [Requirements on page 147](#)
- [Overview on page 147](#)
- [Configuration on page 147](#)
- [Verification on page 148](#)

Requirements

No special configuration beyond device initialization is required before configuring this example.

Overview

In this example, Junos OS defaults are modified to allow the 240.0.0.0/4 address block. This block of addresses is known as the experimental Class E addresses. In Junos OS Release 9.6 and later, you can configure Class E addresses on interfaces and use them for forwarding traffic. However, to do this, you must first allow routing on this address block.

This example also shows how to modify the martian addresses in the IPv6 routing table, **inet6.0**.

Configuration

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.

```
set routing-options rib inet.1 martians 240.0.0.0/4 orlonger allow
set routing-options rib inet6.0 martians fd00::/8 orlonger
set routing-options rib inet.3 martians 240.0.0.0/4 orlonger allow
set routing-options rib inet.2 martians 240.0.0.0/4 orlonger allow
set routing-options martians 240.0.0.0/4 orlonger allow
```

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 martian routes:

1. Allow Class C addresses in the default unicast routing table.

```
[edit routing-options]
user@host# set martians 240.0.0.0/4 orlonger allow
```
2. Allow Class C addresses in the routing table that is used for the IPv4 multicast forwarding cache.

```
[edit routing-options]
user@host# set rib inet.1 martians 240.0.0.0/4 orlonger allow
```
3. Allow Class C addresses in the routing table that is used for multicast reverse path forwarding (RPF) lookup.

```
[edit routing-options]
user@host# set rib inet.2 martians 240.0.0.0/4 orlonger allow
```
4. Allow Class C addresses in the routing table that stores MPLS LSP information.

```
[edit routing-options]
user@host# set rib inet.3 martians 240.0.0.0/4 orlonger allow
```

5. Add a disallowed martian route to the IPv6 unicast routing table.

```
[edit routing-options]
user@host# set rib inet6.0 martians fd00::/8 orlonger
```

6. If you are done configuring the device, commit the configuration.

```
[edit]
user@host# commit
```

Results

Confirm your configuration by issuing the **show routing-options** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show routing-options
rib inet.1 {
  martians {
    240.0.0.0/4 orlonger allow;
  }
}
rib inet6.0 {
  martians {
    fd00::/8 orlonger;
  }
}
rib inet.3 {
  martians {
    240.0.0.0/4 orlonger allow;
  }
}
rib inet.2 {
  martians {
    240.0.0.0/4 orlonger allow;
  }
}
martians {
  240.0.0.0/4 orlonger allow;
}
```

Verification

Confirm that the configuration is working properly.

- [Verifying That the 240.0.0.0/4 Routes Are Now Accepted on page 148](#)
- [Verifying That the fd00::/8 Routes Are Now Rejected on page 149](#)

Verifying That the 240.0.0.0/4 Routes Are Now Accepted

Purpose Make sure that the 240.0.0.0/4 route appears in the routing tables as allowed.

Action user@host> `show route martians table inet.`

```
inet.0:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- allowed
    224.0.0.0/4 exact -- disallowed
    224.0.0.0/24 exact -- disallowed

inet.1:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- allowed

inet.2:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- allowed
    224.0.0.0/4 exact -- disallowed
    224.0.0.0/24 exact -- disallowed

inet.3:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- allowed
    224.0.0.0/4 exact -- disallowed
    224.0.0.0/24 exact -- disallowed
```

Meaning The output shows that the 240.0.0.0/4 route is allowed.

Verifying That the fd00::/8 Routes Are Now Rejected

Purpose Make sure that the fd00::/8 route appears in the IPv6 unicast routing table as disallowed.

Action user@host> `show route martians table inet6.0`

```
inet6.0:
    ::1/128 exact -- disallowed
    ff00::/8 exact -- disallowed
    ff02::/16 exact -- disallowed
    fd00::/8 orlonger -- disallowed
```

Meaning The output shows that the fd00::/8 route is disallowed.

Related Documentation

- [Examples: Creating a Routing Table and Populating It with Routes on page 39](#)
- [Example: Controlling Static Routes in Routing and Forwarding Tables on page 32](#)

CHAPTER 7

Debugging and Trace Operations

- [Example: Tracing Global Routing Protocol Operations on page 151](#)

Example: Tracing Global Routing Protocol Operations

- [Understanding Global Routing Protocol Tracing Operations on page 151](#)
- [Example: Tracing Global Routing Protocol Operations on page 152](#)

Understanding Global Routing Protocol Tracing Operations

Global routing protocol tracing operations track all general routing operations and record them in a log file. To set protocol-specific tracing operations and to modify the global tracing operations for an individual protocol, configure tracing for that protocol.

Using the **traceoptions** statement, you can specify the following global routing protocol tracing flags:

- **all**—All tracing operations
- **condition-manager**—Condition manager events
- **config-internal**—Configuration internals
- **general**—All normal operations and routing table changes (a combination of the normal and route trace operations)
- **graceful-restart**—Graceful restart operations
- **normal**—All normal operations
- **nsr-synchronization**—Nonstop routing synchronization events
- **parse**—Configuration parsing
- **policy**—Policy operations and actions
- **regex-parse**—Regular expression parsing
- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage



NOTE: Use the **all** flag with caution. This flag might cause the CPU to become very busy.

Example: Tracing Global Routing Protocol Operations

This example shows how to list and view files that are created when you enable global routing trace operations.

- [Requirements on page 152](#)
- [Overview on page 152](#)
- [Configuration on page 153](#)
- [Verification on page 155](#)

Requirements

You must have the **view** privilege.

Overview

To configure global routing protocol tracing, include the **traceoptions** statement at the **[edit routing-options]** hierarchy level:

```
traceoptions {  
  file filename <files number> <size size> <world-readable | no-world-readable>;  
  flag flag <disable>;  
}
```

The flags in a **traceoptions flag** statement are identifiers. When you use the **set** command to configure a flag, any flags that might already be set are not modified. In the following example, setting the **timer** tracing flag has no effect on the already configured **task** flag. Use the **delete** command to delete a particular flag.

```
[edit routing-options traceoptions]  
user@host# show  
flag task;  
user@host# set traceoptions flag timer  
user@host# show  
flag task;  
flag timer;  
user@host# delete traceoptions flag task  
user@host# show  
flag timer;
```

This example shows how to configure and view a trace file that tracks changes in the routing table. The steps can be adapted to apply to trace operations for any Junos OS hierarchy level that supports trace operations.



TIP: To view a list of hierarchy levels that support tracing operations, enter the **help apropos traceoptions** command in configuration mode.

Configuration

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.

```
set routing-options traceoptions file routing-table-changes
set routing-options traceoptions file size 10m
set routing-options traceoptions file files 10
set routing-options traceoptions flag route
set routing-options static route 1.1.1.2/32 next-hop 10.0.45.6
```

Configuring Trace Operations

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 the trace operations:

1. Configure trace operations.


```
[edit routing-options traceoptions]
user@host# set file routing-table-changes
user@host# set file size 10m
user@host# set file files 10
user@host# set flag route
```
2. Configure a static route to cause a change in the routing table.


```
[edit routing-options static]
user@host# set route 1.1.1.2/32 next-hop 10.0.45.6
```
3. If you are done configuring the device, commit the configuration.


```
[edit]
user@host# commit
```

Viewing the Trace File

Step-by-Step Procedure To view the trace file:

1. In operational mode, list the log files on the system.


```
user@host> file list /var/log
/var/log:
...
routing-table-changes
...
```
2. View the contents of the **routing-table-changes** file.


```
user@host> file show /var/log/routing-table-changes
Dec 15 11:09:29 trace_on: Tracing to "/var/log/routing-table-changes" started
Dec 15 11:09:29.496507
Dec 15 11:09:29.496507 Tracing flags enabled: route
Dec 15 11:09:29.496507
```

```

Dec 15 11:09:29.533203 inet_routerid_notify: Router ID: 192.168.4.1
Dec 15 11:09:29.533334 inet_routerid_notify: No Router ID assigned
Dec 15 11:09:29.533381 inet_routerid_notify: No Router ID assigned
Dec 15 11:09:29.533420 inet_routerid_notify: No Router ID assigned
Dec 15 11:09:29.534915 inet_routerid_notify: Router ID: 192.168.4.1
Dec 15 11:09:29.542934 inet_routerid_notify: No Router ID assigned
Dec 15 11:09:29.549253 inet_routerid_notify: No Router ID assigned
Dec 15 11:09:29.556878 inet_routerid_notify: No Router ID assigned
Dec 15 11:09:29.582990 rt_static_reinit: examined 3 static nexthops, 0
unreferenced
Dec 15 11:09:29.589920
Dec 15 11:09:29.589920 task_reconfigure reinitializing done
...

```

3. Filter the output of the log file.

```

user@host> file show /var/log/routing-table-changes | match 1.1.1.2
Dec 15 11:15:30.780314 ADD      1.1.1.2/32      nhid 0 gw 10.0.45.6
      Static   pref 5/0 metric at-0/2/0.0 <ctive Int Ext>
Dec 15 11:15:30.782276 KRT Request: send len 216 v104 seq 0 ADD route/user
af 2 table 0 infot 0 addr 1.1.1.2 nhop-type unicast nhindex 663

```

4. View the tracing operations in real time by running the **monitor start** command with an optional **match** condition.

```

user@host> monitor start routing-table-changes | match 1.1.1.2
Aug 10 19:21:40.773467 BGP RECV      0.0.0.0/0
Aug 10 19:21:40.773685 bgp_rcv_nlri: 0.0.0.0/0
Aug 10 19:21:40.773778 bgp_rcv_nlri: 0.0.0.0/0 belongs to meshgroup
Aug 10 19:21:40.773832 bgp_rcv_nlri: 0.0.0.0/0 qualified bnp->ribact 0x0
12afcb 0x0

```

5. Deactivate the static route.

```

user@host# deactivate routing-options static route 1.1.1.2/32
user@host# commit

*** routing-table-changes ***
Dec 15 11:42:59.355557 CHANGE  1.1.1.2/32      nhid 663 gw 10.0.45.6
      Static   pref 5/0 metric at-0/2/0.0 <Delete Int Ext>
Dec 15 11:42:59.426887 KRT Request: send len 216 v104 seq 0 DELETE route/user
af 2 table 0 infot 0 addr 1.1.1.2 nhop-type discard filtidx 0
Dec 15 11:42:59.427366 RELEASE 1.1.1.2/32      nhid 663 gw 10.0.45.6
      Static   pref 5/0 metric at-0/2/0.0 <Release Delete Int Ext>

```

6. Halt the **monitor** command by pressing Enter and typing **monitor stop**.

```

[Enter]
user@host> monitor stop

```

7. When you are finished troubleshooting, consider deactivating trace logging to avoid any unnecessary impact to system resources.

When configuration is deactivated, it appears in the configuration with the **inactive** tag.

```

[edit routing-options]
user@host# deactivate traceoptions
user@host# commit

[edit routing-options]
user@host# show

inactive: traceoptions {

```

```

        file routing-table-changes size 10m files 10;
        flag route;
    }
    static {
        inactive: route 1.1.1.2/32 next-hop 10.0.45.6;
    }
}

```

8. To reactivate trace operations, use the **activate** configuration-mode statement.

```

[edit routing-options]
user@host# activate traceoptions
user@host# commit

```

Results

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

```

user@host# show routing-options
traceoptions {
  file routing-table-changes size 10m files 10;
  flag route;
}
static {
  route 1.1.1.2/32 next-hop 10.0.45.6;
}

```

Verification

Confirm that the configuration is working properly.

Verifying That the Trace Log File Is Operating

Purpose Make sure that events are being written to the log file.

Action user@host> show log routing-table-changes
Dec 15 11:09:29 trace_on: Tracing to "/var/log/routing-table-changes" started

Related Documentation

- *Example: Configuring BGP Trace Operations*

CHAPTER 8

Configuration Statements

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access (Static Access Routes)

Syntax	<pre>access { route <i>ip-prefix</i> </prefix-length> { metric <i>route-cost</i>; next-hop <i>next-hop</i>; preference <i>route-distance</i>; qualified-next-hop <i>next-hop</i>; tag <i>tag-number</i> } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options], [edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-instances <i>routing-instance-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced in Junos OS Release 10.1. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure access routes. 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	<ul style="list-style-type: none">• Examples: Configuring Static Routes on page 9

access-internal (Static Access-Internal Routes)

Syntax	<pre>access-internal { route ip-prefix </prefix-length> { next-hop next-hop; qualified-next-hop next-hop } }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-options]</p>
Release Information	<p>Statement introduced in Junos OS Release 10.1.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Configure parameters for internal access routes.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Configuring Dynamic Access-Internal Routes for DHCP Subscriber Management</i> • <i>Configuring Dynamic Access-Internal Routes for PPP Subscriber Management</i>

active

Syntax	(active passive);
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit routing-options (aggregate generate static) (defaults route)],</p> <p>[edit routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Determine whether static, aggregate, or generated routes are removed from the routing and forwarding tables when they become inactive. Static routes are only removed from the routing table if the next hop becomes unreachable. This can occur if the local or neighbor interface goes down. Routes that have been configured to remain continually installed in the routing and forwarding tables are marked with reject next hops when they are inactive.</p> <ul style="list-style-type: none"> • active—Remove a route from the routing and forwarding tables when it becomes inactive. • passive—Have a route remain continually installed in the routing and forwarding tables even when it becomes inactive. <p>Include the active statement when configuring an individual route in the route portion of the static statement to override a passive option specified in the defaults portion of the statement.</p>
Default	active
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Examples: Configuring Static Routes on page 9 • Example: Summarizing Routes Through Route Aggregation on page 82 • Example: Conditionally Generating Static Routes on page 88

aggregate (Routing)

Syntax	<pre> aggregate { defaults { ... aggregate-options ... } route destination-prefix { policy policy-name; ... aggregate-options ... } } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i>],</p> <p>[edit routing-options],</p> <p>[edit routing-options rib <i>routing-table-name</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	Configure aggregate routes.
Options	<p>aggregate-options—Additional information about aggregate routes that is included with the route when it is installed in the routing table. Specify zero or more of the following options in aggregate-options. Each option is explained separately.</p> <ul style="list-style-type: none"> • (active passive); • as-path <as-path> <origin (egp igp incomplete)> <atomic-aggregate> <aggregator as-number ip-address>; • (brief full); • community [<i>community-ids</i>]; • discard; • (metric metric2 metric3 metric4) <i>value</i> <type type>; • (preference preference2 color color2) <i>preference</i> <type type>; • tag <i>metric type number</i>; <p>defaults—Specify global aggregate route options. These options only set default attributes inherited by all newly created aggregate routes. These are treated as global defaults</p>

and apply to all the aggregate routes you configure in the **aggregate** statement. This part of the **aggregate** statement is optional.

route *destination-prefix*—Configure a nondefault aggregate route:

- **default**—For the default route to the destination. This is equivalent to specifying an IP address of **0.0.0.0/0**.
- ***destination-prefix/prefix-length***—***destination-prefix*** is the network portion of the IP address, and ***prefix-length*** is the destination prefix length.

The **policy** 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	<ul style="list-style-type: none">• Example: Summarizing Routes Through Route Aggregation on page 82

as-path (Routing Options)

Syntax	<code>as-path <as-path> <aggregator as-number ip-address> <atomic-aggregate> <origin (egp igp incomplete)>;</code>
Hierarchy Level	<pre> [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options (aggregate generate static) (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-options (aggregate generate static) (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)], [edit routing-instances <i>routing-instance-name</i> routing-options (aggregate generate static) (defaults route)], [edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)], [edit routing-options (aggregate generate static) (defaults route)], [edit routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)] </pre>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Associate BGP autonomous system (AS) path information with a static, aggregate, or generated route.</p> <p>In Junos OS Release 9.1 and later, the numeric range for the AS number is extended to provide BGP support for 4-byte AS numbers as defined in RFC 4893, <i>BGP Support for Four-octet AS Number Space</i>. RFC 4893 introduces two new optional transitive BGP attributes, AS4_PATH and AS4_AGGREGATOR. These new attributes are used to propagate 4-byte AS path information across BGP speakers that do not support 4-byte AS numbers. RFC 4893 also introduces a reserved, well-known, 2-byte AS number, AS 23456. This reserved AS number is called AS_TRANS in RFC 4893. All releases of Junos OS support 2-byte AS numbers.</p> <p>In Junos OS Release 9.2 and later, you can also configure a 4-byte AS number using the AS-dot notation format of two integer values joined by a period: <i><16-bit high-order value in decimal>.<16-bit low-order value in decimal></i>. For example, the 4-byte AS number of 65,546 in plain-number format is represented as 1.10 in the AS-dot notation format. You can specify a value in the range from 0.0 through 65535.65535 in AS-dot notation format.</p>
Default	No AS path information is associated with static routes.
Options	<p>aggregator—(Optional) Attach the BGP aggregator path attribute to the aggregate route. You must specify the last AS number that formed the aggregate route (encoded as two octets) for as-number, followed by the IP address of the BGP system that formed the aggregate route for ip-address.</p>

as-path—(Optional) AS path to include with the route. It can include a combination of individual AS path numbers and AS sets. Enclose sets in brackets ([]). The first AS number in the path represents the AS immediately adjacent to the local AS. Each subsequent number represents an AS that is progressively farther from the local AS, heading toward the origin of the path. You cannot specify a regular expression for **as-path**. You must use a complete, valid AS path.

atomic-aggregate—(Optional) Attach the BGP **atomic-aggregate** path attribute to the aggregate route. This path attribute indicates that the local system selected a less specific route instead of a more specific route.

origin egp—(Optional) BGP origin attribute that indicates that the path information originated in another AS.

origin igp—(Optional) BGP origin attribute that indicates that the path information originated within the local AS.

origin incomplete—(Optional) BGP origin attribute that indicates that the path information was learned by some other means.

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

Related Documentation	<ul style="list-style-type: none">• Examples: Configuring Static Routes on page 9• Example: Summarizing Routes Through Route Aggregation on page 82• Example: Conditionally Generating Static Routes on page 88• Using 4-Byte Autonomous System Numbers in BGP Networks Technology Overview
------------------------------	--

auto-export

Syntax	<pre> auto-export { disable; family inet { disable; flow { disable; rib-group rib-group; } multicast { disable; rib-group rib-group; } unicast { disable; rib-group rib-group; } } family inet6 { disable; multicast { disable; rib-group rib-group; } unicast { disable; rib-group rib-group; } } family iso { disable; unicast { disable; rib-group rib-group; } } traceoptions { file filename <files number> <size maximum-file-size> <world-readable no-world-readable>; flag flag <flag-modifier> <disable>; } } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-options]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>

Description	<p>Export routes between routing instances.</p> <p>This statement enables you to leak routes between VPN routing and forwarding (VRF) instances that are locally configured on a provider edge (PE) router. Auto export is always applied on the local PE router, because it applies to only local prefix leaking by evaluating the export policy of each VRF and determining which route targets can be leaked. The standard VRF import and export policies affect remote PE prefix leaking.</p> <p>You can use this statement as an alternative to using the VRF import and export policies.</p>
Options	<p>(disable enable)—Disable or enable auto-export.</p> <p>Default: Enable</p> <p>family—Address family.</p> <p>inet—IP version 4 (IPv4) address family.</p> <p>multicast—Multicast routing information.</p> <p>unicast—Unicast routing information.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">• Technology Overview: Understanding the Auto Export Feature

autonomous-system

Syntax	<pre>autonomous-system <i>autonomous-system</i> <asdot-notation> <loops <i>number</i>> { <i>independent-domain</i> <no-attrset>; }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-options]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>asdot-notation option introduced in Junos OS Release 9.3.</p> <p>asdot-notation option introduced in Junos OS Release 9.3 for EX Series switches.</p> <p>no-attrset option introduced in Junos OS Release 10.4.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Specify the routing device's AS number.</p> <p>An autonomous system (AS) is a set of routing devices that are under a single technical administration and that generally use a single interior gateway protocol (IGP) and metrics to propagate routing information within the set of routing devices. An AS appears to other ASs to have a single, coherent interior routing plan and presents a consistent picture of what destinations are reachable through it. ASs are identified by a number that is assigned by the Network Information Center (NIC) in the United States (http://www.isi.edu).</p> <p>If you are using BGP on the routing device, you must configure an AS number.</p> <p>The AS path attribute is modified when a route is advertised to an EBGP peer. Each time a route is advertised to an EBGP peer, the local routing device prepends its AS number to the existing path attribute, and a value of 1 is added to the AS number.</p> <p>In Junos OS Release 9.1 and later, the numeric range is extended to provide BGP support for 4-byte AS numbers as defined in RFC 4893, <i>BGP Support for Four-octet AS Number Space</i>. RFC 4893 introduces two new optional transitive BGP attributes, AS4_PATH and AS4_AGGREGATOR. These new attributes are used to propagate 4-byte AS path information across BGP speakers that do not support 4-byte AS numbers. RFC 4893 also introduces a reserved, well-known, 2-byte AS number, AS 23456. This reserved AS number is called AS_TRANS in RFC 4893. All releases of Junos OS support 2-byte AS numbers.</p> <p>In Junos OS Release 9.3 and later, you can also configure a 4-byte AS number using the AS-dot notation format of two integer values joined by a period: <i><16-bit high-order value in decimal>.<16-bit low-order value in decimal></i>. For example, the 4-byte AS number of 65,546 in plain-number format is represented as 1.10 in the AS-dot notation format.</p>
Options	<p><i>autonomous-system</i>—AS number. Use a number assigned to you by the NIC.</p>

Range: 1 through 4,294,967,295 ($2^{32} - 1$) in plain-number format for 4-byte AS numbers

In this example, the 4-byte AS number 65,546 is represented in plain-number format:

```
[edit]
routing-options {
  autonomous-system 65546;
}
```

Range: 0.0 through 65535.65535 in AS-dot notation format for 4-byte numbers

In this example, 1.10 is the AS-dot notation format for 65,546:

```
[edit]
routing-options {
  autonomous-system 1.10;
}
```

Range: 1 through 65,535 in plain-number format for 2-byte AS numbers (this is a subset of the 4-byte range)

In this example, the 2-byte AS number 60,000 is represented in plain-number format:

```
[edit]
routing-options {
  autonomous-system 60000;
}
```

asdot-notation—(Optional) Display the configured 4-byte autonomous system number in the AS-dot notation format.

Default: Even if a 4-byte AS number is configured in the AS-dot notation format, the default is to display the AS number in the plain-number format.

loops number—(Optional) Specify the number of times detection of the AS number in the AS_PATH attribute causes the route to be discarded or hidden. For example, if you configure **loops 1**, the route is hidden if the AS number is detected in the path one or more times. This is the default behavior. If you configure **loops 2**, the route is hidden if the AS number is detected in the path two or more times.

Range: 1 through 10

Default: 1



NOTE: When you specify the same AS number in more than one routing instance on the local routing device, you must configure the same number of loops for the AS number in each instance. For example, if you configure a value of 3 for the loops statement in a VRF routing instance that uses the same AS number as that of the master instance, you must also configure a value of 3 loops for the AS number in the master instance.

Use the **independent-domain** option if the loops statement must be enabled only on a subset of routing instances.

The remaining statement is explained separately.

Required Privilege	routing—To view this statement in the configuration.
Level	routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Examples: Configuring External BGP Peering</i>• <i>Examples: Configuring Internal BGP Peering</i>

bfd

Syntax	<pre>bfd { traceoptions { file <i>filename</i> <files <i>number</i>> <match <i>regular-expression</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols], [edit protocols], [edit routing-instances <i>routing-instance-name</i> protocols]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Configure trace options for Bidirectional Forwarding Protocol (BFD) traffic.
Default	If you do not include this statement, no BFD tracing operations are performed.
Options	<p>disable—(Optional) Disable the BFD tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. Enclose the name in quotation marks. All files are placed in the /var/log directory. We recommend that you place global routing protocol tracing output in the routing-log file.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named trace-file reaches its maximum size, it is renamed trace-file.0, then trace-file.1, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.</p> <p>If you specify a maximum number of files, you also must specify a maximum file size with the size option.</p> <p>Range: 2 through 1000 files</p> <p>Default: 2 files</p> <p>flag <i>flag</i>—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements. These are the BFD protocol tracing options:</p> <ul style="list-style-type: none">• adjacency—Trace adjacency messages.• all—Trace all options for BFD.• error—Trace all errors.• event—Trace all events.• issu—Trace in-service software upgrade (ISSU) packet activity.

- **nsr-packet**—Trace non-stop-routing (NSR) packet activity.
- **nsr-synchronization**—Trace NSR synchronization events.
- **packet**—Trace all packets.
- **pipe**—Trace pipe messages.
- **pipe-detail**—Trace pipe messages in detail.
- **ppm-packet**—Trace packet activity by periodic packet management (PPM).
- **state**—Trace state transitions.
- **timer**—Trace timer processing.

match *regular-expression*—(Optional) Regular expression for lines to be logged.

no-world-readable—(Optional) Prevent any user from reading the log file.

size *size*—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named ***trace-file*** reaches this size, it is renamed ***trace-file.0***. When the trace file again reaches its maximum size, ***trace-file.0*** is renamed ***trace-file.1*** and ***trace-file*** is renamed ***trace-file.0***. This renaming scheme continues until the maximum number of trace files is reached. Then, the oldest trace file is overwritten.

If you specify a maximum file size, you also must specify a maximum number of trace files with the **files** option.

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 128 KB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	routing and trace—To view this statement in the configuration. routing-control and trace-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring BFD for Static Routes on page 103

bfd-liveness-detection (Routing Options Static Route)

Syntax `bfd-liveness-detection {`
 `authentication {`
 `algorithm` *algorithm-name*;
 `key-chain` *key-chain-name*;
 `loose-check`;
 `}`
 `detection-time {`
 `threshold` *milliseconds*;
 `}`
 `holddown-interval` *milliseconds*;
 `local-address` *ip-address*;
 `minimum-interval` *milliseconds*;
 `minimum-receive-interval` *milliseconds*;
 `minimum-receive-ttl` *number*;
 `multiplier` *number*;
 `neighbor` *address*;
 `no-adaptation`;
 `transmit-interval {`
 `minimum-interval` *milliseconds*;
 `threshold` *milliseconds*;
 `}`
 `version` (1 | automatic);
`}`

Hierarchy Level [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* routing-options rib *routing-table-name* static route *destination-prefix*],
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* routing-options rib *routing-table-name* static route *destination-prefix* qualified-next-hop (*interface-name* | *address*)],
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* routing-options static route *destination-prefix*],
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* routing-options static route *destination-prefix* qualified-next-hop (*interface-name* | *address*)],
 [edit logical-systems *logical-system-name* routing-options rib *routing-table-name* static route *destination-prefix*],
 [edit logical-systems *logical-system-name* routing-options rib *routing-table-name* static route *destination-prefix* qualified-next-hop (*interface-name* | *address*)],
 [edit logical-systems *logical-system-name* routing-options static route *destination-prefix*],
 [edit logical-systems *logical-system-name* routing-options static route *destination-prefix* qualified-next-hop (*interface-name* | *address*)],
 [edit routing-instances *routing-instance-name* routing-options rib *routing-table-name* static route *destination-prefix*],
 [edit routing-instances *routing-instance-name* routing-options rib *routing-table-name* static route *destination-prefix* qualified-next-hop (*interface-name* | *address*)],
 [edit routing-instances *routing-instance-name* routing-options static route *destination-prefix*],
 [edit routing-instances *routing-instance-name* routing-options static route *destination-prefix* qualified-next-hop (*interface-name* | *address*)],
 [edit routing-options rib *routing-table-name* static route *destination-prefix*],
 [edit routing-options rib *routing-table-name* static route *destination-prefix* qualified-next-hop (*interface-name* | *address*)],
 [edit routing-options static route *destination-prefix*],

[edit routing-options static route *destination-prefix* qualified-next-hop (*interface-name* | *address*)]

Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>detection-time threshold and transmit-interval threshold options introduced in Junos OS Release 8.2.</p> <p>local-address statement introduced in Junos OS Release 8.2.</p> <p>minimum-receive-ttl statement introduced in Junos OS Release 8.2.</p> <p>Support for logical routers introduced in Junos OS Release 8.3.</p> <p>holddown-interval statement introduced in Junos OS Release 8.5.</p> <p>no-adaptation statement introduced in Junos OS Release 9.0.</p> <p>Support for IPv6 static routes introduced in Junos OS Release 9.1.</p> <p>authentication algorithm, authentication key-chain, and authentication loose-check statements introduced in Junos OS Release 9.6.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Configure bidirectional failure detection timers and authentication criteria for static routes.</p>

Options **authentication algorithm** *algorithm-name* —Configure the algorithm used to authenticate the specified BFD session: **simple-password**, **keyed-md5**, **keyed-sha-1**, **meticulous-keyed-md5**, or **meticulous-keyed-sha-1**.

authentication key-chain *key-chain-name* —Associate a security key with the specified BFD session using the name of the security keychain. The name you specify must match one of the keychains configured in the **authentication-key-chains key-chain** statement at the **[edit security]** hierarchy level.

authentication loose-check—(Optional) Configure loose authentication checking on the BFD session. Use only for transitional periods when authentication may not be configured at both ends of the BFD session.

detection-time threshold *milliseconds*—Configure a threshold for the adaptation of the BFD session detection time. When the detection time adapts to a value equal to or greater than the threshold, a single trap and a single system log message are sent.

holddown-interval *milliseconds*—Configure an interval specifying how long a BFD session must remain up before a state change notification is sent. If the BFD session goes down and then comes back up during the hold-down interval, the timer is restarted.

Range: 0 through 255,000

Default: 0

local-address *ip-address*—Enable a multihop BFD session and configure the source address for the BFD session.

minimum-interval *milliseconds*—Configure the minimum interval after which the local routing device transmits a hello packet and then expects to receive a reply from the neighbor with which it has established a BFD session. Optionally, instead of using this statement, you can configure the minimum transmit and receive intervals separately using the **transmit-interval**, **minimum-interval**, and **minimum-receive-interval** statements.

Range: 1 through 255,000

minimum-receive-interval *milliseconds*—Configure the minimum interval after which the routing device expects to receive a reply from a neighbor with which it has established a BFD session. Optionally, instead of using this statement, you can configure the minimum receive interval using the **minimum-interval** statement at the **[edit routing-options static route destination-prefix bfd-liveness-detection]** hierarchy level.

Range: 1 through 255,000

minimum-receive-ttl *number*—Configure the time to live (TTL) for the multihop BFD session.

Range: 1 through 255

Default: 255

multiplier *number*—Configure number of hello packets not received by the neighbor that causes the originating interface to be declared down.

Range: 1 through 255

Default: 3

neighbor *address*—Configure a next-hop address for the BFD session for a next hop specified as an interface name.

no-adaptation—Specify for BFD sessions not to adapt to changing network conditions. We recommend that you not disable BFD adaptation unless it is preferable not to have BFD adaptation enabled in your network.

transmit-interval threshold *milliseconds*—Configure the threshold for the adaptation of the BFD session transmit interval. When the transmit interval adapts to a value greater than the threshold, a single trap and a single system message are sent. The interval threshold must be greater than the minimum transmit interval.

Range: 0 through 4,294,967,295

transmit-interval minimum-interval *milliseconds*—Configure the minimum interval at which the routing device transmits hello packets to a neighbor with which it has established a BFD session. Optionally, instead of using this statement, you can configure the minimum transmit interval using the **minimum-interval** statement at the **[edit routing-options static route *destination-prefix* bfd-liveness-detection]** hierarchy level.

Range: 1 through 255,000

version—Configure the BFD version to detect: **1** (BFD version 1) or **automatic** (autodetect the BFD version).

Default: automatic

Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
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Related Documentation	<ul style="list-style-type: none">• Example: Configuring BFD for Static Routes on page 103• Example: Configuring BFD Authentication for Static Routes on page 116
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brief

Syntax	(brief full);
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options (aggregate generate) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options (aggregate generate) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options (aggregate generate) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)],</p> <p>[edit routing-options (aggregate generate) (defaults route)],</p> <p>[edit routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Configure all AS numbers from all contributing paths to be included in the aggregate or generated route's path.</p> <ul style="list-style-type: none"> • brief—Include only the longest common leading sequences from the contributing AS paths. If this results in AS numbers being omitted from the aggregate route, the BGP ATOMIC_ATTRIBUTE path attribute is included with the aggregate route. • full—Include all AS numbers from all contributing paths in the aggregate or generated route's path. Include this option when configuring an individual route in the route portion of the generate statement to override a retain option specified in the defaults portion of the statement.
Default	full
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Summarizing Routes Through Route Aggregation on page 82 • Example: Conditionally Generating Static Routes on page 88 • aggregate on page 163 • generate on page 196

color

See [preference](#)

community (Routing Options)

Syntax	<code>community ([<i>community-ids</i>] no-advertise no-export no-export-subconfed none);</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit routing-options (aggregate generate static) (defaults route)],</p> <p>[edit routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	Associate BGP community information with a static, aggregate, or generated route.
Default	No BGP community information is associated with static routes.
Options	<p><i>community-ids</i>—One or more community identifiers. The <i>community-ids</i> format varies according to the type of attribute that you use.</p> <p>The BGP community attribute format is <i>as-number:community-value</i>:</p> <ul style="list-style-type: none"> • <i>as-number</i>—AS number of the community member. It can be a value from 1 through 65,535. The AS number can be a decimal or hexadecimal value. • <i>community-value</i>—Identifier of the community member. It can be a number from 0 through 65,535. <p>For more information about BGP community attributes, see the “Configuring the Extended Communities Attribute” section in the <i>Routing Policy Feature Guide for Routing Devices</i>.</p> <p>For specifying the BGP community attribute only, you also can specify <i>community-ids</i> as one of the following well-known community names defined in RFC 1997:</p> <ul style="list-style-type: none"> • no-advertise—Routes containing this community name are not advertised to other BGP peers. • no-export—Routes containing this community name are not advertised outside a BGP confederation boundary. • no-export-subconfed—Routes containing this community are advertised to IBGP peers with the same AS number, but not to members of other confederations.



NOTE: Extended community attributes are not supported at the [edit routing-options] hierarchy level. You must configure extended communities at the [edit policy-options] hierarchy level. For information about configuring extended communities, see the *Routing Policy Feature Guide for Routing Devices*.

Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
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Related Documentation	<ul style="list-style-type: none">• Examples: Configuring Static Routes on page 9• Example: Summarizing Routes Through Route Aggregation on page 82• Example: Conditionally Generating Static Routes on page 88• aggregate on page 163• generate on page 196• static on page 258
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confederation

Syntax	<code>confederation <i>confederation-autonomous-system</i> members [<i>autonomous-systems</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	<p>Specify the routing device's confederation AS number.</p> <p>If you administer multiple ASs that contain a very large number of BGP systems, you can group them into one or more <i>confederations</i>. Each confederation is identified by its own AS number, which is called a <i>confederation AS number</i>. To external ASs, a confederation appears to be a single AS. Thus, the internal topology of the ASs making up the confederation is hidden.</p> <p>The BGP path attributes NEXT_HOP, LOCAL_PREF, and MULTI_EXIT_DISC, which normally are restricted to a single AS, are allowed to be propagated throughout the ASs that are members of the same confederation.</p> <p>Because each confederation is treated as if it were a single AS, you can apply the same routing policy to all the ASs that make up the confederation.</p> <p>Grouping ASs into confederations reduces the number of BGP connections required to interconnect ASs.</p> <p>If you are using BGP, you can enable the local routing device to participate as a member of an AS confederation. To do this, include the confederation statement.</p> <p>Specify the AS confederation identifier, along with the peer AS numbers that are members of the confederation.</p> <p>Note that peer adjacencies do not form if two BGP neighbors disagree about whether an adjacency falls within a particular confederation.</p>
Options	<p><i>autonomous-systems</i>—AS numbers of the confederation members. Range: 1 through 65,535</p> <p><i>confederation-autonomous-system</i>—Confederation AS number. Use one of the numbers assigned to you by the NIC. Range: 1 through 65,535</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>

Related Documentation • *Example: Configuring BGP Confederations*


destination-networks

Syntax	<code>destination-networks prefix;</code>
Hierarchy Level	<code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options dynamic-tunnels <i>tunnel-name</i>],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-options dynamic-tunnels <i>tunnel-name</i> rsvp-te entry],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-options dynamic-tunnels <i>tunnel-name</i>],</code> <code>[edit routing-instances <i>routing-instance-name</i> routing-options dynamic-tunnels <i>tunnel-name</i>],</code> <code>[edit routing-instances <i>routing-instance-name</i> routing-options dynamic-tunnels <i>tunnel-name</i> rsvp-te entry],</code> <code>[edit routing-options dynamic-tunnels <i>tunnel-name</i>],</code> <code>[edit routing-options dynamic-tunnels <i>tunnel-name</i> rsvp-te entry]</code>
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Specify the IPv4 prefix range for the destination network. Only tunnels within the specified IPv4 prefix range can be created.
Options	<i>prefix</i> —Destination prefix of the network.
Required Privilege Level	<code>routing</code> —To view this statement in the configuration. <code>routing-control</code> —To add this statement to the configuration.
Related Documentation	• <i>Configuring GRE Tunnels for Layer 3 VPNs</i> • <i>Configuring Dynamic Tunnels</i> • <i>Configuring RSVP Automatic Mesh</i>

disable (Routing Options)

Syntax	disable;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options graceful-restart], [edit logical-systems <i>logical-system-name</i> routing-options graceful-restart], [edit routing-instances <i>routing-instance-name</i> routing-options graceful-restart], [edit routing-options graceful-restart]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Disable graceful restart.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Junos OS High Availability Library for Routing Devices</i>

discard

Syntax	discard;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options (aggregate generate) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options (aggregate generate) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options (aggregate generate) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)],</p> <p>[edit routing-options (aggregate generate) (defaults route)],</p> <p>[edit routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Do not forward packets addressed to this destination. Instead, drop the packets, do not send ICMP unreachable messages to the packets' originators, and install a reject route for this destination into the routing table.</p> <p>To propagate static routes into the routing protocols, include the discard statement when you define the route, along with a routing policy.</p>
	<p> NOTE: In other vendors' software, a common way to propagate static routes into routing protocols is to configure the routes so that the next-hop routing device is the loopback address (commonly, 127.0.0.1). However, configuring static routes in this way (by including a statement such as <code>route <i>address/mask-length</i> next-hop 127.0.0.1</code>) does not propagate the static routes, because the forwarding table ignores static routes whose next-hop routing device is the loopback address.</p>
Default	When an aggregate route becomes active, it is installed in the routing table with a reject next hop, which means that ICMP unreachable messages are sent.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Summarizing Routes Through Route Aggregation on page 82 • Example: Conditionally Generating Static Routes on page 88

- [aggregate on page 163](#)
- [generate on page 196](#)

dynamic-tunnels

Syntax	<pre>dynamic-tunnels <i>tunnel-name</i> { destination-networks <i>prefix</i>; gre; rsvp-te <i>entry-name</i> { destination-networks <i>network-prefix</i>; label-switched-path-template { default-template; <i>template-name</i>; } } source-address <i>address</i>; }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-options]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	Configure a dynamic tunnel between two PE routers.
Options	<p><i>tunnel-name</i>—Name of the dynamic tunnel.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Example: Configuring a Two-Tiered Virtualized Data Center for Large Enterprise Networks</i> • <i>Configuring GRE Tunnels for Layer 3 VPNs</i> • <i>Configuring Dynamic Tunnels</i>

export (Routing Options)

Syntax	<code>export [<i>policy-name</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options forwarding-table], [edit logical-systems <i>logical-system-name</i> routing-options forwarding-table], [edit routing-instances <i>routing-instance-name</i> routing-options forwarding-table], [edit routing-options forwarding-table]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	<p>Apply one or more policies to routes being exported from the routing table into the forwarding table.</p> <p>In the export statement, list the name of the routing policy to be evaluated when routes are being exported from the routing table into the forwarding table. Only active routes are exported from the routing table.</p> <p>You can reference the same routing policy one or more times in the same or a different export statement.</p> <p>You can apply export policies to routes being exported from the routing table into the forwarding table for the following features:</p> <ul style="list-style-type: none">• Per-packet load balancing• Class of service (CoS)
Options	<i>policy-name</i> —Name of one or more policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Example: Load Balancing BGP Traffic</i>• <i>Routing Policy Feature Guide for Routing Devices</i>• <i>How a Routing Policy Is Evaluated</i>

export-rib

Syntax	<code>export-rib <i>routing-table-name</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib-groups <i>group-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options rib-groups <i>group-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options rib-groups <i>group-name</i>], [edit routing-options rib-groups <i>group-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 11.3 for the QFX Series. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Specify the name of the routing table from which Junos OS should export routing information. For any individual RIB group, only one table can be specified in the export-rib statement.

The **export-rib** statement specifies the source table from which routing information is advertised.

One common use of the **export-rib** statement is interdomain routing. The export RIB is the table used when BGP extracts routes to advertise to peers. In multicast interdomain routing, for example, the export RIB is likely to be inet.2.

Another use of **export-rib** is dynamic route leaking between the global routing table (inet.0) and a VRF routing table (*instance.inet.0*). For example, you can use a RIB group to copy routes learned in the VRF into the global routing table, inet.0, or copy routes learned in inet.0 into a VRF. You define the use of this RIB group in the VRF's BGP configuration. In a routing policy you can do dynamic filtering of routes. For instance, you can use an import policy to only copy routes with certain communities into the global routing table.

For example:

```
rib-groups {
  rib-interface-routes-v4 {
    import-rib [ inet.0 VRF.inet.0 ];
  }
  rib-import-VRF-routes-to-inet0-v4 {
    export-rib VRF.inet.0;
    import-rib [ VRF.inet.0 inet.0 ];
    import-policy rib-import-VRF-routes-to-inet0-v4;
  }
  rib-import-inet0-routes-to-VRF-v4 {
    export-rib inet.0;
    import-rib [ inet.0 VRF.inet.0 ];
    import-policy rib-import-inet0-routes-to-VRF-v4;
  }
}
routing-options {
  interface-routes {
    rib-group {
```

```

        inet rib-interface-routes-v4;
    }
}
protocols {
    bgp {
        group iBGP-peers {
            type internal;
            family inet {
                unicast {
                    rib-group rib-import-inet0-routes-to-VRF-v4;
                }
            }
        }
    }
}
routing-instances {
    VRF {
        routing-options {
            interface-routes {
                rib-group {
                    inet rib-interface-routes-v4;
                }
            }
        }
        protocols {
            bgp {
                group peersin-VRF {
                    family inet {
                        unicast {
                            rib-group rib-import-VRF-routes-to-inet0-v4;
                        }
                    }
                }
            }
        }
    }
}
}

```

Options *routing-table-name*—Routing table group name.

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

- Related Documentation**
- [Example: Exporting Specific Routes from One Routing Table Into Another Routing Table on page 46](#)
 - *Example: Configuring a PIM RPF Routing Table*
 - *Example: Configuring DVMRP to Announce Unicast Routes*
 - *Example: Configuring a Dedicated PIM RPF Routing Table*
 - *Example: Configuring Any-Source Multicast for Draft-Rosen VPNs*
 - [import-rib on page 201](#)
 - [passive on page 228](#)

fate-sharing

Syntax	<pre>fate-sharing { group <i>group-name</i> { cost <i>value</i>; from <i>address</i> <to <i>address</i>>; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options], [edit routing-options], [edit routing-instances <i>routing-instance-name</i> routing-options]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	<p>Specify a backup path in case the primary path becomes unusable.</p> <p>You specify one or more objects with common characteristics within a group. All objects are treated as /32 host addresses. The objects can be a LAN interface, a router ID, or a point-to-point link. Sequence is insignificant.</p> <p>Changing the fate-sharing database does not affect existing established LSPs until the next CSPF reoptimization. The fate-sharing database does affect fast-reroute detour path computations.</p>
Options	<p>cost <i>value</i>—Cost assigned to the group. Range: 1 through 65,535 Default: 1</p> <p>from <i>address</i>—Address of the router or address of the LAN/NBMA interface. For example, an Ethernet network with four hosts in the same fate-sharing group would require you to list all four of the separate from addresses in the group.</p> <p>group <i>group-name</i>—Each fate-sharing group must have a name, which can have a maximum of 32 characters, including letters, numbers, periods (.), and hyphens (-). You can define up to 512 groups.</p> <p>to <i>address</i>—(Optional) Address of egress router. For point-to-point link objects, you must specify both a from and a to address.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">Configuring the Ingress Router for MPLS-Signaled LSPsJunos OS MPLS Applications Library for Routing Devices

filter

Syntax	filter { input <i>filter-name</i> ; }
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i>], [edit routing-options rib <i>routing-table-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Specify the name of the routing table from which Junos OS should export routing information.
Options	input <i>filter-name</i> —Forwarding table filter name.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Configuring Forwarding Table Filters</i> • <i>Applying Filters to Forwarding Tables</i>

firewall-install-disable

Syntax	firewall-install-disable;
Hierarchy Level	[edit routing-options flow], [edit logical-systems <i>logical-system-name</i> routing-options flow], [edit routing-instances <i>routing-instance-name</i> routing-options flow], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options flow]
Release Information	Statement introduced in Junos OS Releases 12.1X48 and 12.3.
Description	Disable installing flow-specification firewall filters in the firewall process (dfwd).
Default	If you omit the firewall-install-disable statement, the default behavior is firewall-install-disable mode.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Example: Configuring Flow Routes</i>

flow

Syntax	<pre> flow { route <i>name</i> { match { <i>match-conditions</i>; } term-order (legacy standard); then { <i>actions</i>; } } firewall-install-disable; term-order (legacy standard); validation { traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; } } } </pre>
Hierarchy Level	<p>[edit routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>term-order statement introduced in Junos OS Release 10.0</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>firewall-install-disable statement introduced in Junos OS Releases 12.1X48 and 12.3 for PTX Series routers.</p>
Description	Configure a flow route.
Default	legacy
Options	<p>actions—An action to take if conditions match.</p> <p>firewall-install-disable—(PTX Series routers only) Disable installing flow-specification firewall filters in the firewall process (dfwd).</p> <p>Default: If you omit the firewall-install-disable statement, the default behavior is firewall-install-disable mode.</p> <p>match-conditions—Match packets to these conditions.</p> <p>route <i>name</i>—Name of the flow route.</p> <p>standard—Specify to use version 7 or later of the flow-specification algorithm.</p>

term-order (legacy | standard)—Specify the version of the flow-specification algorithm.

- **legacy**—Use version 6 of the flow-specification algorithm.
- **standard**—Use version 7 of the flow-specification algorithm.

then—Actions to take on matching packets.

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	<ul style="list-style-type: none">• <i>Example: Configuring Flow Routes</i>

forwarding-table

```
Syntax forwarding-table {
    chained-composite-next-hop {
        ingress {
            l2ckt;
            l2vpn;
            l3vpn {
                extended-space;
            }
            labeled-bgp {
                inet6;
            }
            no-l2ckt;
            no-l2vpn;
        }
        transit {
            l2vpn;
            l3vpn;
            labeled-bgp;
            ldp;
            ldp-p2mp;
            no-l2vpn;
            no-l3vpn;
            no-ldp;
            no-ldp-p2mp;
            no-rsvp;
            no-rsvp-p2mp;
            no-static;
            rsvp;
            rsvp-p2mp;
            static;
        }
    }
    export [ policy-name ];
    (indirect-next-hop | no-indirect-next-hop);
    (indirect-next-hop-change-acknowledgements |
    no-indirect-next-hop-change-acknowledgements);
    krt-nexthop-ack-timeout interval;
    unicast-reverse-path (active-paths | feasible-paths);
}
```

Hierarchy Level [edit logical-systems *logical-system-name* **routing-options**],
[edit **routing-options**]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.3 for the QFX Series.

Description Configure information about the routing device's forwarding table.

The remaining statements are explained separately.

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

Related • *Example: Load Balancing BGP Traffic*
Documentation

[full](#)

See [brief](#)

generate

Syntax	<pre> generate { defaults { generate-options; } route destination-prefix { policy policy-name; generate-options; } } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i>],</p> <p>[edit routing-options],</p> <p>[edit routing-options rib <i>routing-table-name</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure generated routes, which are used as routes of last resort.
Options	<p>defaults—(Optional) Specify global generated route options. These options only set default attributes inherited by all newly created generated routes. These are treated as global defaults and apply to all the generated routes you configure in the generate statement.</p> <p>generate-options—Additional information about generated routes, which is included with the route when it is installed in the routing table. Specify zero or more of the following options in generate-options. Each option is explained separately.</p> <ul style="list-style-type: none"> • (active passive); • as-path <i><as-path></i> <i><origin (egp igp incomplete)></i> <i><atomic-aggregate></i> <i><aggregator as-number in-address></i>; • (brief full); • community [<i>community-ids</i>]; • discard; • (metric <i>metric2</i> <i>metric3</i> <i>metric4</i>) <i>value</i> <i><type type></i>; • (preference <i>preference2</i> color <i>color2</i>) <i>preference</i> <i><type type></i>; • tag <i>metric type number</i>; <p>route destination-prefix—Configure a non-default generated route:</p> <ul style="list-style-type: none"> • default—For the default route to the destination. This is equivalent to specifying an IP address of 0.0.0.0/0.

- *destination-prefix/prefix-length—/destination-prefix* is the network portion of the IP address, and *prefix-length* is the destination prefix length.

The [policy](#) 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	<ul style="list-style-type: none">• Example: Conditionally Generating Static Routes on page 88

graceful-restart (Enabling Globally)

Syntax	<pre>graceful-restart { disable; helper-disable; maximum-helper-recovery-time <i>seconds</i>; maximum-helper-restart-time <i>seconds</i>; notify-duration <i>seconds</i>; recovery-time <i>seconds</i>; restart-duration <i>seconds</i>; stale-routes-time <i>seconds</i>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options], [edit routing-options], [edit routing-instances <i>routing-instance-name</i> routing-options]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure graceful restart globally to enable the feature. You cannot enable graceful restart for specific protocols unless graceful restart is also enabled globally. You can, optionally, modify the global settings at the individual protocol level.

**NOTE:**

- For VPNs, the **graceful-restart** statement allows a router whose VPN control plane is undergoing a restart to continue to forward traffic while recovering its state from neighboring routers.
 - For BGP, if you configure graceful restart after a BGP session has been established, the BGP session restarts and the peers negotiate graceful restart capabilities.
 - LDP sessions flap when **graceful-restart** configurations change.
-

Default	Graceful restart is disabled by default.
Options	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	<ul style="list-style-type: none">• <i>Enabling Graceful Restart</i>• <i>Configuring Routing Protocols Graceful Restart</i>

- *Configuring Graceful Restart for MPLS-Related Protocols*
- *Configuring VPN Graceful Restart*
- *Configuring Logical System Graceful Restart*
- *Graceful Restart Configuration Statements*
- *Configuring Graceful Restart for QFabric Systems*

import (Routing Options)

Syntax	<code>import [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options resolution rib], [edit logical-systems <i>logical-system-name</i> routing-options resolution rib], [edit routing-instances <i>routing-instance-name</i> routing-options resolution rib], [edit routing-options resolution rib]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Specify one or more import policies to use for route resolution.
Options	<i>policy-names</i> —Name of one or more import policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Example: Configuring Route Resolution on PE Routers</i>

import-policy


Syntax	<code>import-policy [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib-groups <i>group-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options rib-groups <i>group-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options rib-groups <i>group-name</i>], [edit routing-options rib-groups <i>group-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Apply one or more policies to routes imported into the routing table group. The import-policy statement complements the import-rib statement and cannot be used unless you first specify the routing tables to which routes are being imported.




NOTE: On EX Series switches, only dynamically learned routes can be imported from one routing table group to another.

Options	<i>policy-names</i> —Name of one or more policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Exporting Specific Routes from One Routing Table Into Another Routing Table on page 46• export-rib on page 187• passive on page 228


import-rib

Syntax	<code>import-rib [<i>routing-table-names</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib-groups <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib-groups <i>group-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib-groups <i>group-name</i>],</p> <p>[edit routing-options rib-groups <i>group-name</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Specify the name of the routing table into which Junos OS should import routing information. The first routing table name you enter is the primary routing table. Any additional names you enter identify secondary routing tables. When a protocol imports routes, it imports them into the primary and any secondary routing tables. If the primary route is deleted, the secondary route also is deleted. For IPv4 import routing tables, the primary routing table must be inet.0 or routing-instance-name.inet.0. For IPv6 import routing tables, the primary routing table must be inet6.0.</p> <p>In Junos OS Release 9.5 and later, you can configure an IPv4 import routing table that includes both IPv4 and IPv6 routing tables. Including both types of routing tables permits you, for example, to populate an IPv6 routing table with IPv6 addresses that are compatible with IPv4. In releases prior to Junos OS Release 9.5, you could configure an import routing table with only either IPv4 or IPv6 routing tables.</p>
<div>  <p>NOTE: On EX Series switches, only dynamically learned routes can be imported from one routing table group to another.</p> </div>	
Options	<i>routing-table-names</i> —Name of one or more routing tables.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Exporting Specific Routes from One Routing Table Into Another Routing Table on page 46 • export-rib on page 187 • passive on page 228

independent-domain

Syntax	<code>independent-domain <no-attrset>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options autonomous-system <i>autonomous-system</i>], [edit routing-instances <i>routing-instance-name</i> routing-options autonomous-system <i>autonomous-system</i>]
Release Information	Statement introduced before Junos OS Release 7.4. no-attrset option introduced in Junos OS Release 10.4.
Description	<p>Configure an independent AS domain.</p> <p>The independent domain uses transitive path attribute 128 (attribute set) messages to tunnel the independent domain's BGP attributes through the internal BGP (IBGP) core.</p> <p>This improves the transparency of Layer 3 VPN services for customer networks by preventing the IBGP routes that originate within an autonomous system (AS) in the customer network from being sent to a service provider's AS. Similarly, IBGP routes that originate within an AS in the service provider's network are prevented from being sent to a customer AS.</p>
	<div> NOTE: In Junos OS Release 10.3 and later, if BGP receives attribute 128 and you have not configured an independent domain in any routing instance, BGP treats the received attribute 128 as an unknown attribute.</div>
Options	no-attrset —(Optional) Disables attribute set messages on the independent AS domain.
Required Privilege Level	routing —To view this statement in the configuration. routing-control —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Example: Tunneling Layer 3 VPN IPv6 Islands over an IPv4 Core Using IBGP and Independent Domains</i>• <i>Configuring Layer 3 VPNs to Carry IBGP Traffic</i>• autonomous-system on page 169

indirect-next-hop

Syntax	(indirect-next-hop no-indirect-next-hop);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options forwarding-table], [edit routing-options forwarding-table]
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Enable indirectly connected next hops for route convergence. This statement is implemented on the Packet Forward Engine to speed up forwarding information base (FIB) updates. Configuring this statement significantly speeds convergence times. The only downside of configuring this statement is that some additional FIB memory overhead is required. Unless routes have an extremely high number of next hops, this increased memory usage should not be noticeable.
<div>  <p>NOTE: When virtual private LAN service (VPLS) is configured on the routing device, the <code>indirect-next-hop</code> statement is configurable at the [edit routing-options forwarding-table] hierarchy level. However, this configuration is not applicable to indirect nexthops specific to VPLS routing instances.</p> </div>	
Default	Disabled.
Options	<code>indirect-next-hop</code> —Enable indirectly connected next hops. <code>no-indirect-next-hop</code> —Explicitly disable indirect next hops.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Optimizing Route Reconvergence by Enabling Indirect Next Hops on the Packet Forwarding Engine on page 124

indirect-next-hop-change-acknowledgements

Syntax	(indirect-next-hop-change-acknowledgements no-indirect-next-hop-change-acknowledgements);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options forwarding-table], [edit routing-options forwarding-table]
Release Information	Statement introduced in Junos OS Release 12.2.
Description	<p>Configure the routing protocol process (rpd) to request an acknowledgement when creating a new forwarding next hop.</p> <p>During an indirect next-hop change sequence, the routing device might create a new forwarding next hop that is referenced by the indirect next hop. If the indirect-next-hop-change-acknowledgements statement is configured, the routing protocol process requests an acknowledgement when creating the new forwarding next hop. When the routing protocol process receives the acknowledgement, this indicates that all PICs have received the new forwarding next hop and it is then safe to change the indirect next hop to reference the new forwarding next hop. This prevents packet loss when changing the indirect next hop by ensuring that all PICs have consistent state information for the new forwarding next hop.</p> <p>The routing protocol process is not requesting an acknowledgement for the indirect next hop itself. Rather, the routing protocol process is requesting an acknowledgement for the new forwarding next hop that the indirect next hop is going to reference. In the case when the forwarding next hop is an existing one (meaning that it is already installed in the forwarding table), the routing protocol process does not request an acknowledgement, even if the indirect-next-hop-change-acknowledgements statement is configured.</p> <p>We recommend that the indirect-next-hop-change-acknowledgements statement be configured when protection mechanisms are being used. This includes MPLS RSVP protection such as fast reroute (FRR) as well as interior gateway protocol (IGP) loop-free alternate (LFA) link or node protection. If there is no protection mechanism being used in the network, the indirect-next-hop-change-acknowledgements statement does not provide any benefit and might increase packet loss.</p>
Default	Disabled by default in all platforms except PTX Series, where it is enabled by default.
Options	indirect-next-hop-change-acknowledgements —Enable acknowledgements. no-indirect-next-hop-change-acknowledgements —Explicitly disable acknowledgements.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Optimizing Route Reconvergence by Enabling Indirect Next Hops on the Packet Forwarding Engine on page 124• krt-nexthop-ack-timeout on page 211

input (Routing Options RIB)

Syntax	<code>input <i>filter-name</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> filter], [edit routing-options rib <i>routing-table-name</i> filter]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Specify the name of the input filter.
Options	<i>filter-name</i> —Name of the input filter.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Configuring Forwarding Table Filters</i>• <i>Applying Filters to Forwarding Tables</i>

install (Routing Options)

Syntax	(install no-install);
Hierarchy Level	<pre>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options static (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-options static (defaults route)], [edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)], [edit routing-instances <i>routing-instance-name</i> routing-options static (defaults route)], [edit routing-options rib <i>routing-table-name</i> static (defaults route)] [edit routing-options static (defaults route)]</pre>
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure whether Junos OS installs all static routes into the forwarding table. Even if you configure a route so it is not installed in the forwarding table, the route is still eligible to be exported from the routing table to other protocols.
Options	<p>install—Explicitly install all static routes into the forwarding table. Include this statement when configuring an individual route in the route portion of the static statement to override a no-install option specified in the defaults portion of the statement.</p> <p>no-install—Do not install the route into the forwarding table, even if it is the route with the lowest preference.</p> <p>Default: install</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Examples: Configuring Static Routes on page 9• static on page 258

instance-export

Syntax	<code>instance-export [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options], [edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-instances <i>routing-instance-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches.
Description	Apply one or more policies to routes being exported from a routing instance.
Options	<i>policy-names</i> —Name of one or more export policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Routing Policy Feature Guide for Routing Devices</i>


instance-import

Syntax	<code>instance-import [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options], [edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-instances <i>routing-instance-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches.
Description	Apply one or more policies to routes being imported into a routing instance.
Options	<i>policy-names</i> —Name of one or more import policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Routing Policy Feature Guide for Routing Devices</i>

interface (Multicast Static Routes)

Syntax	<pre>interface <i>interface-names</i> { disable; maximum-bandwidth <i>bps</i>; no-qos-adjust; reverse-oif-mapping { no-qos-adjust; } subscriber-leave-timer <i>seconds</i>; }</pre>
Hierarchy Level	<pre>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast]</pre>
Release Information	<p>Statement introduced in Junos OS Release 8.1.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Enable multicast traffic on an interface.</p> <p>By default, multicast packets are forwarded by enabling Protocol Independent Multicast (PIM) on an interface. PIM adds multicast routes into the routing table.</p> <p>You can also configure multicast packets to be forwarded over a static route, such as a static route associated with an LSP next hop. Multicast packets are accepted on an interface and forwarded over a static route in the forwarding table. This is useful when you want to enable multicast traffic on a specific interface without configuring PIM on the interface.</p> <p>You cannot enable multicast traffic on an interface and configure PIM on the same interface simultaneously.</p> <p>Static routes must be configured before you can enable multicast on an interface. Configuring the interface statement alone does not install any routes into the routing table. This feature relies on the static route configuration.</p>
Options	<p><i>interface-names</i>—Name of one or more interfaces on which to enable multicast traffic.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">• <i>Example: Defining Interface Bandwidth Maximums</i>• <i>Example: Configuring Multicast with Subscriber VLANs</i>

interface (Multicast Scoping)

Syntax	<code>interface [<i>interface-names</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast scope <i>scope-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast scope <i>scope-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast scope <i>scope-name</i>],</p> <p>[edit routing-options multicast scope <i>scope-name</i>]</p>
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Configure the set of interfaces for multicast scoping.
Options	<p><i>interface-names</i>—Names of the interfaces on which to configure scoping. Specify the full interface name, including the physical and logical address components. To configure all interfaces, you can specify all.</p>
<div>  <p>NOTE: You cannot apply a scoping policy to a specific routing instance. All scoping policies are applied to all routing instances. However, you can apply the <code>scope</code> statement to a specific routing instance.</p> </div>	
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Examples: Configuring Administrative Scoping</i> • multicast on page 222

interface-routes

Syntax

```
interface-routes {
    family (inet | inet6) {
        export {
            lan;
            point-to-point;
        }
    }
    rib-group group-name;
}
```

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

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.3 for the QFX Series.



NOTE: On EX Series switches, only dynamically learned routes can be imported from one routing table group to another.

Description Associate a routing table group with the routing device's interfaces, and specify routing table groups into which interface routes are imported.

By default, IPv4 interface routes (also called direct routes) are imported into routing table **inet.0**, and IPv6 interface routes are imported into routing table **inet6.0**. If you are configuring alternate routing tables for use by some routing protocols, it might be necessary to import the interface routes into the alternate routing tables. To define the routing tables into which interface routes are imported, you create a routing table group and associate it with the routing device's interfaces.

To create the routing table groups, include the **passive** statement at the **[edit routing-options]** hierarchy level.

If you have configured a routing table, configure the OSPF primary instance at the **[edit protocols ospf]** hierarchy level with the statements needed for your network so that routes are installed in **inet.0** and in the forwarding table. Make sure to include the routing table group.

To export local routes, include the **export** statement.

To export LAN routes, include the **lan** option. To export point-to-point routes, include the **point-to-point** option.

Only local routes on point-to-point interfaces configured with a destination address are exportable.

- Options**
- inet**—Specify the IPv4 address family.
 - inet6**—Specify the IPv6 address family.
 - lan**—Export LAN routes.
 - point-to-point**—Export point-to-point routes.

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: Importing Direct and Static Routes Into a Routing Instance on page 42](#)
 - [Example: Configuring Multiple Routing Instances of OSPF](#)
 - [passive on page 228](#)

krt-nexthop-ack-timeout

Syntax `krt-nexthop-ack-timeout interval;`

Hierarchy Level [edit logical-systems *logical-system-name* routing-options [forwarding-table](#)],
[edit routing-options [forwarding-table](#)]

Release Information Statement introduced in Junos OS Release 12.2.

Description For indirect next-hop and multicast next-hop change acknowledgements, configure the time interval for which to wait for the next-hop acknowledgement. The routing protocol process (rpd) waits for the specified time period before changing the route to point to the new next hop.


If the acknowledgement is not received within the time period, it is assumed to have been received and the route is made to point to the new next hop.

- Options**
- interval**—Kernel next-hop acknowledgement timeout interval.
 - Range:** 1 through 100 seconds
 - Default:** 1 second

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

- Related Documentation**
- [Example: Optimizing Route Reconvergence by Enabling Indirect Next Hops on the Packet Forwarding Engine on page 124](#)
 - [indirect-next-hop-change-acknowledgements on page 204](#)

lsp-next-hop (Static Routes)

Syntax	<code>lsp-next-hop <i>lsp-name</i> { metric <i>metric</i>; preference <i>preference</i>; }</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options static route <i>destination-prefix</i>], [edit logical-systems <i>logical-system-name</i> routing-options static route <i>destination-prefix</i>], [edit routing-instances <i>routing-instance-name</i> routing-options static route <i>destination-prefix</i>] [edit routing-options static route <i>destination-prefix</i>]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Specify an LSP as the next hop for a static route, and configure an independent metric or preference on that next-hop LSP.
<div> NOTE: The preference and metric configured by means of the <code>lsp-next-hop</code> statement only apply to the LSP next hops. The LSP next-hop preference and metric override the route preference and metric (for that specific LSP next hop), similar to how the route preference overrides the default preference and metric (for that specific route).</div>	
Options	<i>lsp-name</i> —Name of the next-hop LSP. 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	<ul style="list-style-type: none">• Example: Configuring an RSVP-Signaled Point-to-Multipoint LSP on page 53

martians

Syntax	<pre>martians { destination-prefix match-type <allow>; }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i>],</p> <p>[edit routing-options],</p> <p>[edit routing-options rib <i>routing-table-name</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure martian addresses.
Options	<p>allow—(Optional) Explicitly allow a subset of a range of addresses that has been disallowed. The allow option is the only supported action.</p> <p>destination-prefix—Destination route you are configuring:</p> <ul style="list-style-type: none"> destination-prefix/prefix-length—destination-prefix is the network portion of the IP address, and prefix-length is the destination prefix length. default—Default route to use when routing packets do not match a network or host in the routing table. This is equivalent to specifying the IP address 0.0.0.0/0. <p>match-type—Criteria that the destination must match:</p> <ul style="list-style-type: none"> exact—Exactly match the route's mask length. longer—The route's mask length is greater than the specified mask length. orlonger—The route's mask length is equal to or greater than the specified mask length. through destination-prefix—The route matches the first prefix, the route matches the second prefix for the number of bits in the route, and the number of bits in the route is less than or equal to the number of bits in the second prefix. upto prefix-length—The route's mask length falls between the two destination prefix lengths, inclusive.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>

- Related Documentation**
- [Example: Configuring Martian Addresses on page 146](#)

maximum-paths

Syntax	<code>maximum-paths <i>path-limit</i> <log-interval <i>seconds</i>> <log-only threshold <i>value</i>>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options], [edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-instances <i>routing-instance-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced in Junos OS Release 8.0. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure a limit for the number of routes installed in a routing table based upon the route path.



NOTE: The `maximum-paths` statement is similar to the `maximum-prefixes` statement. The `maximum-prefixes` statement limits the number of unique destinations in a routing instance. For example, suppose a routing instance has the following routes:

```
OSPF 10.10.10.0/24
ISIS 10.10.10.0/24
```

These are two routes, but only one destination (prefix). The `maximum-paths` limit applies the total number of routes (two). The `maximum-prefixes` limit applies to the total number of unique prefixes (one).

Options	<p><code>log-interval <i>seconds</i></code>—(Optional) Minimum time interval (in seconds) between log messages. Range: 5 through 86,400</p> <p><code>log-only</code>—(Optional) Sets the route limit as an advisory limit. An advisory limit triggers only a warning, and additional routes are not rejected.</p> <p><code><i>path-limit</i></code>—Maximum number of routes. If this limit is reached, a warning is triggered and additional routes are rejected. Range: 1 through 4,294,967,295 ($2^{32} - 1$) Default: No default</p> <p><code>threshold <i>value</i></code>—(Optional) Percentage of the maximum number of routes that starts triggering a warning. You can configure a percentage of the <code><i>path-limit</i></code> value that starts triggering the warnings. Range: 1 through 100</p>
----------------	---



NOTE: When the number of routes reaches the threshold value, routes are still installed into the routing table while warning messages are sent. When the number of routes reaches the *path-limit* value, then additional routes are rejected.

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

Related Documentation	<ul style="list-style-type: none">• <i>Limiting the Number of Paths and Prefixes Accepted from CE Routers in Layer 3 VPNs</i>
------------------------------	---

maximum-prefixes

Syntax	<code>maximum-prefixes <i>prefix-limit</i> <log-interval <i>seconds</i>> <log-only threshold <i>percentage</i>>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options], [edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-instances <i>routing-instance-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced in Junos OS Release 8.0. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure a limit for the number of routes installed in a routing table based upon the route prefix. Using a prefix limit, you can curtail the number of prefixes received from a CE router in a VPN. Prefix limits apply only to dynamic routing protocols and are not applicable to static or interface routes.



NOTE: The `maximum-prefixes` statement is similar to the `maximum-paths` statement. The `maximum-prefixes` statement limits the number of unique destinations in a routing instance. For example, suppose a routing instance has the following routes:

```
OSPF 10.10.10.0/24
ISIS 10.10.10.0/24
```

These are two routes, but only one destination (prefix). The `maximum-paths` limit applies the total number of routes (two). The `maximum-prefixes` limit applies to the total number of unique prefixes (one).

Options	<p><code>log-interval <i>seconds</i></code>—(Optional) Minimum time interval (in seconds) between log messages. Range: 5 through 86,400</p> <p><code>log-only</code>—(Optional) Sets the prefix limit as an advisory limit. An advisory limit triggers only a warning, and additional routes are not rejected.</p> <p><code><i>prefix-limit</i></code>—Maximum number of route prefixes. If this limit is reached, a warning is triggered and any additional routes are rejected. Range: 1 through 4,294,967,295 Default: No default</p> <p><code>threshold <i>value</i></code>—(Optional) Percentage of the maximum number of prefixes that starts triggering a warning. You can configure a percentage of the <code><i>prefix-limit</i></code> value that starts triggering the warnings.</p>
----------------	---

Range: 1 through 100



NOTE: When the number of routes reaches the threshold value, routes are still installed into the routing table while warning messages are sent. When the number of routes reaches the *prefix-limit* value, then additional routes are rejected.

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

Related Documentation

- *Limiting the Number of Paths and Prefixes Accepted from CE Routers in Layer 3 VPNs*

med-igp-update-interval

Syntax med-igp-update-interval *minutes*;

Hierarchy Level [edit routing-options]

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

Description Configure a timer for how long to delay updates for the multiple exit discriminator (MED) path attribute for BGP groups and peers configured with the **metric-out igp offset delay-med-update** statement. The timer delays MED updates for the interval configured unless the MED is lower than the previously advertised attribute or another attribute associated with the route has changed or if the BGP peer is responding to a refresh route request.

Options *minutes*—Interval to delay MED updates.
Range: 10 through 600
Default: 10 minutes

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

Related Documentation

- *Example: Associating the MED Path Attribute with the IGP Metric and Delaying MED Updates*
- *metric-out*

metric

Syntax	<code>metric route-cost;</code>
Hierarchy Level	[edit routing-options access route <i>ip-prefix</i> </prefix-length>]
Release Information	Statement introduced in Junos OS Release 10.1.
Description	Configure the cost for an access route.
Options	<i>route-cost</i> —Specific cost you want to assign to the access route.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Examples: Configuring Static Routes on page 9

metric (Aggregate, Generated, or Static Route)

Syntax	(metric metric2 metric3 metric4) <i>metric</i> <type type>;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options (aggregate generate static) (defaults route)], [edit routing-options (aggregate generate static) (defaults route)]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Specify the metric value for an aggregate, generated, or static route. You can specify up to four metric values, starting with metric (for the first metric value) and continuing with metric2 , metric3 , and metric4 .
Options	metric —Metric value. Range: 0 through 4,294,967,295 ($2^{32} - 1$) type type —(Optional) Type of route. When routes are exported to OSPF, type 1 routes are advertised in type 1 externals, and routes of any other type are advertised in type 2 externals. Note that if a qualified-next-hop metric value is configured, this value overrides the route metric. Range: 1 through 16
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Summarizing Static Routes Through Route Aggregation on page 75• Example: Conditionally Generating Static Routes on page 88• aggregate on page 163• generate on page 196• static on page 258

metric (Qualified Next Hop on Static Route)

Syntax	<code>metric <i>metric</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options static route <i>destination-prefix</i> qualified-next-hop], [edit routing-options static route <i>destination-prefix</i> qualified-next-hop]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Metric value for a static route.
Options	metric —Metric value. Range: 0 through 4,294,967,295 ($2^{32} - 1$)
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• qualified-next-hop on page 234• static on page 258

multicast (Routing Options)

Syntax

```
multicast {
  forwarding-cache {
    threshold suppress value <reuse value>;
  }
  interface interface-name {
    enable;
  }
  scope scope-name {
    interface [ interface-names ];
    prefix destination-prefix;
  }
  ssm-groups {
    address;
  }
}
```

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

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.3 for the QFX Series.
Statement introduced in Junos OS Release 12.3 for ACX Series routers.

Description Configure generic multicast properties.



NOTE: You cannot apply a scoping policy to a specific routing instance. All scoping policies are applied to all routing instances. However, you can apply the `scope` statement to a specific routing instance.

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 Administrative Scoping*
- *Example: Configuring Source-Specific Multicast Groups with Any-Source Override*
- *Examples: Configuring the Multicast Forwarding Cache*
- *Multicast Protocols Feature Guide for Routing Devices*
- ([indirect-next-hop on page 203](#) | no-indirect-next-hop)


next-hop (Access)

Syntax	<code>next-hop <i>next-hop</i>;</code>
Hierarchy Level	[edit routing-options access route <i>ip-prefix</i> </prefix-length>]
Release Information	Statement introduced in Junos OS Release 10.1. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure the next-hop address for an access route. Access routes are typically unnumbered interfaces.
Options	<i>next-hop</i> —Specific next-hop address you want to assign to the access route.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Examples: Configuring Static Routes on page 9

next-hop (Access Internal)

Syntax	<code>next-hop <i>next-hop</i>;</code>
Hierarchy Level	[edit routing-options access-internal route <i>ip-prefix</i> </prefix-length>]
Release Information	Statement introduced in Junos OS Release 10.1. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure the next-hop address for an internal access route. Access routes are typically unnumbered interfaces.
Options	<i>next-hop</i> —Specific next-hop address you want to assign to the internal access route.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Examples: Configuring Static Routes on page 9

no-delegate-processing

Syntax	no-delegate-processing;
Hierarchy Level	[edit routing-options ppm]
Release Information	Statement introduced in Junos OS Release 10.1 for EX Series switches.
Description	<p>Disable distributed periodic packet management (PPM) processing and run all PPM processing on the Routing Engine.</p> <p>PPM processing cannot be completely disabled on EX Series switches. You can only configure whether PPM processing is distributed between the access ports (EX3200 and EX4200 switches) or the line cards (EX8200 switches) and the Routing Engine or is handled just on the Routing Engine.</p>
	<div><p>BEST PRACTICE: Generally, you should only disable distributed PPM if Juniper Networks Customer Service advised you to do so. You should only disable distributed PPM if you have a compelling reason to disable it.</p></div>
Default	Distributed PPM processing is enabled.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Configuring Distributed Periodic Packet Management on an EX Series Switch (CLI Procedure)</i>

nonstop-routing

Syntax	nonstop-routing;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options], [edit routing-instances <i>routing-instance-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 10.4 for EX Series switches. Statement introduced in Junos OS Release 12.3 for ACX Series routers. Statement introduced in Junos OS Release 13.2X51-D20 for QFX Series switches
Description	For routing platforms with two Routing Engines, configure a master Routing Engine to switch over gracefully to a backup Routing Engine and to preserve routing protocol information.
Default	disabled
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Configuring Nonstop Active Routing</i> • <i>Configuring Nonstop Active Routing on EX Series Switches (CLI Procedure)</i> • <i>Example: Configuring Nonstop Active Routing on EX Series Switches</i>

options (Routing Options)

Syntax	<pre>options { syslog (level <i>level</i> upto level <i>level</i>); }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options], [edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-instances <i>routing-instance-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure the types of system logging messages sent about the routing protocols process to the system message logging file. These messages are also displayed on the system console. You can log messages at a particular level, or up to and including a particular level.
Options	<p>level <i>level</i>—Severity of the message. It can be one or more of the following levels, in order of decreasing urgency:</p> <ul style="list-style-type: none">• alert—Conditions that should be corrected immediately, such as a corrupted system database.• critical—Critical conditions, such as hard drive errors.• debug—Software debugging messages.• emergency—Panic or other conditions that cause the system to become unusable.• error—Standard error conditions.• info—Informational messages.• notice—Conditions that are not error conditions, but might warrant special handling.• warning—System warning messages. <p>upto level <i>level</i>—Log all messages up to a particular level.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• syslog in the <i>Junos OS Administration Library for Routing Devices</i>

p2mp-ldp-next-hop

Syntax	<pre>p2mp-ldp-next-hop { root-address <i>root-address</i>{ lsp-id <i>id</i>; } }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options static route <i>destination-prefix</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options static route <i>destination-prefix</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options static route <i>destination-prefix</i>].</p> <p>[edit routing-options static route <i>destination-prefix</i>]</p>
Release Information	Statement introduced in Junos OS Release 13.3.
Description	Specify a point-to-multipoint LDP label-switched path (LSP) as the next hop for a static route, and configure a root and provide an lsp-id on that LDP-signalled label-switched path.
Options	<p>root-address <i>root address</i>— Specify the root address of the point-to-multipoint LSP.</p> <p>lsp-id <i>id</i>— Specify the generic LSP identifier. The range is 1 through 65535.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • [edit <i>routing-options</i>] <i>Hierarchy Level</i>

p2mp-lsp-next-hop

Syntax	<pre>p2mp-lsp-next-hop { metric <i>metric</i>; preference <i>preference</i>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options static route <i>destination-prefix</i>], [edit logical-systems <i>logical-system-name</i> routing-options static route <i>destination-prefix</i>], [edit routing-instances <i>routing-instance-name</i> routing-options static route <i>destination-prefix</i>]. [edit routing-options static route <i>destination-prefix</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Specify a point-to-multipoint LSP as the next hop for a static route, and configure an independent metric or preference on that next-hop LSP. 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	<ul style="list-style-type: none">• <i>Configuring Static LSPs</i>• Example: Configuring an RSVP-Signaled Point-to-Multipoint LSP on page 53• <i>Example: Configuring an RSVP-Signaled Point-to-Multipoint LSP on Logical Systems</i>

passive (Routing Options)

See [active](#)

policy (Aggregate and Generated Routes)

Syntax	<code>policy <i>policy-name</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options (aggregate generate) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options (aggregate generate) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options (aggregate generate) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)],</p> <p>[edit routing-options (aggregate generate) (defaults route)],</p> <p>[edit routing-options rib <i>routing-table-name</i> (aggregate generate) (defaults route)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Associate a routing policy when configuring an aggregate or generated route's destination prefix in the routes part of the aggregate or generate statement. This provides the equivalent of an import routing policy filter for the destination prefix. That is, each potential contributor to an aggregate route, along with any aggregate options, is passed through the policy filter. The policy then can accept or reject the route as a contributor to the aggregate route.</p> <p>If the contributor is accepted, the policy can modify the default preferences. The contributor with the numerically smallest prefix becomes the most preferred, or <i>primary</i>, contributor. A rejected contributor still can contribute to a less specific aggregate route. If you do not specify a policy filter, all candidate routes contribute to an aggregate route.</p> <p>The following algorithm is used to compare two generated contributing routes in order to determine which one is the primary or preferred contributor:</p> <ol style="list-style-type: none"> 1. Compare the protocol's preference of the contributing routes. The lower the preference, the better the route. This is similar to the comparison that is done while determining the best route for the routing table. 2. Compare the protocol's preference2 of the contributing routes. The lower preference2 value is better. If only one route has preference2, then this route is preferred. 3. The preference values are the same. Proceed with a numerical comparison of the prefixes' values. <ol style="list-style-type: none"> a. The primary contributor is the numerically smallest prefix value. b. If the two prefixes are numerically equal, the primary contributor is the route that has the smallest prefix length value.

At this point, the two routes are the same. The primary contributor does not change. An additional next hop is available for the existing primary contributor.

A rejected contributor still can contribute to less specific generated route. If you do not specify a policy filter, all candidate routes contribute to a generated route.

Options *policy-name*—Name of a routing policy.

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

Related Documentation

- [Example: Summarizing Routes Through Route Aggregation on page 82](#)
- [Example: Conditionally Generating Static Routes on page 88](#)
- [aggregate on page 163](#)
- [generate on page 196](#)

ppm

Syntax	<pre>ppm { no-delegate-processing; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-options]
Release Information	<p>Statement introduced in Junos OS Release 9.4.</p> <p>Statement introduced in Junos OS Release 10.2 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>(M120, M320, MX Series, T Series, TX Matrix routers, M7i and M10i routers with Enhanced CFEB [CFEB-E], EX Series switches, and QFX Series only) Disable distributed periodic packet management (PPM) to the Packet Forwarding Engine (on routers), to access ports (on EX3200 and EX4200 switches, and QFX Series), or to line cards (on EX6200 and EX8200 switches).</p> <p>After you disable PPM, PPM processing continues to run on the Routing Engine.</p> <p>In Junos OS Release 8.2, PPM was moved from the Routing Engine to the Packet Forwarding Engine, access ports, or line cards. The no-delegate-processing statement disables the default behavior and restores the legacy behavior.</p>
Default	Distributed PPM processing is enabled for all protocols that use PPM.
Options	no-delegate-processing —Disable PPM to the Packet Forwarding Engine, access ports, or line cards. Distributed PPM is enabled by default.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> <i>Configuring Distributed Periodic Packet Management on an EX Series Switch (CLI Procedure)</i> <i>Configuring Distributed Periodic Packet Management</i> <i>Ensuring That Distributed ppm Is Not Disabled</i>

preference (Routing Options)

Syntax	(<i>preference</i> <i>preference2</i> <i>color</i> <i>color2</i>) <i>preference</i> <type type>;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit routing-options (aggregate generate static) (defaults route)],</p> <p>[edit routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Preference value for a static, aggregate, or generated route. You also can specify a secondary preference value (preference2), as well as colors, which are even finer-grained preference values (color and color2).</p> <p>If the Junos OS routing table contains a dynamic route to a destination that has a better (lower) preference value than the static, aggregate, or generated route, the dynamic route is chosen as the active route and is installed in the forwarding table.</p>
Options	<p>preference—Preference value. A lower number indicates a more preferred route.</p> <p>Range: 0 through 4,294,967,295 ($2^{32} - 1$)</p> <p>Default: 5 (for static routes), 130 (for aggregate and generated routes)</p> <p>type type—(Optional) Type of route.</p> <p>Range: 1 through 16</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Examples: Configuring Static Routes on page 9 • Example: Summarizing Routes Through Route Aggregation on page 82 • Example: Conditionally Generating Static Routes on page 88 • aggregate on page 163 • generate on page 196 • static on page 258

preference (Access)

Syntax	<code>preference route-distance;</code>
Hierarchy Level	[edit routing-options access route <i>ip-prefix</i> </prefix-length>]
Release Information	Statement introduced in Junos OS Release 10.1. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure the distance for an access route.
Options	<i>route-distance</i> —Specific distance you want to assign to the access route.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Examples: Configuring Static Routes on page 9

prefix

Syntax	<code>prefix destination-prefix;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast <i>scope scope-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast <i>scope scope-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast <i>scope scope-name</i>], [edit routing-options multicast <i>scope scope-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure the prefix for multicast scopes.
Options	<i>destination-prefix</i> —Address range for the multicast scope.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Examples: Configuring Administrative Scoping • Example: Creating a Named Scope for Multicast Scoping • <i>multicast</i>

qualified-next-hop (Static Routes)

Syntax `qualified-next-hop (address | interface-name) {
 bfd-liveness-detection {
 authentication {
 algorithm (keyed-md5 | keyed-sha-1 | meticulous-keyed-md5 | meticulous-keyed-sha-1 |
 simple-password);
 key-chain key-chain-name;
 loose-check;
 }
 detection-time {
 threshold milliseconds;
 }
 holddown-interval milliseconds;
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 version (1 | automatic);
 }
 interface interface-name;
 metric metric;
 preference preference;
}`

Hierarchy Level `[edit logical-systems logical-system-name routing-instances routing-instance-name
 routing-options static route destination-prefix],
 [edit logical-systems logical-system-name routing-options rib inet6.0 static route
 destination-prefix],
 [edit logical-systems logical-system-name routing-options static route destination-prefix],
 [edit routing-instances routing-instance-name routing-options static route destination-prefix],
 [edit routing-options rib inet6.0 static route destination-prefix],
 [edit routing-options static route destination-prefix]`

Release Information Statement introduced before Junos OS Release 7.4.
 Statement introduced in Junos OS Release 9.0 for EX Series switches.
 Statement introduced in Junos OS Release 11.3 for the QFX Series.
 Statement introduced in Junos OS Release 12.3 for ACX Series routers.

Description Configure a static route with multiple possible next hops, each of which can have its own preference value, IGP metric that is used when the route is exported into an IGP, and Bidirectional Forwarding Detection (BFD) settings. If multiple links are operational, the one with the most preferred next hop is used. The most preferred next hop is the one with the lowest preference value.

Options *address*—IPv4, IPv6, or ISO network address of the next hop.
interface-name—Name of the interface on which to configure an independent metric or preference for a static route. To configure an unnumbered interface as the next-hop

interface for a static route, specify **qualified-next-hop *interface-name***, where *interface-name* is the name of the IPv4 or IPv6 unnumbered interface.



NOTE: For an Ethernet interface to be configured as the qualified next hop for a static route, it must be an unnumbered interface.

To configure an Ethernet interface as an unnumbered interface, configure the `unnumbered-address <interface-name>` statement at the `[edit interfaces <interface-name> unit <logical-unit-number> family <family-name>]` hierarchy level as described in *Configuring an Unnumbered Interface*.

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	<ul style="list-style-type: none"> • Example: Configuring Static Route Preferences and Qualified Next Hops on page 26 • Example: Enabling BFD on Qualified Next Hops in Static Routes on page 108

qualified-next-hop (Access)

Syntax	<code>qualified-next-hop <i>next-hop</i>;</code>
Hierarchy Level	<code>[edit routing-options access route <i>ip-prefix</i> </prefix-length>]</code>
Release Information	Statement introduced in Junos OS Release 10.1. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure the qualified next-hop address for an access route.
Options	<i>next-hop</i> —Specific qualified next-hop address you want to assign to the access route.
Required Privilege Level	routing—To view this statement in the configuration.
	routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Examples: Configuring Static Routes on page 9


qualified-next-hop (Access-Internal)

Syntax	<code>qualified-next-hop <i>next-hop</i>;</code>
Hierarchy Level	[edit routing-options access-internal route <i>ip-prefix</i> </ <i>prefix-length</i> >]
Release Information	Statement introduced in Junos OS Release 10.1. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure the qualified next-hop address for an internal access route.
Options	<i>next-hop</i> —Specific qualified next-hop address you want to assign to the internal access route.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Examples: Configuring Static Routes on page 9

readvertise

Syntax	(readvertise no-readvertise);
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options static (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options static (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options static (defaults route)],</p> <p>[edit routing-options rib <i>routing-table-name</i> static (defaults route)],</p> <p>[edit routing-options static (defaults route)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	Configure whether static routes are eligible to be readvertised by routing protocols:
Default	Static routes are eligible to be readvertised (that is, exported from the routing table into dynamic routing protocols) if a policy to do so is configured. To mark an IPv4 static route as being ineligible for readvertisement, include the no-readvertise statement.
Options	<p>readvertise—Readvertise static routes. Include the readvertise statement when configuring an individual route in the route portion of the static statement to override a no-readvertise option specified in the defaults portion of the statement.</p> <p>no-readvertise—Mark a static route as being ineligible for readvertisement. Include the no-readvertise option when configuring the route.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Controlling Static Routes in Routing and Forwarding Tables on page 32 • static on page 258

resolution

Syntax	<pre> resolution { rib <i>routing-table-name</i> { import [<i>policy-names</i>]; resolution-ribs [<i>routing-table-names</i>]; } } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-options]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Configure the router to perform custom route resolution on protocol next hops of routes in a certain routing table. The protocol next hop is used to determine the forwarding next-hop.</p> <p>For example, you might want to direct inet.2 route resolution to use topology routing tables :red.inet.0 and :blue.inet.0 for protocol next-hop IP address lookups. Or you might want to direct bgp.l3vpn.0 to use the information in inet.0 to resolve routes, thus overriding the default behavior, which is to use inet.3.</p> <p>You can specify up to two routing tables in the resolution-ribs statement. The route resolution scheme first checks the first-listed routing table for the protocol next-hop address. If the address is found, it uses this entry. If it is not found, the resolution scheme checks second-listed routing table. Hence, only one routing table is used for each protocol nexthop address. For example, if you configure resolution rib bgp.l3vpn.0 resolution-ribs [inet.0 inet.3], inet.0 is checked first and then inet.3 is checked.</p> <div style="border: 1px solid #ccc; padding: 10px; margin-top: 20px;"> <p> NOTE: Customizing route resolution might cause the routing protocol process (rpd) to consume more memory resources than it ordinarily would. When you customize route resolution, we recommend that you check the memory resources by running the show system processes and the show task memory commands. For more information, see “Routing Protocol Process Memory FAQs” on page 430.</p> </div> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>

- Related Documentation**
- *Example: Configuring Route Resolution on PE Routers*
 - *Example: Configuring Route Resolution on Route Reflectors*
 - *Example: Configuring Multitopology Routing Based on a Multicast Source*

resolution-ribs

Syntax	<code>resolution-ribs [<i>routing-table-names</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options resolution rib],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options resolution rib],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options resolution rib],</p> <p>[edit routing-options resolution rib]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Specify one or more routing tables to use for route resolution.</p> <p>This statement enables you to override the default routing tables that Junos OS uses for route resolution. For example, suppose that the resolution routing table is inet.3, but you want to allow fallback resolution through inet.0. One example use case is overriding the bgp.rtarget.0 (family route-target) routing table resolution from using only inet.3 to using both inet.3 and inet.0.</p>
Options	<i>routing-table-names</i> —Name of one or more routing tables.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Example: Configuring Route Resolution on PE Routers</i> • <i>Example: Configuring Multitopology Routing Based on a Multicast Source</i>

resolve

Syntax	resolve;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options static (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-options static (defaults route)], [edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)], [edit routing-instances <i>routing-instance-name</i> routing-options static (defaults route)], [edit routing-options rib <i>routing-table-name</i> static (defaults route)], [edit routing-options static (defaults route)]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Statically configure routes to be resolved to a next hop that is not directly connected. The route is resolved through the inet.0 and inet.3 routing tables.
Default	Static routes can point only to a directly connected next hop.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• static on page 258

restart-duration

Syntax	<code>restart-duration <i>seconds</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols (isis ospf ospf3 pim) graceful-restart],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (ospf ospf3 pim) graceful-restart],</p> <p>[edit protocols (esis isis ospf ospf3 pim) graceful-restart],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols (ospf ospf3 pim) graceful-restart],</p> <p>[edit routing-options graceful-restart]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	<p>Configure the grace period for graceful restart globally.</p> <p>Additionally, you can individually configure the duration of the graceful restart period for the End System-to-Intermediate System (ES-IS), Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), and OSPFv3 protocols and for Protocol Independent Multicast (PIM) sparse mode.</p>
Options	<p><i>seconds</i>—Time for the graceful restart period.</p> <p>Range:</p> <p>The range of values varies according to whether the graceful restart period is being set globally or for a particular protocol:</p> <ul style="list-style-type: none"> • [edit routing-options graceful-restart] (global setting)—120 through 900 • ES-IS—30 through 300 • IS-IS—30 through 300 • OSPF/OSPFv3—1 through 3600 • PIM—30 through 300 <p>Default:</p> <p>The default value varies according to whether the graceful restart period is being set globally or for a particular protocol:</p> <ul style="list-style-type: none"> • [edit routing-options graceful-restart] (global setting)—300 • ES-IS—180 • IS-IS—210 • OSPF/OSPFv3—180 • PIM—60
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>

Related Documentation	<ul style="list-style-type: none">• <i>Enabling Graceful Restart</i>• <i>Configuring Routing Protocols Graceful Restart</i>• <i>Configuring Graceful Restart for MPLS-Related Protocols</i>• <i>Configuring VPN Graceful Restart</i>• <i>Configuring Graceful Restart for VPNs</i>• <i>Configuring Logical System Graceful Restart</i>• <i>Graceful Restart Configuration Statements</i>• <i>Configuring Graceful Restart for QFabric Systems</i>
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restart-duration (Routing Options)

Syntax	<code>restart-duration seconds;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options graceful-restart], [edit logical-systems <i>logical-system-name</i> routing-options graceful-restart], [edit routing-instances <i>routing-instance-name</i> routing-options graceful-restart], [edit routing-options graceful-restart]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches.
Description	Configure the restart timer for graceful restart.
Options	seconds —Configure the time period for the restart to last. Range: 120 through 900 seconds Default: 300 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Junos OS High Availability Library for Routing Devices</i>

retain

Syntax	(no-retain retain);
Hierarchy Level	<pre>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options static (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)], [edit logical-systems <i>logical-system-name</i> routing-options static (defaults route)], [edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> static (defaults route)], [edit routing-instances <i>routing-instance-name</i> routing-options static (defaults route)], [edit routing-options rib <i>routing-table-name</i> static (defaults route)], [edit routing-options static (defaults route)]</pre>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure statically configured routes to be deleted from or retained in the forwarding table when the routing protocol process shuts down normally:
Default	Statically configured routes are deleted from the forwarding table when the routing protocol process shuts down normally. Doing this greatly reduces the time required to restart a system that has a large number of routes in its routing table.
Options	<p>no-retain—Delete statically configured routes from the forwarding table when the routing protocol process shuts down normally. To explicitly specify that routes be deleted from the forwarding table, include the no-retain statement. Include this statement when configuring an individual route in the route portion of the static statement to override a retain option specified in the defaults portion of the statement.</p> <p>retain—Have a static route remain in the forwarding table when the routing protocol process shuts down normally. Doing this greatly reduces the time required to restart a system that has a large number of routes in its routing table.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Examples: Configuring Static Routes on page 9 • static on page 258

rib (General)

```
Syntax  rib routing-table-name {  
        aggregate {  
            defaults {  
                ... aggregate-options ...  
            }  
            route destination-prefix {  
                policy policy-name;  
                ... aggregate-options ...  
            }  
        }  
        generate {  
            defaults {  
                generate-options;  
            }  
            route destination-prefix {  
                policy policy-name;  
                generate-options;  
            }  
        }  
        martians {  
            destination-prefix match-type <allow>;  
        }  
    }  
    static {  
        defaults {  
            static-options;  
        }  
        rib-group group-name;  
        route destination-prefix {  
            next-hop;  
            static-options;  
        }  
    }  
}
```

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

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.3 for the QFX Series.

Description Create a routing table.

Explicitly creating a routing table with ***routing-table-name*** is optional if you are not adding any static, martian, aggregate, or generated routes to the routing table and if you also are creating a routing table group.



NOTE: The IPv4 multicast routing table (`inet.1`) and the IPv6 multicast routing table (`inet6.1`) are not supported for this statement.

Default If you do not specify a routing table name with the *routing-table-name* option, the software uses the default routing tables, which are `inet.0` for unicast routes and `inet.1` for the multicast cache.

Options *routing-table-name*—Name of the routing table, in the following format:
protocol [.identifier].

In a routing instance, the routing table name must include the routing instance name.

For example, if the routing instance name is `link0`, the routing table name might be `link0.inet6.0`.

- *protocol* is the protocol family. It can be `inet6` for the IPv6 family, `inet` for the IPv4 family, `iso` for the ISO protocol family, or *instance-name.iso.0* for an ISO routing instance.
- *identifier* is a positive integer that specifies the instance of the routing table.

Default: `inet.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

- [Example: Creating Routing Tables on page 40](#)
- [passive on page 228](#)

rib (Route Resolution)

Syntax	<pre>rib <i>routing-table-name</i> { import [<i>policy-names</i>]; resolution-ribs [<i>routing-table-names</i>]; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options resolution], [edit logical-systems <i>logical-system-name</i> routing-options resolution], [edit routing-instances <i>routing-instance-name</i> routing-options resolution], [edit routing-options resolution]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Specify a routing table name for route resolution. 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	<ul style="list-style-type: none">• <i>Example: Configuring Route Resolution on PE Routers</i>

rib-group (Routing Options)

Syntax	<code>rib-group group-name;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options interface-routes],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options interface-routes],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> static],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options static],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options interface-routes],</p> <p>[edit routing-options interface-routes],</p> <p>[edit routing-options rib <i>routing-table-name</i> static],</p> <p>[edit routing-options static]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure which routing table groups interface routes are imported into.
Options	<p><i>group-name</i>—Name of the routing table group. The name must start with a letter and can include letters, numbers, and hyphens. It generally does not make sense to specify more than a single routing table group.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Importing Direct and Static Routes Into a Routing Instance on page 42 • Example: Exporting Specific Routes from One Routing Table Into Another Routing Table on page 46 • interface-routes on page 210 • rib-groups on page 248

rib-groups

Syntax	<pre>rib-groups { group-name { export-rib group-name; import-policy [policy-names]; import-rib [group-names]; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	<p>Group one or more routing tables to form a routing table group. A routing protocol can import routes into all the routing tables in the group and can export routes from a single routing table.</p> <p>Each routing table group must contain one or more routing tables that Junos OS uses when importing routes (specified in the import-rib statement) and optionally can contain one routing table group that Junos OS uses when exporting routes to the routing protocols (specified in the export-rib statement).</p> <p>The first routing table you specify is the <i>primary routing table</i>, and any additional routing tables are the <i>secondary routing tables</i>.</p> <p>The primary routing table determines the address family of the routing table group. To configure an IP version 4 (IPv4) routing table group, specify inet.0 as the primary routing table. To configure an IP version 6 (IPv6) routing table group, specify inet6.0 as the primary routing table. If you configure an IPv6 routing table group, the primary and all secondary routing tables must be IPv6 routing tables (inet6.x).</p> <p>In Junos OS Release 9.5 and later, you can include both IPv4 and IPv6 routing tables in an IPv4 import routing table group using the import-rib statement. In releases prior to Junos OS Release 9.5, you can only include either IPv4 or IPv6 routing tables in the same import-rib statement. The ability to configure an import routing table group with both IPv4 and IPv6 routing tables enables you, for example, to populate the inet6.3 routing table with IPv6 addresses that are compatible with IPv4. Specify inet.0 as the primary routing table, and specify inet6.3 as a secondary routing table.</p>



NOTE: On EX Series switches, only dynamically learned routes can be imported from one routing table group to another.



NOTE: If you configure an import routing table group that includes both IPv4 and IPv6 routing tables, any corresponding export routing table group must include only IPv4 routing tables.

If you have configured a routing table, configure the OSPF primary instance at the **[edit protocols ospf]** hierarchy level with the statements needed for your network so that routes are installed in **inet.0** and in the forwarding table. Make sure to include the routing table group. For more information, see *Example: Configuring Multiple Routing Instances of OSPF*.

After specifying the routing table from which to import routes, you can apply one or more policies to control which routes are installed in the routing table group. To apply a policy to routes being imported into the routing table group, include the **import-policy** statement.

Options *group-name*—Name of the routing table group. The name must start with a letter and can include letters, numbers, and hyphens.

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: Exporting Specific Routes from One Routing Table Into Another Routing Table on page 46](#)
- [rib-group on page 247](#)


route (Access)

Syntax	<pre>route <i>ip-prefix</i></prefix-length> { <i>metric route-cost</i>; <i>next-hop next-hop</i>; <i>preference route-distance</i>; <i>qualified-next-hop next-hop</i>; <i>tag tag-number</i>; }</pre>
Hierarchy Level	[edit routing-options access]
Release Information	Statement introduced in Junos OS Release 10.1.
Description	Configure the parameters for access routes.
Options	<p><i>ip-prefix</i></prefix-length>—Specific route prefix that you want to assign to the access route.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Examples: Configuring Static Routes on page 9

route (Access-Internal)

Syntax	<pre>route <i>ip-prefix</i></prefix-length> { <i>next-hop next-hop</i>; <i>qualified-next-hop next-hop</i>; }</pre>
Hierarchy Level	[edit routing-options access-internal]
Release Information	Statement introduced in Junos OS Release 10.1.
Description	Configure the parameters for internal access routes.
Options	<p><i>ip-prefix</i></prefix-length>—Specific route prefix that you want to assign to the internal access route.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Examples: Configuring Static Routes on page 9


route-distinguisher-id

Syntax	<code>route-distinguisher-id <i>ip-address</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches.
Description	<p>Automatically assign a route distinguisher to the routing instance.</p> <p>If you configure the route-distinguisher statement in addition to the route-distinguisher-id statement, the value configured for route-distinguisher supersedes the value generated from route-distinguisher-id.</p>
	<p>.....</p> <div>  <p>NOTE: To avoid a conflict in the two route distinguisher values, it is recommended to ensure that the first half of the route distinguisher obtained by configuring the route-distinguisher statement is different from the first half of the route distinguisher obtained by configuring the route-distinguisher-id statement.</p> </div> <p>.....</p>
Options	<i>ip-address</i> —Address for routing instance.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Example: Configuring BGP Route Target Filtering for VPNs</i> • <i>Configuring Routing Instances on PE Routers in VPNs</i>

route-record

Syntax	route-record;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options], [edit routing-options]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Export the AS path and routing information to the traffic sampling process. Before you can perform flow aggregation, the routing protocol process must export the AS path and routing information to the sampling process.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Enabling Flow Aggregation</i>• <i>Junos OS Services Interfaces Library for Routing Devices</i>

router-id

Syntax	<code>router-id address;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-options]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Specify the routing device's IP address.</p> <p>The router identifier is used by BGP and OSPF to identify the routing device from which a packet originated. The router identifier usually is the IP address of the local routing device. If you do not configure a router identifier, the IP address of the first interface to come online is used. This is usually the loopback interface. Otherwise, the first hardware interface with an IP address is used.</p>
<div>  <p>NOTE: We strongly recommend that you configure the router identifier under the [edit routing-options] hierarchy level to avoid unpredictable behavior if the interface address on a loopback interface changes.</p> </div>	
<p>For more information about the router identifier in OSPF, see <i>Example: Configuring an OSPF Router Identifier</i>.</p>	
Options	<p>address—IP address of the routing device.</p> <p>Default: Address of the first interface encountered by Junos OS</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Examples: Configuring External BGP Peering</i> • <i>Examples: Configuring Internal BGP Peering</i>

routing-options

Syntax	routing-options { ... }
Hierarchy Level	[edit], [edit logical-systems <i>logical-system-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i>], [edit routing-instances <i>routing-instance-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches.
Description	Configure protocol-independent routing properties.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Protocol-Independent Routing Properties Feature Guide for Routing Devices</i>


scope

Syntax	scope <i>scope-name</i> { interface [<i>interface-names</i>]; prefix <i>destination-prefix</i> ; }
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure multicast scoping.
Options	<i>scope-name</i> —Name of the multicast scope. 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	<ul style="list-style-type: none">• <i>Example: Creating a Named Scope for Multicast Scoping</i>

source-address (Routing Options)

Syntax	<code>source-address <i>address</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options dynamic-tunnels <i>tunnel-name</i> , [edit logical-systems <i>logical-system-name</i> routing-options dynamic-tunnels <i>tunnel-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options dynamic-tunnels <i>tunnel-name</i>], [edit routing-options dynamic-tunnels <i>tunnel-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Specify the source address for the generic routing encapsulation (GRE) tunnels. The source address specifies the address used as the source for the local tunnel endpoint. This address can be any local address on the router, typically the router ID or the loopback address.
Options	<i>address</i> —Name of the source address.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Configuring GRE Tunnels for Layer 3 VPNs</i>

source-routing

Syntax	source-routing { (ip ipv6) }
Hierarchy Level	[edit routing-options]
Release Information	Statement for IPv6 introduced in Junos OS Release 8.2. Statement for IPv4 introduced in Junos OS Release 8.5. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	<p>Enable source routing.</p> <p>Source routing allows a sender of a packet to partially or completely specify the route the packet takes through the network. In contrast, in non-source routing protocols, routers in the network determine the path based on the packet's destination.</p> <div> NOTE: We recommend that you not use source routing. Instead, we recommend that you use policy-based routing or filter-based forwarding to route packets based on source addresses.</div>
Default	Disabled
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"><i>Example: Configuring Filter-Based Forwarding on the Source Address</i>

ssm-groups

Syntax	<code>ssm-groups [<i>ip-addresses</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast],</p> <p>[edit routing-options multicast]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Configure source-specific multicast (SSM) groups.</p> <p>By default, the SSM group multicast address is limited to the IP address range from 232.0.0.0 through 232.255.255.255. However, you can extend SSM operations into another Class D range by including the ssm-groups statement in the configuration. The default SSM address range from 232.0.0.0 through 232.255.255.255 cannot be used in the ssm-groups statement. This statement is for adding other multicast addresses to the default SSM group addresses. This statement does not override the default SSM group address range.</p> <p>IGMPv3 supports SSM groups. By utilizing inclusion lists, only sources that are specified send to the SSM group.</p>
Options	<i>ip-addresses</i> —List of one or more additional SSM group addresses separated by a space.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Example: Configuring Source-Specific Multicast Groups with Any-Source Override</i>

static (Routing Options)

```
Syntax  static {
        defaults {
            static-options;
        }
        rib-group group-name;
        route destination-prefix {
            bfd-liveness-detection {
                authentication {
                    algorithm algorithm-name;
                    key-chain key-chain-name;
                    loose-check;
                }
                detection-time {
                    threshold milliseconds;
                }
                local-address ip-address;
                minimum-interval milliseconds;
                minimum-receive-interval milliseconds;
                minimum-receive-ttl number;
                multiplier number;
                neighbor address;
                no-adaptation;
                transmit-interval {
                    threshold milliseconds;
                    minimum-interval milliseconds;
                }
                version (1 | automatic);
            }
            next-hop address;
            next-hop options;
            qualified-next-hop address {
                bfd-liveness-detection {
                    authentication {
                        algorithm (keyed-md5 | keyed-sha-1 | meticulous-keyed-md5 |
                                meticulous-keyed-sha-1 | simple-password);
                        key-chain key-chain-name;
                        loose-check;
                    }
                    detection-time {
                        threshold milliseconds;
                    }
                    holddown-interval milliseconds;
                    minimum-interval milliseconds;
                    minimum-receive-interval milliseconds;
                    multiplier number;
                    no-adaptation;
                    transmit-interval {
                        minimum-interval milliseconds;
                        threshold milliseconds;
                    }
                    version (1 | automatic);
                }
            }
        }
    }
```

```

        metric metric;
        preference preference;
    }
    static-options;
}

```

Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-options],</p> <p>[edit routing-options rib <i>routing-table-name</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Support for BFD authentication introduced in Junos 9.6.</p> <p>Support for BFD authentication introduced in Junos 9.6 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Configure static routes to be installed in the routing table. You can specify any number of routes within a single static statement, and you can specify any number of static options in the configuration.</p>

Options defaults—(Optional) Specify global static route options. These options only set default attributes inherited by all newly created static routes. These are treated as global defaults and apply to all the static routes you configure in the **static** statement.



NOTE: Specifying the global static route options does not create default routes. These options only set default attributes inherited by all newly created static routes.

route—Configure individual static routes. In this part of the **static** statement, you optionally can configure static route options. These options apply to the individual destination only and override any options you configured in the **defaults** part of the **static** statement.

- **destination-prefix/prefix-length—destination-prefix** is the network portion of the IP address, and **prefix-length** is the destination prefix length.

When you configure an individual static route in the **route** part of the **static** statement, specify the destination of the route (in **route destination-prefix**) in one of the following ways:

- **network/mask-length**, where **network** is the network portion of the IP address and **mask-length** is the destination prefix length.
- **default** if this is the default route to the destination. This is equivalent to specifying an IP address of **0.0.0.0/0**.



NOTE: IPv4 packets with a destination of 0.0.0.0 (the obsoleted limited broadcast address) and IPv6 packets with a destination of 0::0 are discarded by default. To forward traffic destined to these addresses, you can add a static route to 0.0.0.0/32 for IPv4 or 0::0/128 for IPv6.

- **nsap-prefix—nsap-prefix** is the network service access point (NSAP) address for ISO.
- **next-hop address**—Reach the next-hop routing device by specifying an IP address, an interface name, or an ISO network entity title (NET).

IPv4 or IPv6 address of the next hop to the destination, specified as:

- IPv4 or IPv6 address of the next hop
- Interface name (for point-to-point interfaces only)
- **address** or **interface-name** to specify an IP address of a multipoint interface or an interface name of a point-to-point interface.



NOTE: If an interface becomes unavailable, all configured static routes on that interface are withdrawn from the routing table.



NOTE: Load balancing is not supported on management and internal Ethernet (fxo) interfaces because this type of interface cannot handle the routing process. On fxp interfaces, you cannot configure multiple next hops and enable load balancing.

next-hop options—Additional information for how to manage forwarding of packets to the next hop.

- **discard**—Do not forward packets addressed to this destination. Instead, drop the packets, do not send ICMP (or ICMPv6) unreachable messages to the packets' originators, and install a reject route for this destination into the routing table.
- **iso-net**—Reach the next-hop routing device by specifying an ISO NSAP.

- **next-table *routing-table-name***—Name of the next routing table to the destination.

If you use the **next-table** action, the configuration must include a term qualifier that specifies a different table than the one specified in the **next-table** action. In other words, the term qualifier in the **from** statement must exclude the table in the **next-table** action. In the following example, the first term contains **rib vrf-customer2.inet.0** as a matching condition. The action specifies a next-hop in a different routing table, **vrf-customer1.inet.0**. The second term does the opposite by using **rib vrf-customer1.inet.0** in the match condition and **vrf-customer2.inet.0** in the **next-table** action.

```
term 1 {
  from {
    protocol bgp;
    rib vrf-customer2.inet.0;
    community customer;
  }
  then {
    next-hop next-table vrf-customer1.inet.0;
  }
}
term 2 {
  from {
    protocol bgp;
    rib vrf-customer1.inet.0;
    community customer;
  }
  then {
    next-hop next-table vrf-customer2.inet.0;
  }
}
```



NOTE: Within a routing instance, you cannot configure a static route with the **next-table inet.0** statement if any static route in the main routing instance is already configured with the **next-table** statement to point to the **inet.0** routing table of the routing instance. For example, if you configure on the main routing instance a static route 192.168.88.88/32 with the **next-table test.inet.0** statement and the routing instance **test** is also configured with a static route 192.168.88.88/32 with the **next-table inet.0** statement, the commit operation fails. Instead, you must configure a routing table group both on the main instance and on the routing instance, which enables you to install the static route into both routing tables.

- **receive**—Install a route for this next-hop destination into the routing table.

The **receive** option forces the packet to be sent to the Routing Engine.

The **receive** option can be useful in the following cases:

- For receiving MPLS packets destined to a VRF instance's loopback address
- For receiving packets on a link's subnet address, with zeros in the host portion of the address
- **reject**—Do not forward packets addressed to this destination. Instead, drop the packets, send ICMP (or ICMPv6) unreachable messages to the packets' originators, and install a reject route for this destination into the routing table.

static-options—(Optional under **route**) Additional information about static routes, which is included with the route when it is installed in the routing table.

You can specify one or more of the following in **static-options**. Each of the options is explained separately.

- (**active** | **passive**);
- **as-path** <as-path> <origin (egp | igp | incomplete)> <atomic-aggregate> <aggregator as-number in-address>;
- **community** [*community-ids*];
- (**install** | **no-install**);
- (**metric** | **metric2** | **metric3** | **metric4**) *value* <type type>;
- (**preference** | **preference2** | **color** | **color2**) *preference* <type type>;
- (**readvertise** | **no-readvertise**);
- (**resolve** | **no-resolve**);
- (**retain** | **no-retain**);
- **tag** *metric type number*;

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 on page 9

tag (Routing Options)

Syntax	<code>tag metric type number;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options (aggregate generate static) (defaults route)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options aggregate generate static) (defaults route)],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)],</p> <p>[edit routing-options (aggregate generate static) (defaults route)],</p> <p>[edit routing-options rib <i>routing-table-name</i> (aggregate generate static) (defaults route)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	Associate a tag with a static, aggregate, or generated route.
Default	No tag strings are associated with routes.
Options	<p><i>metric</i>—Tag metric.</p> <p>Range: 0 through 4,294,967,295</p> <p><i>type number</i>—Tag type.</p> <p>Range: 1 through 16</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Examples: Configuring Static Routes on page 9 • Example: Summarizing Routes Through Route Aggregation on page 82 • Example: Conditionally Generating Static Routes on page 88 • aggregate on page 163 • generate on page 196 • static on page 258

tag (Access)

Syntax	<code>tag tag-number;</code>
Hierarchy Level	[edit routing-options access route <i>ip-prefix</i> </prefix-length>]
Release Information	Statement introduced in Junos OS Release 10.1. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Configure a tag for an access route.
Options	<i>tag-number</i> —Tag number for the access route.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Examples: Configuring Static Routes on page 9

threshold (Multicast Forwarding Cache)

Syntax	<pre>threshold { log-warning <i>value</i>; suppress <i>value</i> <reuse <i>value</i>>; }</pre>
Hierarchy Level	<pre>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast forwarding-cache], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast forwarding-cache family (inet inet6)], [edit logical-systems <i>logical-system-name</i> routing-options multicast forwarding-cache], [edit logical-systems <i>logical-system-name</i> routing-options multicast forwarding-cache family (inet inet6)], [edit routing-instances <i>routing-instance-name</i> routing-options multicast forwarding-cache], [edit routing-instances <i>routing-instance-name</i> routing-options multicast forwarding-cache (inet inet6)], [edit routing-options multicast forwarding-cache], [edit routing-options multicast forwarding-cache family (inet inet6)]</pre>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.2 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Configure the global suppression, reuse, and warning log message thresholds for multicast forwarding cache limits. You can configure the thresholds globally for the multicast forwarding cache or individually for the IPv4 and IPv6 multicast forwarding caches. Configuring the threshold statement globally for the multicast forwarding cache or including the family statement to configure the thresholds for the IPv4 and IPv6 multicast forwarding caches are mutually exclusive.</p> <p>To confirm the configured threshold values, use the show multicast forwarding-cache statistics command.</p>
Options	<p>reuse <i>value</i>—(Optional) Value at which to begin creating new multicast forwarding cache entries. If configured, this number should be less than the suppress value.</p> <p>Range: 1 through 200,000</p> <p>suppress <i>value</i>—Value at which to begin suppressing new multicast forwarding cache entries. This value is mandatory. This number should be greater than the reuse value.</p> <p>Range: 1 through 200,000</p> <p>The remaining statement is explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">• <i>Examples: Configuring the Multicast Forwarding Cache</i>

traceoptions (Routing Options)

Syntax	<pre> traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <disable>; } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast],</p> <p>[edit routing-options],</p> <p>[edit routing-options flow],</p> <p>[edit routing-options multicast]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>nsr-synchronization flag for BGP, IS-IS, LDP, and OSPF added in Junos OS Release 8.4.</p> <p>nsr-synchronization and nsr-packet flags for BFD sessions added in Junos OS Release 8.5.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>nsr-synchronization flag for RIP and RIPng added in Junos OS Release 9.0.</p> <p>nsr-synchronization flag for Layer 2 VPNs and VPLS added in Junos OS Release 9.1.</p> <p>nsr-synchronization flag for PIM added in Junos OS Release 9.3.</p> <p>nsr-synchronization flag for MPLS added in Junos OS Release 10.1.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>nsr-synchronization flag for MSDP added in Junos OS Release 12.1.</p> <p>Statement introduced in Junos OS Release 12.3 for ACX Series routers.</p>
Description	<p>Define tracing operations that track all routing protocol functionality in the routing device.</p> <p>To specify more than one tracing operation, include multiple flag statements.</p>
Default	If you do not include this statement, no global tracing operations are performed.
Options	<p>Values:</p> <p>disable—(Optional) Disable the tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory /var/log. We recommend that you place global routing protocol tracing output in the file routing-log.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named trace-file reaches its maximum size, it is renamed trace-file.0, then trace-file.1, and</p>

so on, until the maximum number of trace files is reached. Then, the oldest trace file is overwritten. Note that if you specify a maximum number of files, you also must specify a maximum file size with the **size** option.

Range: 2 through 1000 files

Default: 10 files

flag flag—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements. These are the global routing protocol tracing options:

- **all**—All tracing operations
- **condition-manager**—Condition-manager events
- **config-internal**—Configuration internals
- **general**—All normal operations and routing table changes (a combination of the **normal** and **route** trace operations)
- **graceful-restart**—Graceful restart operations
- **normal**—All normal operations
- **nsr-packet**—Detailed trace information for BFD nonstop active routing only
- **nsr-synchronization**—Tracing operations for nonstop active routing
- **nsr-synchronization-detail**—(MPLS only) Tracing operations for nonstop active routing in detail
- **parse**—Configuration parsing
- **policy**—Routing policy operations and actions
- **regex-parse**—Regular-expression parsing
- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage

no-world-readable—(Optional) Prevent any user from reading the log file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches this size, it is renamed **trace-file.0**. When the **trace-file** again reaches its maximum size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then, the oldest trace file is overwritten. Note that if you specify a maximum file size, you also must specify a maximum number of trace files with the **files** option.

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 128 KB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	routing and trace—To view this statement in the configuration. routing-control and trace-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Tracing Global Routing Protocol Operations on page 152 • <i>Tracing Nonstop Active Routing Synchronization Events</i>

unicast-reverse-path

Syntax	unicast-reverse-path (active-paths feasible-paths);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-options forwarding-table], [edit routing-instances <i>routing-instance-name</i> instance-type <i>name</i> routing-options forwarding-table], [edit routing-options forwarding-table]
Release Information	Statement introduced before Junos OS Release 7.4. Support for routing instances added in Junos OS Release 8.3. Statement introduced in Junos OS Release 12.3 for ACX Series routers.
Description	Control the operation of unicast reverse-path-forwarding check. This statement enables the RPF check to be used when routing is asymmetrical.
Options	<p>active-paths—Consider only active paths during the unicast reverse-path check.</p> <p>feasible-paths—Consider all feasible paths during the unicast reverse-path check.</p> <p>Default: If you omit the unicast-reverse-path statement, only the active paths to a particular destination are considered.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring Unicast Reverse-Path-Forwarding Check on page 134 • <i>Enabling Unicast Reverse-Path Forwarding Check for VPNs</i>

PART 3

Administration

- [Operational Commands on page 273](#)

CHAPTER 9

Operational Commands

- clear bfd adaptation
- clear bfd session
- show bfd session
- show as-path
- show as-path domain
- show as-path summary
- show interfaces routing summary
- show route
- show route active-path
- show route all
- show route best
- show route brief
- show route cumulative
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- show route exact
- show route export
- show route export vrf-target
- show route forwarding-table interface-name
- show route hidden
- show route inactive-path
- show route instance
- show route label-switched-path
- show route localization
- show route martians
- show route next-hop
- show route protocol
- show route range
- show route resolution

- [show route snooping](#)
- [show route source-gateway](#)
- [show route summary](#)
- [show route table](#)
- [show route terse](#)

clear bfd adaptation

Syntax	clear bfd adaptation <address <i>session-address</i> > <discriminator <i>discr-number</i> >
Release Information	Command introduced before Junos OS Release 7.4.
Description	<p>Clear adaptation for Bidirectional Forwarding Detection (BFD) sessions. BFD is a simple hello mechanism that detects failures in a network. Configured BFD interval timers can change, adapting to network situations. Use this command to return BFD interval timers to their configured values.</p> <p>The clear bfd adaptation command is hitless, meaning that the command does not affect traffic flow on the routing device.</p>
Options	<p>none—Clear adaptation for all BFD sessions.</p> <p>address <i>session-address</i>—(Optional) Clear adaptation for all BFD sessions matching the specified address.</p> <p>discriminator <i>discr-number</i>—(Optional) Clear adaptation for the local BFD session matching the specified discriminator.</p>
Additional Information	For more information, see the description of the bfd-liveness-detection configuration statement in the <i>Junos Routing Protocols Configuration Guide</i> .
Required Privilege Level	clear
List of Sample Output	clear bfd adaptation on page 275
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear bfd adaptation

```
user@host> clear bfd adaptation
```

clear bfd session

Syntax	clear bfd session <address <i>session-address</i> > <discriminator <i>discr-number</i> > <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switch and QFX Series)	clear bfd session <address <i>session-address</i> > <discriminator <i>discr-number</i> >
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 12.1 for the QFX Series.
Description	Drop one or more Bidirectional Forwarding Detection (BFD) sessions.
Options	none —Drop all BFD sessions. address <i>session-address</i> —(Optional) Drop all BFD sessions matching the specified address. discriminator <i>discr-number</i> —(Optional) Drop the local BFD session matching the specified discriminator. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show bfd session on page 277
List of Sample Output	clear bfd session on page 276
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear bfd session

```
user@host> clear bfd session
```


show bfd session

Syntax	<pre>show bfd session <brief detail extensive summary> <address address> <client rsvp-oam (brief detail extensive summary) vpls-oam (brief detail extensive instance instance-name summary)> <discriminator discriminator> <logical-system (all logical-system-name)> <prefix address></pre>
Syntax (EX Series Switch and QFX Series)	<pre>show bfd session <brief detail extensive summary> <address address> <client rsvp-oam (brief detail extensive summary) vpls-oam (brief detail extensive instance instance-name summary)> <discriminator discriminator> <prefix address></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Options discriminator and address introduced in Junos OS Release 8.2.</p> <p>Option prefix introduced in Junos OS Release 9.0.</p> <p>Command introduced in Junos OS Release 12.1 for the QFX Series.</p> <p>Option client introduced in Junos OS Release 12.3R3.</p>
Description	Display information about active Bidirectional Forwarding Detection (BFD) sessions.
Options	<p>none—(Same as brief) Display information about active BFD sessions.</p> <p>brief detail extensive summary—(Optional) Display the specified level of output.</p> <p>address address—(Optional) Display information about the BFD session for the specified neighbor address.</p> <p>client rsvp-oam (brief detail extensive summary) vpls-oam (brief detail extensive instance instance-name summary)—(Optional) Display information about RSVP-OAM or VPLS-OAM BFD sessions in the specified level of output. For VPLS-OAM, display the specified level of output or display information about all of the BFD sessions for the specified VPLS routing instance.</p> <p>discriminator discriminator—(Optional) Display information about the BFD session using the specified local discriminator.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>prefix address—(Optional) Display information about all of the BFD sessions for the specified LDP forwarding equivalence class (FEC).</p>

Required Privilege Level view

- Related Documentation**
- [clear bfd session on page 276](#)
 - [Examples: Configuring BFD for Static Routes on page 99](#)
 - [Example: Configuring BFD for OSPF](#)
 - [Example: Configuring BFD for BGP](#)
 - [Configuring PIM and the Bidirectional Forwarding Detection \(BFD\) Protocol](#)
 - [Example: Configuring BFD for IS-IS](#)

List of Sample Output

- [show bfd session on page 281](#)
- [show bfd session brief on page 282](#)
- [show bfd session detail on page 282](#)
- [show bfd session detail \(with Authentication\) on page 282](#)
- [show bfd session address extensive on page 282](#)
- [show bfd session client rsvp-oam on page 283](#)
- [show bfd session client vpls-oam summary on page 283](#)
- [show bfd session client vpls-oam instance instance-name on page 283](#)
- [show bfd session extensive on page 283](#)
- [show bfd session extensive \(with Authentication\) on page 284](#)
- [show bfd session summary on page 284](#)

Output Fields [Table 4 on page 278](#) describes the output fields for the **show bfd session** command. Output fields are listed in the approximate order in which they appear.

Table 4: show bfd session Output Fields

Field Name	Field Description	Level of Output
Address	Address on which the BFD session is active.	brief detail extensive none
State	State of the BFD session: Up , Down , Init (initializing), or Failing .	brief detail extensive none
Interface	Interface on which the BFD session is active.	brief detail extensive none
Detect Time	Negotiated time interval, in seconds, used to detect BFD control packets.	brief detail extensive none
Transmit Interval	Time interval, in seconds, used by the transmitting system to send BFD control packets.	brief detail extensive none
Multiplier	Negotiated multiplier by which the time interval is multiplied to determine the detection time for the transmitting system.	detail extensive
Session up time	How long a BFD session has been established.	detail extensive

Table 4: show bfd session Output Fields (*continued*)

Field Name	Field Description	Level of Output
Client	Protocol for which the BFD session is active: ISIS , OSPF , or Static .	detail extensive
TX interval	Time interval, in seconds, used by the host system to transmit BFD control packets.	brief detail extensive none
RX interval	Time interval, in seconds, used by the host system to receive BFD control packets.	brief detail extensive none
Authenticate	Indicates that BFD authentication is configured.	detail extensive
keychain	Name of the security authentication keychain being used by a specific client. BFD authentication information for a client is provided in a single line and includes the keychain , algo , and mode parameters. Multiple clients can be configured on a BFD session.	extensive
algo	BFD authentication algorithm being used for a specific client: keyed-md5 , keyed-sha-1 , meticulous-keyed-md5 , meticulous-keyed-sha-1 , or simple-password . BFD authentication information for a client is provided in a single line and includes the keychain , algo , and mode parameters. Multiple clients can be configured on a BFD session.	extensive
mode	Level of BFD authentication enforcement being used by a specific client: strict or loose . Strict enforcement indicates that authentication is configured at both ends of the session (the default). Loose enforcement indicates that one end of the session might not be authenticated. BFD authentication information for a client is provided in a single line and includes the keychain , algo , and mode parameters. Multiple clients can be configured on a BFD session.	extensive
Local diagnostic	Local diagnostic information about failing BFD sessions.	detail extensive
Remote diagnostic	Remote diagnostic information about failing BFD sessions.	detail extensive
Remote state	Reports whether the remote system's BFD packets have been received and whether the remote system is receiving transmitted control packets.	detail extensive
Version	BFD version: 0 or 1 .	extensive
Replicated	The replicated flag appears when nonstop routing or graceful Routing Engine switchover is configured and the BFD session has been replicated to the backup Routing Engine.	detail extensive
Min async interval	Minimum amount of time, in seconds, between asynchronous control packet transmissions across the BFD session.	extensive
Min slow interval	Minimum amount of time, in seconds, between synchronous control packet transmissions across the BFD session.	extensive

Table 4: show bfd session Output Fields (*continued*)

Field Name	Field Description	Level of Output
Adaptive async TX interval	Transmission interval being used because of adaptation.	extensive
RX interval	Minimum required receive interval.	extensive
Local min TX interval	Minimum amount of time, in seconds, between control packet transmissions on the local system.	extensive
Local min RX interval	Minimum amount of time, in seconds, between control packet detections on the local system.	extensive
Remote min TX interval	Minimum amount of time, in seconds, between control packet transmissions on the remote system.	extensive
Remote min RX interval	Minimum amount of time, in seconds, between control packet detections on the remote system.	extensive
Threshold transmission interval	Threshold for notification if the transmission interval increases.	extensive
Threshold for detection time	Threshold for notification if the detection time increases.	extensive
Local discriminator	Authentication code used by the local system to identify that BFD session.	extensive
Remote discriminator	Authentication code used by the remote system to identify that BFD session.	extensive
Echo mode	Information about the state of echo transmissions on the BFD session.	extensive
Prefix	LDP FEC address associated with the BFD session.	All levels
Egress, Destination	Displays the LDP FEC destination address. This field is displayed only on a router at the egress of an LDP FEC, where the BFD session has an LDP Operation, Administration, and Maintenance (OAM) client.	All levels
Remote is control-plane independent	<p>The BFD session on the remote peer is running on its Packet Forwarding Engine. In this case, when the remote node undergoes a graceful restart, the local peer can help the remote peer with the graceful restart.</p> <p>The following BFD sessions are not distributed to the Packet Forwarding Engine: tunnel-encapsulated sessions, and sessions over integrated routing and bridging (IRB) interfaces.</p>	extensive

Table 4: show bfd session Output Fields (*continued*)

Field Name	Field Description	Level of Output
Authentication	<p>Summary status of BFD authentication:</p> <ul style="list-style-type: none"> status—enabled/active indicates authentication is configured and active. enabled/inactive indicates authentication is configured but not active. This only occurs when the remote end of the session does not support authentication and loose checking is configured. keychain—Name of the security authentication keychain associated with the specified BFD session. algo—BFD authentication algorithm being used: keyed-md5, keyed-sha-1, meticulous-keyed-md5, meticulous-keyed-sha-1, or simple-password. mode—Level of BFD authentication enforcement: strict or loose. Strict enforcement indicates authentication is configured at both ends of the session (the default). Loose enforcement indicates that one end of the session might not be authenticated. <p>This information is only shown if BFD authentication is configured.</p>	extensive
Session ID	The BFD session ID number that represents the protection using MPLS fast reroute (FRR) and loop-free alternate (LFA).	detail extensive
sessions	Total number of active BFD sessions.	All levels
clients	Total number of clients that are hosting active BFD sessions.	All levels
Cumulative transmit rate	Total number of BFD control packets transmitted per second on all active sessions.	All levels
Cumulative receive rate	Total number of BFD control packets received per second on all active sessions.	All levels
Multi-hop, min-recv-TTL	Minimum time to live (TTL) accepted if the session is configured for multihop.	extensive
route table	Route table used if the session is configured for multihop.	extensive
local address	<p>Local address of the source used if the session is configured for multihop.</p> <p>The source IP address for outgoing BFD packets from the egress side of an MPLS BFD session is based on the outgoing interface IP address.</p>	extensive

Sample Output

show bfd session

```

user@host> show bfd session

Address          State    Interface    Detect Time    Transmit Interval    Multiplier
10.9.1.33        Up      so-7/1/0.0   0.600         0.200           3
10.9.1.29        Up      ge-4/0/0.0   0.600         0.200           3

2 sessions, 2 clients
Cumulative transmit rate 10.0 pps, cumulative receive rate 10.0 pps

```

show bfd session brief

The output for the **show bfd session brief** command is identical to that for the **show bfd session** command. For sample output, see [show bfd session on page 281](#).

show bfd session detail

```
user@host> show bfd session detail
```

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
10.9.1.33	Up	so-7/1/0.0	0.600	0.200	3
Client OSPF, TX interval 0.200, RX interval 0.200, multiplier 3					
Session up time 3d 00:34					
Local diagnostic None, remote diagnostic None					
Remote state Up, version 1					
Replicated					
10.9.1.29	Up	ge-4/0/0.0	0.600	0.200	3
Client ISIS L2, TX interval 0.200, RX interval 0.200, multiplier 3					
Session up time 3d 00:29, previous down time 00:00:01					
Local diagnostic NbrSignal, remote diagnostic AdminDown					
Remote state Up, version 1					

2 sessions, 2 clients
Cumulative transmit rate 10.0 pps, cumulative receive rate 10.0 pps

show bfd session detail (with Authentication)

```
user@host> show bfd session detail
```

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
10.9.1.33	Up	so-7/1/0.0	0.600	0.200	3
Client OSPF, TX interval 0.200, RX interval 0.200, multiplier 3, Authenticate					
Session up time 3d 00:34					
Local diagnostic None, remote diagnostic None					
Remote state Up, version 1					
Replicated					
10.9.1.29	Up	ge-4/0/0.0	0.600	0.200	3
Client ISIS L2, TX interval 0.200, RX interval 0.200, multiplier 3					
Session up time 3d 00:29, previous down time 00:00:01					
Local diagnostic NbrSignal, remote diagnostic AdminDown					
Remote state Up, version 1					

2 sessions, 2 clients
Cumulative transmit rate 10.0 pps, cumulative receive rate 10.0 pps

show bfd session address extensive

```
user@host> show bfd session 10.255.245.212 extensive
```

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
10.255.245.212	Up		1.200	0.400	3
Client Static, TX interval 0.400, RX interval 0.400, multiplier 3					
Session up time 00:17:03, previous down time 00:00:14					
Local diagnostic CtlExpire, remote diagnostic NbrSignal					
Remote state Up, version 1					
Replicated					
Min async interval 0.400, min slow interval 1.000					
Adaptive async tx interval 0.400, rx interval 0.400					
Local min tx interval 0.400, min rx interval 0.400, multiplier 3					
Remote min tx interval 0.400, min rx interval 0.400, multiplier 3					

Threshold transmission interval 0.000, Threshold for detection time 0.000
 Local discriminator 6, remote discriminator 16
 Echo mode disabled/inactive
 Multi-hop, min-recv-TTL 255, route-table 0, local-address 10.255.245.205

1 sessions, 1 clients
 Cumulative transmit rate 2.5 pps, cumulative receive rate 2.5 pps

show bfd session client rsvp-oam

user@host> show bfd session client rsvp-oam

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
192.168.0.223	Up		540.000	180.000	3

1 Up sessions, 0 Down sessions
 1 sessions, 1 clients
 Cumulative transmit rate 0.0 pps, cumulative receive rate 0.0 pps

show bfd session client vpls-oam summary

user@host> show bfd session client vpls-oam summary

1 Up sessions, 1 Down sessions
 2 sessions, 2 clients
 Cumulative transmit rate 2.0 pps, cumulative receive rate 1.0 pps

show bfd session client vpls-oam instance instance-name

user@host> show bfd session client vpls-oam instance vpls

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
127.0.0.1	Up	ae9.0	3.000	1.000	3

1 Up Sessions, 0 Down Sessions
 1 sessions, 1 clients
 Cumulative transmit rate 1.0 pps, cumulative receive rate 1.0 pps

show bfd session extensive

user@host> show bfd session extensive

10.31.1.2 Up ge-2/1/8.0 0.030 0.010 3
 Client OSPF realm ospf-v2 Area 0.0.0.0, TX interval 0.010, RX interval 0.010
 Session up time 00:10:13
 Local diagnostic None, remote diagnostic None
 Remote state Up, version 1
 Replicated
 Min async interval 0.010, min slow interval 1.000
 Adaptive async TX interval 0.010, RX interval 0.010
 Local min TX interval 0.010, minimum RX interval 0.010, multiplier 3
 Remote min TX interval 0.010, min RX interval 0.010, multiplier 3
 Local discriminator 12, remote discriminator 4
 Echo mode disabled/inactive
 Remote is control-plane independent
 Session ID: 0x201
 Micro-BFD Session

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
10.31.2.2	Up	ge-2/1/4.0	0.030	0.010	3

Client OSPF realm ospf-v2 Area 0.0.0.0, TX interval 0.010, RX interval 0.010

```

Session up time 00:10:14
Local diagnostic None, remote diagnostic NbrSignal
Remote state Up, version 1
Replicated
Min async interval 0.010, min slow interval 1.000
Adaptive async TX interval 0.010, RX interval 0.010
Local min TX interval 0.010, minimum RX interval 0.010, multiplier 3
Remote min TX interval 0.010, min RX interval 0.010, multiplier 3
Local discriminator 13, remote discriminator 5
Echo mode disabled/inactive
Remote is control-plane independent
Session ID: 0x202

```

```

2 sessions, 2 clients
Cumulative transmit rate 200.0 pps, cumulative receive rate 200.0 pps

```

show bfd session extensive (with Authentication)

```

user@host> show bfd session extensive

```

Address	State	Interface	Detect Time	Transmit Interval	Multiplier
192.168.208.26	Up	so-1/0/0.0	2.400	0.800	10

```

Client Static, TX interval 0.600, RX interval 0.600, Authenticate
    keychain bfd, algo keyed-md5, mode loose
Session up time 00:18:07
Local diagnostic None, remote diagnostic NbrSignal
Remote state Up, version 1
Replicated
Min async interval 0.600, min slow interval 1.000
Adaptive async TX interval 0.600, RX interval 0.600
Local min TX interval 0.600, minimum RX interval 0.600, multiplier 10
Remote min TX interval 0.800, min RX interval 0.800, multiplier 3
Local discriminator 2, remote discriminator 3
Echo mode disabled/inactive
Authentication enabled/active, keychain bfd, algo keyed-md5, mode loose

1 sessions, 1 clients
Cumulative transmit rate 1.2 pps, cumulative receive rate 1.2 pps

```

show bfd session summary

```

user@host> show bfd session summary
2 sessions, 2 clients
Cumulative transmit rate 10.0 pps, cumulative receive rate 10.0 pps

```


show as-path

Syntax	show as-path <brief detail> <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	show as-path <brief detail>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	<p>Display the distribution of autonomous system (AS) paths that the local routing device is using (usually through the routing table). Use this command to debug problems for AS paths and to understand how AS paths have been manipulated through a policy (through the as-path-prepend action) or through aggregation.</p> <p>AS paths are stored in a hash table. A hash table is one method for fast lookup. Each entry in the table is called a bucket. Junos OS computes a hash value that indicates in which bucket the AS path is stored. The AS paths are dispersed among the hash buckets so that a manageable number of AS paths is stored in each bucket. Only unique AS paths are stored. Duplicate AS paths increase a reference count, but do not increase the number of AS paths stored in the hash table.</p>
Options	<p>none—Display basic information about AS paths that the local routing device is using (same as brief).</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show as-path summary on page 291
List of Sample Output	show as-path on page 286 show as-path detail on page 287
Output Fields	Table 5 on page 285 lists the output fields for the show as-path command. Output fields are listed in the approximate order in which they appear.

Table 5: show as-path Output Fields

Field Name	Field Description	Level of Output
Total AS paths	Total number of AS paths.	brief none
Bucket	Bucket number.	All levels

Table 5: show as-path Output Fields (*continued*)

Field Name	Field Description	Level of Output
Count	Number of AS path entries in this bucket.	All levels
AS path	<p>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:</p> <ul style="list-style-type: none"> • I—IGP. • E—EGP. • ?—Incomplete; typically, the AS path was aggregated. • Atomic—Route is an aggregate of several route prefixes. • Aggregator—Routing device has summarized a range of prefixes. 	All levels
domain	Number of independent AS domains. The AS paths of an independent AS domain are not shared with the AS paths and AS path attributes of other domains, including the master routing instance domain.	detail
neighbor as	AS peer address.	detail
length	Length of the AS path.	detail
segments	Length of the AS segment descriptor.	detail
references	Path reference count.	detail

Sample Output

show as-path

```

user@host> show as-path
Total AS paths: 30382
Bucket 0      Count: 36
I
14203 2914 174 31752 I
14203 2914 701 21512 I
14203 2914 1239 26632 I
14203 2914 1239 29704 I
14203 2914 4323 10248 I
14203 2914 4766 23560 I
14203 2914 6395 32776 I
14203 2914 7911 11272 I
14203 2914 12180 18440 I
14203 2914 17408 17416 I
14203 2914 701 702 24586 I
14203 2914 1239 4657 9226 I
14203 2914 1239 7132 16394 I
14203 2914 1299 8308 34826 I
14203 2914 3320 5603 28682 I
14203 2914 3491 1680 33802 I
14203 2914 3549 7908 27658 I
14203 2914 3549 20804 30730 I
14203 2914 7018 2687 9226 I
14203 2914 174 9318 9318 23564 I

```

```

14203 2914 701 3786 3786 23564 I
14203 2914 701 4761 4795 9228 I
14203 2914 1239 7132 5673 18444 I
14203 2914 3491 20485 24588 24588 I
14203 2914 5511 2200 1945 2060 I
14203 2914 7911 14325 14325 14348 I
14203 2914 701 4637 9230 9230 9230 I
14203 2914 6395 14 14 14 14 I
14203 2914 9299 6163 6163 6163 6163 9232 I
14203 2914 3356 3356 3356 3356 3356 11955 21522 I
14203 2914 9837 9837 9219 I Aggregator: 9219 202.27.91.253
14203 2914 174 30209 30222 30222 30222 ?
14203 2914 1299 5377 I (Atomic) Aggregator: 5377 193.219.192.22
14203 2914 4323 36097 I (Atomic) Aggregator: 36097 216.69.252.254
14203 2914 209 2516 17676 23813 I (Atomic) Aggregator: 23813 219.127.233.66
Bucket 1    Count: 28
14203 2914 35847 I
14203 2914 174 19465 I
14203 2914 174 35849 I
14203 2914 2828 32777 I
14203 2914 4323 14345 I
14203 2914 4323 29705 I
14203 2914 6395 32777 I
...

```

show as-path detail

```

user@host> show as-path detail
Total AS paths: 30410
Bucket 0    Count: 36
AS path: I
  domain 0, length 0, segments 0, references 54
AS path: 14203 2914 174 31752 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 2
AS path: 14203 2914 701 21512 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 2
AS path: 14203 2914 1239 26632 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 2
AS path: 14203 2914 1239 29704 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 2
AS path: 14203 2914 4323 10248 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 2
AS path: 14203 2914 4766 23560 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 2
AS path: 14203 2914 6395 32776 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 3
AS path: 14203 2914 7911 11272 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 2
AS path: 14203 2914 12180 18440 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 3
AS path: 14203 2914 17408 17416 I
  domain 1, neighbor as: 14203, length 4, segments 1, references 3
AS path: 14203 2914 701 702 24586 I
  domain 1, neighbor as: 14203, length 5, segments 1, references 3
AS path: 14203 2914 1239 4657 9226 I
  domain 1, neighbor as: 14203, length 5, segments 1, references 7
AS path: 14203 2914 1239 7132 16394 I
  domain 1, neighbor as: 14203, length 5, segments 1, references 2
AS path: 14203 2914 1299 8308 34826 I
  domain 1, neighbor as: 14203, length 5, segments 1, references 2

```

```
AS path: 14203 2914 3320 5603 28682 I
  domain 1, neighbor as: 14203, length 5, segments 1, references 2
AS path: 14203 2914 3491 1680 33802 I
  domain 1, neighbor as: 14203, length 5, segments 1, references 2
AS path: 14203 2914 3549 7908 27658 I
  domain 1, neighbor as: 14203, length 5, segments 1, references 2
AS path: 14203 2914 3549 20804 30730 I
  domain 1, neighbor as: 14203, length 5, segments 1, references 2
AS path: 14203 2914 7018 2687 9226 I
  domain 1, neighbor as: 14203, length 5, segments 1, references 3
AS path: 14203 2914 174 9318 9318 23564 I
  domain 1, neighbor as: 14203, length 6, segments 1, references 2
AS path: 14203 2914 701 3786 3786 23564 I
  domain 1, neighbor as: 14203, length 6, segments 1, references 2
AS path: 14203 2914 701 4761 4795 9228 I
  domain 1, neighbor as: 14203, length 6, segments 1, references 14
AS path: 14203 2914 1239 7132 5673 18444 I
  domain 1, neighbor as: 14203, length 6, segments 1, references 2
AS path: 14203 2914 3491 20485 24588 24588 I
  domain 1, neighbor as: 14203, length 6, segments 1, references 4
AS path: 14203 2914 5511 2200 1945 2060 I
  domain 1, neighbor as: 14203, length 6, segments 1, references 2
AS path: 14203 2914 7911 14325 14325 14348 I
  domain 1, neighbor as: 14203, length 6, segments 1, references 2
AS path: 14203 2914 701 4637 9230 9230 9230 I
  domain 1, neighbor as: 14203, length 7, segments 1, references 3
AS path: 14203 2914 6395 14 14 14 14 I
  domain 1, neighbor as: 14203, length 7, segments 1, references 10
...
```

show as-path domain

Syntax	show as-path domain <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	show as-path domain
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches.
Description	Display autonomous system (AS) path domain information.
Options	none —(Optional) Display AS path domain information for all routing instances. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
List of Sample Output	show as-path domain on page 290
Output Fields	Table 6 on page 289 lists the output fields for the show as-path domain command. Output fields are listed in the approximate order in which they appear

Table 6: show as-path domain Output Fields

Field Name	Field Description
Domain	Number of independent AS domains. The AS paths of an independent AS domain are not shared with the AS paths and AS path attributes of other domains, including the master routing instance domain.
Primary	Primary AS number.
References	Path reference count.
Number Paths	Number of known AS paths.
Flags	Information about the AS path: <ul style="list-style-type: none"> • ASLoop—Path contains an AS loop. • Atomic—Path includes the ATOMIC_AGGREGATE path attribute. • Local—Path was created by local aggregation. • Master—Path was created by the master routing instance.
Local AS	AS number of the local routing device.
Loops	How many times this AS number can appear in an AS path.

Sample Output

show as-path domain

```
user@host> show as-path domain
Domain: 1          Primary: 10458
References:        3 Paths:      30383
Flags: Master
Local AS: 10458   Loops: 1
```

show as-path summary

Syntax	show as-path summary <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	show as-path 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 autonomous system (AS) path summary information. AS paths are stored in a hash table. A hash table is one method for fast lookup. Each entry in the table is called a bucket. Junos OS computes a hash value that indicates in which bucket the AS path is stored. The AS paths are dispersed among the hash buckets so that a manageable number of AS paths is stored in each bucket. Only unique AS paths are stored. Duplicate AS paths increase a reference count, but do not increase the number of AS paths stored in the hash table.
Options	none —(Optional) Display AS path summary information for all routing instances. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> show as-path on page 285
List of Sample Output	show as-path summary on page 292
Output Fields	Table 7 on page 291 lists the output fields for the show as-path summary command. Output fields are listed in the approximate order in which they appear.

Table 7: show as-path summary Output Fields

Field Name	Field Description
AS Paths	Number of AS paths.
Buckets	Number of hash buckets in use.
Max	Maximum number of AS path entries per bucket.
Min	Minimum number of AS path entries per bucket.
Avg	Average number of AS path entries per bucket.
Std deviation	Standard deviation of AS path entries per bucket.

Sample Output

show as-path summary

```
user@host> show as-path summary
AS  Paths  Buckets  Max  Min  Avg  Std deviation
30425    1024    95   12   29   6.481419
```


show interfaces routing summary

Syntax	show interfaces routing summary <interface-name> <logical-system (all logical-system-name)>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 12.1x48 for PTX Series Packet Transport Routers.
Description	Display a summary of the state of the router interfaces. Use this command for performing router diagnostics only, when you are determining whether the routing protocols and the Junos OS differ about the state of an interface.
Options	none —Display summary information about the state of all router interfaces on all logical systems. interface-name —(Optional) Name of a specific interface. logical-system (all logical-system-name) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Additional Information	For information about how to configure routing protocols, see the <i>Junos OS Routing Protocols Library for Routing Devices</i> . For information about related operational mode commands for routing instances and protocols, see the CLI Explorer .
Required Privilege Level	view
List of Sample Output	show interfaces routing summary on page 294 show interfaces routing summary (TX Matrix Plus Router) on page 294 show interfaces routing summary (PTX5000 Packet Transport Routers) on page 295
Output Fields	Table 8 on page 293 lists the output fields for the show interfaces routing summary command. Output fields are listed in the approximate order in which they appear.

Table 8: show interfaces routing summary Output Fields

Field Name	Field Description
n physical interfaces	Number of routing interfaces and number of interfaces in the up state.
n protocol protocol interfaces	Type and number of routing protocols and number of related interfaces in the up state.
Interface	Logical interface name.
Index	Logical interface index number, which reflects its initialization sequence.

Table 8: show interfaces routing summary Output Fields (*continued*)

Field Name	Field Description
Metric	Metric value for the interface.
Trans	Number of times the interface has transitioned from Down to Up .
Status	Interface status (Up or Down) and type.

Sample Output

show interfaces routing summary

```

user@host> show interfaces routing summary
14 physical interfaces (12 up)
  11 INET protocol addresses (11 up)
  6 ISO protocol addresses (4 up)
  3 MPLS protocol addresses (3 up)
  3 CCC protocol addresses (3 up)
Interface  Index    Metric  Trans.  Status
so-5/0/3.0   15        0        0 Broadcast PointToPoint Multicast
so-5/0/2.0   14        0        0 Up Broadcast PointToPoint Multicast
so-5/0/1.0   13        0        5 Up Broadcast PointToPoint Multicast
so-5/0/0.0   12        0        2 Up Broadcast PointToPoint Multicast
so-1/2/0.0   11        0        0 Broadcast PointToPoint Multicast
so-1/1/0.0   10        0        5 Up Broadcast PointToPoint Multicast
at-1/0/0.6    9        0        0 Up Broadcast PointToPoint Multicast
at-1/0/0.5    8        0        0 Up Broadcast PointToPoint Multicast
at-1/0/0.4    7        0        0 Up Broadcast PointToPoint Multicast
at-1/0/0.3    6        0        0 Up Broadcast PointToPoint Multicast
at-1/0/0.2    5        0        0 Up Broadcast PointToPoint Multicast
at-1/0/0.0    4        0        0 Up Broadcast PointToPoint Multicast
lo0.0         3        0        0 Up Broadcast Loopback Multicast
fxp1.0        2        0        1 Up Broadcast Multicast
fxp0.0        1        0        0 Up Broadcast Multicast

```

show interfaces routing summary (TX Matrix Plus Router)

```

user@host> show interfaces routing summary
9 physical interfaces (9 up)
  11 INET protocol addresses (11 up)
  6 MPLS protocol addresses (6 up)
  4 INET6 protocol addresses (4 up)

Interface      Index    Metric  Trans.  Status
ge-23/0/8.0    73        0        0 Up Broadcast Multicast
ge-23/0/7.0    72        0        0 Up Broadcast Multicast
ge-23/0/6.0    71        0        0 Up Broadcast Multicast
ge-7/0/9.0     69        0        0 Up Broadcast Multicast
ge-15/0/9.0    70        0        0 Up Broadcast Multicast
xe-6/1/1.0     68        0        0 Up Broadcast Multicast
lo0.16385      66        0        0 Up Broadcast Loopback Multicast
lo0.16384      65        0        0 Up Broadcast Loopback Multicast
lo0.0          64        0        0 Up Broadcast Loopback Multicast
ixgbe1.0       5        0        0 Up Broadcast Multicast
ixgbe0.0       4        0        0 Up Broadcast Multicast
em0.0          3        0        0 Up Broadcast Multicast

```

show interfaces routing summary (PTX5000 Packet Transport Routers)

```
user@host> show interfaces routing summary
```

```
7 physical interfaces (68 up)
```

```
7 INET protocol addresses (7 up)
```

```
2 CCC protocol addresses (2 up)
```

```
4 INET6 protocol addresses (4 up)
```

Interface	Index	Metric	Trans. Status
lo0.16385	66	0	0 Up Broadcast Loopback Multicast
lo0.16384	64	0	0 Up Broadcast Loopback Multicast
lo0.0	65	0	0 Up Broadcast Loopback Multicast
ixgbe1.0	5	0	0 Up Broadcast Multicast
ixgbe0.0	4	0	0 Up Broadcast Multicast
et-5/0/5.32767	72	0	0 Up Broadcast Multicast
et-5/0/5.0	68	0	0 Up Broadcast Multicast
et-5/0/0.32767	67	0	0 Up Broadcast Multicast
et-5/0/0.0	71	0	0 Up Broadcast Multicast
em0.0	3	0	0 Up Broadcast Multicast

show route

Syntax	<pre>show route <all> <destination-prefix> <logical-system (all logical-system-name)> <private></pre>
Syntax (EX Series Switches)	<pre>show route <all> <destination-prefix> <private></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Option private introduced in Junos OS Release 9.5.</p> <p>Option private introduced in Junos OS Release 9.5 for EX Series switches.</p>
Description	Display the active entries in the routing tables.
Options	<p>none—Display brief information about all active entries in the routing tables.</p> <p>all—(Optional) Display information about all routing tables, including private, or internal, routing tables.</p> <p>destination-prefix—(Optional) Display active entries for the specified address or range of addresses.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>private—(Optional) Display information only about all private, or internal, routing tables.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none">• <i>Example: Configuring RIP</i>• <i>Example: Configuring RIPng</i>• <i>Example: Configuring IS-IS</i>• <i>Examples: Configuring Internal BGP Peering</i>• <i>Examples: Configuring External BGP Peering</i>• <i>Examples: Configuring OSPF Routing Policy</i>
List of Sample Output	<p>show route on page 299</p> <p>show route on page 299</p> <p>show route destination-prefix on page 300</p> <p>show route extensive on page 300</p>

Output Fields Table 9 on page 297 describes the output fields for the **show route** command. Output fields are listed in the approximate order in which they appear.

Table 9: show route Output Fields

Field Name	Field Description
<i>routing-table-name</i>	Name of the routing table (for example, inet.0).
<i>number destinations</i>	Number of destinations for which there are routes in the routing table.
<i>number routes</i>	<p>Number of routes in the routing table and total number of routes in the following states:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <ul style="list-style-type: none"> • hidden (routes that are not used because of a routing policy).
<i>destination-prefix</i>	<p>Route destination (for example:10.0.0.1/24). Sometimes the route information is presented in another format, such as:</p> <ul style="list-style-type: none"> • 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): <ul style="list-style-type: none"> • 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.
[<i>protocol, preference</i>]	<p>Protocol from which the route was learned and the preference value for the route.</p> <ul style="list-style-type: none"> • +—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. <p>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.</p>

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

Field Name	Field Description
<i>weeks:days</i> <i>hours:minutes:seconds</i>	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	<p>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:</p> <ul style="list-style-type: none"> • I—IGP. • E—EGP. • ?—Incomplete; typically, the AS path was aggregated. <p>When AS path numbers are included in the route, the format is as follows:</p> <ul style="list-style-type: none"> • []—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. <p>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.</p>
validation-state	<p>(BGP-learned routes) Validation status of the route:</p> <ul style="list-style-type: none"> • 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. • Unverified—Indicates that the origin of the prefix is not verified against the database. This is because the database got populated and the validation is not called for in the BGP import policy, although origin validation is enabled, or the origin validation is not enabled for the BGP peers. • Valid—Indicates that the prefix and autonomous system pair are found in the database.
to	<p>Next hop to the destination. An angle bracket (>) indicates that the route is the selected route.</p> <p>If the destination is Discard, traffic is dropped.</p>

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

Field Name	Field Description
via	<p>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:</p> <ul style="list-style-type: 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. • 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 ?, validation-state: unverified
                  > 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 ?, validation-state: unverified
                  > 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
    Validation State: unverified
    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 active-path

Syntax	show route active-path <brief detail extensive terse> <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	show route active-path <brief detail extensive terse>
Release Information	Command introduced in Junos OS Release 8.0. Command introduced in Junos OS Release 9.0 for EX Series switches.
Description	Display all active routes for destinations. An active route is a route that is selected as the best path. Inactive routes are not displayed.
Options	<p>none—Display all active routes.</p> <p>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.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show route active-path on page 301 show route active-path brief on page 302 show route active-path detail on page 302 show route active-path extensive on page 303 show route active-path terse on page 305
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 active-path

```

user@host> show route active-path

inet.0: 7 destinations, 7 routes (6 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

10.255.70.19/32    *[Direct/0] 21:33:52
                  > via lo0.0
10.255.71.50/32    *[IS-IS/15] 00:18:13, metric 10
                  > to 100.1.2.1 via so-2/1/3.0
100.1.2.0/24      *[Direct/0] 00:18:36
                  > via so-2/1/3.0
100.1.2.2/32      *[Local/0] 00:18:41
                  Local via so-2/1/3.0
192.168.64.0/21   *[Direct/0] 21:33:52

```

```

> via fxp0.0
192.168.70.19/32  *Local/0] 21:33:52
                  Local via fxp0.0

```

show route active-path brief

The output for the **show route active-path brief** command is identical to that for the **show route active-path** command. For sample output, see [show route active-path on page 301](#).

show route active-path detail

```

user@host> show route active-path detail

inet.0: 7 destinations, 7 routes (6 active, 0 holddown, 1 hidden)

10.255.70.19/32 (1 entry, 1 announced)
  *Direct Preference: 0
    Next hop type: Interface
    Next-hop reference count: 3
    Next hop: via lo0.0, selected
    State: <Active Int>
    Local AS: 200
    Age: 21:37:10
    Task: IF
    Announcement bits (3): 2-IS-IS 5-Resolve tree 2 6-Resolve tree 3

    AS path: I

10.255.71.50/32 (1 entry, 1 announced)
  *IS-IS Preference: 15
    Level: 1
    Next hop type: Router, Next hop index: 397
    Next-hop reference count: 4
    Next hop: 100.1.2.1 via so-2/1/3.0, selected
    State: <Active Int>
    Local AS: 200
    Age: 21:31 Metric: 10
    Task: IS-IS
    Announcement bits (4): 0-KRT 2-IS-IS 5-Resolve tree 2 6-Resolve
tree 3
    AS path: I

100.1.2.0/24 (1 entry, 1 announced)
  *Direct Preference: 0
    Next hop type: Interface
    Next-hop reference count: 3
    Next hop: via so-2/1/3.0, selected
    State: <Active Int>
    Local AS: 200
    Age: 21:54
    Task: IF
    Announcement bits (3): 2-IS-IS 5-Resolve tree 2 6-Resolve tree 3

    AS path: I

100.1.2.2/32 (1 entry, 1 announced)
  *Local Preference: 0
    Next hop type: Local
    Next-hop reference count: 11
    Interface: so-2/1/3.0
    State: <Active NoReadvrt Int>

```

```

Local AS: 200
Age: 21:59
Task: IF
Announcement bits (2): 5-Resolve tree 2 6-Resolve tree 3
AS path: I

192.168.64.0/21 (1 entry, 1 announced)
*Direct Preference: 0
Next hop type: Interface
Next-hop reference count: 3
Next hop: via fxp0.0, selected
State: <Active Int>
Local AS: 200
Age: 21:37:10
Task: IF
Announcement bits (2): 5-Resolve tree 2 6-Resolve tree 3
AS path: I

192.168.70.19/32 (1 entry, 1 announced)
*Local Preference: 0
Next hop type: Local
Next-hop reference count: 11
Interface: fxp0.0
State: <Active NoReadvrt Int>
Local AS: 200
Age: 21:37:10
Task: IF
Announcement bits (2): 5-Resolve tree 2 6-Resolve tree 3
AS path: I

```

show route active-path extensive

```

user@host> show route active-path extensive

inet.0: 7 destinations, 7 routes (6 active, 0 holddown, 1 hidden)
10.255.70.19/32 (1 entry, 1 announced)
TSI:
IS-IS level 1, LSP fragment 0
IS-IS level 2, LSP fragment 0
*Direct Preference: 0
Next hop type: Interface
Next-hop reference count: 3
Next hop: via lo0.0, selected
State: <Active Int>
Local AS: 200
Age: 21:39:47
Task: IF
Announcement bits (3): 2-IS-IS 5-Resolve tree 2 6-Resolve tree 3
AS path: I

10.255.71.50/32 (1 entry, 1 announced)
TSI:
KRT in-kernel 10.255.71.50/32 -> {100.1.2.1}
IS-IS level 2, LSP fragment 0
*IS-IS Preference: 15
Level: 1
Next hop type: Router, Next hop index: 397
Next-hop reference count: 4
Next hop: 100.1.2.1 via so-2/1/3.0, selected
State: <Active Int>

```

```

Local AS: 200
Age: 24:08 Metric: 10
Task: IS-IS
Announcement bits (4): 0-KRT 2-IS-IS 5-Resolve tree 2 6-Resolve
tree 3
AS path: I

100.1.2.0/24 (1 entry, 1 announced)
TSI:
IS-IS level 1, LSP fragment 0
IS-IS level 2, LSP fragment 0
*Direct Preference: 0
Next hop type: Interface
Next-hop reference count: 3
Next hop: via so-2/1/3.0, selected
State: <Active Int>
Local AS: 200
Age: 24:31
Task: IF
Announcement bits (3): 2-IS-IS 5-Resolve tree 2 6-Resolve tree 3
AS path: I

100.1.2.2/32 (1 entry, 1 announced)
*Local Preference: 0
Next hop type: Local
Next-hop reference count: 11
Interface: so-2/1/3.0
State: <Active NoReadvrt Int>
Local AS: 200
Age: 24:36
Task: IF
Announcement bits (2): 5-Resolve tree 2 6-Resolve tree 3
AS path: I

192.168.64.0/21 (1 entry, 1 announced)
*Direct Preference: 0
Next hop type: Interface
Next-hop reference count: 3
Next hop: via fxp0.0, selected
State: <Active Int>
Local AS: 200
Age: 21:39:47
Task: IF
Announcement bits (2): 5-Resolve tree 2 6-Resolve tree 3
AS path: I

192.168.70.19/32 (1 entry, 1 announced)
*Local Preference: 0
Next hop type: Local
Next-hop reference count: 11
Interface: fxp0.0
State: <Active NoReadvrt Int>
Local AS: 200
Age: 21:39:47
Task: IF
Announcement bits (2): 5-Resolve tree 2 6-Resolve tree 3
AS path: I

```

show route active-path terse

```
user@host> show route active-path terse
```

```
inet.0: 7 destinations, 7 routes (6 active, 0 holddown, 1 hidden)
```

```
+ = Active Route, - = Last Active, * = Both
```

A	Destination	P	Prf	Metric 1	Metric 2	Next hop	AS path
*	10.255.70.19/32	D	0			>1o0.0	
*	10.255.71.50/32	I	15	10		>100.1.2.1	
*	100.1.2.0/24	D	0			>so-2/1/3.0	
*	100.1.2.2/32	L	0			Local	
*	192.168.64.0/21	D	0			>fxp0.0	
*	192.168.70.19/32	L	0			Local	

show route all

Syntax	<code>show route all</code> <code><logical-system (all <i>logical-system-name</i>)></code>
Syntax (EX Series Switches)	<code>show route all</code>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches.
Description	Display information about all routes in all routing tables, including private, or internal, tables.
Options	none —Display information about all routes in all routing tables, including private, or internal, tables. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
List of Sample Output	show route all on page 306
Output Fields	In Junos OS Release 9.5 and later, only the output fields for the show route all command display all routing tables, including private, or hidden, routing tables. The output field table of the show route command does not display entries for private, or hidden, routing tables in Junos OS Release 9.5 and later.

Sample Output

show route all

The following example displays a snippet of output from the **show route** command and then displays the same snippet of output from the **show route all** command:

```
user@host> show route
mpls.0: 7 destinations, 7 routes (5 active, 0 holddown, 2 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both
0                *[MPLS/0] 2d 02:24:39, metric 1
                  Receive
1                *[MPLS/0] 2d 02:24:39, metric 1
                  Receive
2                *[MPLS/0] 2d 02:24:39, metric 1
                  Receive
800017           *[VPLS/7] 1d 14:00:16
                  > via vt-3/2/0.32769, Pop
800018           *[VPLS/7] 1d 14:00:26
                  > via vt-3/2/0.32772, Pop

user@host> show route all
mpls.0: 7 destinations, 7 routes (5 active, 0 holddown, 2 hidden)
Restart Complete
```

```
+ = Active Route, - = Last Active, * = Both
0          *[MPLS/0] 2d 02:19:12, metric 1
           Receive
1          *[MPLS/0] 2d 02:19:12, metric 1
           Receive
2          *[MPLS/0] 2d 02:19:12, metric 1
           Receive
800017     *[VPLS/7] 1d 13:54:49
           > via vt-3/2/0.32769, Pop
800018     *[VPLS/7] 1d 13:54:59
           > via vt-3/2/0.32772, Pop
vt-3/2/0.32769 [VPLS/7] 1d 13:54:49
              Unusable
vt-3/2/0.32772 [VPLS/7] 1d 13:54:59
              Unusable
```

show route best

Syntax	<code>show route best <i>destination-prefix</i></code> <code><brief detail extensive terse></code> <code><logical-system (all <i>logical-system-name</i>)></code>
Syntax (EX Series Switches)	<code>show route best <i>destination-prefix</i></code> <code><brief detail extensive terse></code>
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 in the routing table that is the best route to the specified address or range of addresses. The best route is the longest matching route.
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 . <i>destination-prefix</i> —Address or range of addresses. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
List of Sample Output	show route best on page 308 show route best detail on page 309 show route best extensive on page 310 show route best terse on page 310
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 best

```

user@host> show route best 10.255.70.103
inet.0: 24 destinations, 25 routes (23 active, 0 holddown, 1 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both
10.255.70.103/32    *[OSPF/10] 1d 13:19:20, metric 2
                  > to 10.31.1.6 via ge-3/1/0.0
                  via so-0/3/0.0

inet.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both
10.255.70.103/32    *[RSVP/7] 1d 13:20:13, metric 2
                  > via so-0/3/0.0, label-switched-path green-r1-r3

private1___.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

```



```

+ = Active Route, - = Last Active, * = Both
10.0.0.0/8      *[Direct/0] 2d 01:43:34
                 > via fxp2.0
                 [Direct/0] 2d 01:43:34
                 > via fxp1.0

```

show route best detail

```

user@host> show route best 10.255.70.103 detail
inet.0: 24 destinations, 25 routes (23 active, 0 holddown, 1 hidden)
Restart Complete
10.255.70.103/32 (1 entry, 1 announced)
    *OSPF    Preference: 10
              Next-hop reference count: 9
              Next hop: 10.31.1.6 via ge-3/1/0.0, selected
              Next hop: via so-0/3/0.0
              State: <Active Int>
              Local AS:    69
              Age: 1d 13:20:06      Metric: 2
              Area: 0.0.0.0
              Task: OSPF
              Announcement bits (2): 0-KRT 3-Resolve tree 2
              AS path: I

inet.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
Restart Complete
10.255.70.103/32 (1 entry, 1 announced)
    State: <FlashAll>
    *RSVP    Preference: 7
              Next-hop reference count: 5
              Next hop: via so-0/3/0.0 weight 0x1, selected
              Label-switched-path green-r1-r3
              Label operation: Push 100016
              State: <Active Int>
              Local AS:    69
              Age: 1d 13:20:59      Metric: 2
              Task: RSVP
              Announcement bits (1): 1-Resolve tree 2
              AS path: I

private1__inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)
10.0.0.0/8 (2 entries, 0 announced)
    *Direct Preference: 0
              Next hop type: Interface
              Next-hop reference count: 1
              Next hop: via fxp2.0, selected
              State: <Active Int>
              Age: 2d 1:44:20
              Task: IF
              AS path: I
    Direct Preference: 0
              Next hop type: Interface
              Next-hop reference count: 1
              Next hop: via fxp1.0, selected
              State: <NotBest Int>
              Inactive reason: No difference
              Age: 2d 1:44:20
              Task: IF
              AS path: I

```

show route best extensive

The output for the **show route best extensive** command is identical to that for the **show route best detail** command. For sample output, see [show route best detail on page 309](#).

show route best terse

```
user@host> show route best 10.255.70.103 terse
inet.0: 24 destinations, 25 routes (23 active, 0 holddown, 1 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

A Destination      P Prf  Metric 1   Metric 2   Next hop      AS path
* 10.255.70.103/32  0 10      2           >10.31.1.6
                               so-0/3/0.0

inet.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

A Destination      P Prf  Metric 1   Metric 2   Next hop      AS path
* 10.255.70.103/32  R  7      2           >so-0/3/0.0

private1___.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

A Destination      P Prf  Metric 1   Metric 2   Next hop      AS path
* 10.0.0.0/8        D  0           >fxp2.0
                    D  0           >fxp1.0
```

show route brief

Syntax	show route brief <destination-prefix> <logical-system (all logical-system-name)>
Syntax (EX Series Switches)	show route brief <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 brief information about the active entries in the routing tables.
Options	<p>none—Display all active entries in the routing table.</p> <p>destination-prefix—(Optional) Display active entries for the specified address or range of addresses.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show route brief on page 311
Output Fields	For information about output fields, see the Output Field table of the show route command.

Sample Output

show route brief

```

user@host> show route brief
inet.0: 10 destinations, 10 routes (9 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

0.0.0.0/0          *[Static/5] 1w5d 20:30:29
                   Discard
10.255.245.51/32   *[Direct/0] 2w4d 13:11:14
                   > via lo0.0
172.16.0.0/12      *[Static/5] 2w4d 13:11:14
                   > to 192.168.167.254 via fxp0.0
192.168.0.0/18     *[Static/5] 1w5d 20:30:29
                   > to 192.168.167.254 via fxp0.0
192.168.40.0/22    *[Static/5] 2w4d 13:11:14
                   > to 192.168.167.254 via fxp0.0
192.168.64.0/18    *[Static/5] 2w4d 13:11:14
                   > to 192.168.167.254 via fxp0.0
192.168.164.0/22   *[Direct/0] 2w4d 13:11:14
                   > via fxp0.0
192.168.164.51/32  *[Local/0] 2w4d 13:11:14
                   Local via fxp0.0
207.17.136.192/32 *[Static/5] 2w4d 13:11:14

```

```

> to 192.168.167.254 via fxp0.0
green.inet.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
100.101.0.0/16    *[Direct/0] 1w5d 20:30:28
                  > via fe-0/0/3.0
100.101.2.3/32   *[Local/0] 1w5d 20:30:28
                  Local via fe-0/0/3.0
224.0.0.5/32     *[OSPF/10] 1w5d 20:30:29, metric 1
                  MultiRecv
```

show route cumulative

Syntax	show route cumulative <fabric> <logical-system (all <i>logical-system-name</i>)> <vpn-family (inet.0 inet6.0)>
Release Information	Command introduced in Junos OS Release 13.3.
Description	Shows the cumulative number of either IPv4 or IPv6 routes in the VRF table.
Options	<p>fabric— Internal fabric state.</p> <p>logical-system (all <i>logical-system-name</i>)— (Optional) Show cumulative routes on all logical systems or on a particular logical system.</p> <p>vpn-family (inet.0 inet6.0)— Enter inet.0 for IPv4 routes or inet6.0 for IPv6 routes.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show route summary on page 399
List of Sample Output	show route cumulative on page 313

Field Name	Field Description
destinations	Number of destinations for which there are VRF routes in the routing table.
routes	Number of VRF routes in the routing table: <ul style="list-style-type: none"> • active—Number of routes that are active. • holddown—Number of VRF routes that are in the hold-down state before being declared inactive. • hidden—Number of VRF routes that are not used because of routing policy.

Sample Output

show route cumulative

```
user@host> show route cumulative vpn-family inet.0
Total VRF Routes: 720 destinations, 722 routes (720 active, 0 holddown, 0 hidden)
```

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. Command introduced in Junos OS Release 13.2X51-D15 for the QFX Series.
Description	Display detailed information about the active entries in the routing tables.
Options	<p>none—Display all active entries in the routing table on all systems.</p> <p>destination-prefix—(Optional) Display active entries for the specified address or range of addresses.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show route detail on page 323 show route detail (with BGP Multipath) on page 329 show route label detail (Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs) on page 329 show route label detail (Multipoint LDP with Multicast-Only Fast Reroute) on page 330
Output Fields	Table 10 on page 314 describes the output fields for the show route detail command. Output fields are listed in the approximate order in which they appear.

Table 10: show route detail Output Fields

Field Name	Field Description
<i>routing-table-name</i>	Name of the routing table (for example, inet.0).
<i>number destinations</i>	Number of destinations for which there are routes in the routing table.
<i>number routes</i>	Number of routes in the routing table and total number of routes in the following states: <ul style="list-style-type: none"> 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 10: show route detail Output Fields (*continued*)

Field Name	Field Description
<i>route-destination</i> (entry, announced)	<p>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:</p> <ul style="list-style-type: none"> • 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). <ul style="list-style-type: none"> • 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	<p>(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.</p> <ul style="list-style-type: none"> • 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).
[<i>protocol, preference</i>]	<p>Protocol from which the route was learned and the preference value for the route.</p> <ul style="list-style-type: none"> • +—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. <p>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.</p>
Level	<p>(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.</p>
Route Distinguisher	IP subnet augmented with a 64-bit prefix.
PMSI	Provider multicast service interface (MVPN routing table).
Next-hop type	Type of next hop. For a description of possible values for this field, see Table 11 on page 319 .

Table 10: 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	<p>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:</p> <ul style="list-style-type: 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. • 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 12 on page 320 .
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.
Metricn	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 10: 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	<p>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.</p> <p>For sample output, see show route table.</p>
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	<p>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:</p> <ul style="list-style-type: none"> • I—IGP. • E—EGP. • Recorded—The AS path is recorded by the sample process (sampled). • ?—Incomplete; typically, the AS path was aggregated. <p>When AS path numbers are included in the route, the format is as follows:</p> <ul style="list-style-type: none"> • []—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. <p>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.</p>
validation-state	<p>(BGP-learned routes) Validation status of the route:</p> <ul style="list-style-type: none"> • 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. • Unverified—Indicates that the origin of the prefix is not verified against the database. This is because the database got populated and the validation is not called for in the BGP import policy, although origin validation is enabled, or the origin validation is not enabled for the BGP peers. • Valid—Indicates that the prefix and autonomous system pair are found in the database.
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.

Table 10: show route detail Output Fields (*continued*)

Field Name	Field Description
Primary Upstream	When multipoint LDP with multicast-only fast reroute (MoFRR) is configured, the primary upstream path. MoFRR transmits a multicast join message from a receiver toward a source on a primary path, while also transmitting a secondary multicast join message from the receiver toward the source on a backup path.
RPF Nexthops	When multipoint LDP with MoFRR is configured, the reverse-path forwarding (RPF) next-hop information. Data packets are received from both the primary path and the secondary paths. The redundant packets are discarded at topology merge points due to the RPF checks.
Label	Multiple MPLS labels are used to control MoFRR stream selection. Each label represents a separate route, but each references the same interface list check. Only the primary label is forwarded while all others are dropped. Multiple interfaces can receive packets using the same label.
weight	Value used to distinguish MoFRR primary and backup routes. A lower weight value is preferred. Among routes with the same weight value, load balancing is possible.
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 13 on page 322 for all possible values for this field.
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 11 on page 319 describes all possible values for the Next-hop Types output field.

Table 11: 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.
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.

Table 11: Next-hop Types Output Field Values (*continued*)

Next-Hop Type	Description
Router	<p>A specific node or set of nodes to which the routing device forwards packets that match the route prefix.</p> <p>To qualify as next-hop type router, the route must meet the following criteria:</p> <ul style="list-style-type: none"> • 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 12 on page 320 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 12: 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.

Table 12: State Output Field Values (*continued*)

Value	Description
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).
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.

Table 12: State Output Field Values (*continued*)

Value	Description
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: <ul style="list-style-type: none"> • 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 13 on page 322 describes the possible values for the Communities output field.

Table 13: Communities Output Field Values

Value	Description
<i>area-number</i>	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.
<i>link-bandwidth-number</i>	Link-bandwidth number: from 0 through 4,294,967,295 (bytes per second).
<i>local AS number</i>	Local AS number: from 1 through 65,535.
<i>options</i>	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.

Table 13: Communities Output Field Values (*continued*)

Value	Description
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 <i>area-number:ospf-route-type:options</i> .
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 <i>area-number:ospf-route-type:options</i> .
target	Defines which VPN the route participates in; target has the format <i>32-bit IP address:16-bit number</i> . 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)

299840 (1 entry, 1 announced)

```

```

TSI:
KRT in-kerne 299840 /52 -> {indirect(1048575)}
    *RSVP Preference: 7/2
        Next hop type: Flood
        Address: 0x9174a30
        Next-hop reference count: 4
        Next hop type: Router, Next hop index: 798
        Address: 0x9174c28
        Next-hop reference count: 2
        Next hop: 8.0.0.2 via lt-1/2/0.9 weight 0x1
        Label-switched-path R2-to-R4-2p2mp
        Label operation: Pop
        Next hop type: Router, Next hop index: 1048574
        Address: 0x92544f0
        Next-hop reference count: 2
        Next hop: 7.0.0.2 via lt-1/2/0.7 weight 0x1
        Label-switched-path R2-to-R200-p2mp
        Label operation: Pop
        Next hop: 6.0.0.2 via lt-1/2/0.5 weight 0x8001
        Label operation: Pop
        State: <Active Int>
        Age: 1:29 Metric: 1
        Task: RSVP
        Announcement bits (1): 0-KRT
        AS path: I...

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
        Validation State: unverified
        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
        Validation State: unverified
        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 Point-to-Multipoint LSPs)

```

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
        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 label detail (Multipoint LDP with Multicast-Only Fast Reroute)

```

user@host> show route label 301568 detail

mpls.0: 18 destinations, 18 routes (18 active, 0 holddown, 0 hidden)
301568 (1 entry, 1 announced)
  *LDP    Preference: 9
    Next hop type: Flood
    Address: 0x2735208
    Next-hop reference count: 3
    Next hop type: Router, Next hop index: 1397
    Address: 0x2735d2c
    Next-hop reference count: 3
    Next hop: 1.3.8.2 via ge-1/2/22.0
    Label operation: Pop
    Load balance label: None;
    Next hop type: Router, Next hop index: 1395
    Address: 0x2736290
    Next-hop reference count: 3
    Next hop: 1.3.4.2 via ge-1/2/18.0
    Label operation: Pop
    Load balance label: None;
    State: <Active Int AckRequest MulticastRPF>
    Local AS: 10
    Age: 54:05      Metric: 1
    Validation State: unverified
    Task: LDP
    Announcement bits (1): 0-KRT
    AS path: I
    FECs bound to route: P2MP root-addr 1.1.1.1, grp: 232.1.1.1, src:
192.168.219.11
    Primary Upstream : 1.1.1.3:0--1.1.1.2:0
      RPF Nexthops :
        ge-1/2/15.0, 1.2.94.1, Label: 301568, weight: 0x1
        ge-1/2/14.0, 1.2.3.1, Label: 301568, weight: 0x1
    Backup Upstream : 1.1.1.3:0--1.1.1.6:0
      RPF Nexthops :
        ge-1/2/20.0, 1.2.96.1, Label: 301584, weight: 0xffffe
        ge-1/2/19.0, 1.3.6.1, Label: 301584, weight: 0xffffe

```

show route exact

Syntax	<code>show route exact <i>destination-prefix</i></code> <brief detail extensive terse> <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	<code>show route exact <i>destination-prefix</i></code> <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 only the routes that exactly match the specified address or range of addresses.
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 . <i>destination-prefix</i> —Address or range of addresses. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
List of Sample Output	show route exact on page 331 show route exact detail on page 331 show route exact extensive on page 332 show route exact terse on page 332
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 exact

```
user@host> show route exact 207.17.136.0/24

inet.0: 24 destinations, 25 routes (23 active, 0 holddown, 1 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both
207.17.136.0/24    *[Static/5] 2d 03:30:22
                  > to 192.168.71.254 via fxp0.0
```

show route exact detail

```
user@host> show route exact 207.17.136.0/24 detail

inet.0: 24 destinations, 25 routes (23 active, 0 holddown, 1 hidden)
Restart Complete
207.17.136.0/24 (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: 2d 3:30:26
Task: RT
Announcement bits (2): 0-KRT 3-Resolve tree 2
AS path: I
```

show route exact extensive

```
user@host> show route exact 207.17.136.0/24 extensive
inet.0: 22 destinations, 23 routes (21 active, 0 holddown, 1 hidden)
207.17.136.0/24 (1 entry, 1 announced)
TSI:
KRT in-kernel 207.17.136.0/24 -> {192.168.71.254}
  *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: 1:25:18
    Task: RT
    Announcement bits (2): 0-KRT 3-Resolve tree 2
    AS path: I
```

show route exact terse

```
user@host> show route exact 207.17.136.0/24 terse

inet.0: 22 destinations, 23 routes (21 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both
A Destination      P Prf  Metric 1   Metric 2   Next hop      AS path
* 207.17.136.0/24  S   5                      >192.168.71.254
```


show route export

Syntax	show route export <brief detail> <instance <instance-name> routing-table-name> <logical-system (all logical-system-name)>
Syntax (EX Series Switches)	show route export <brief detail> <instance <instance-name> routing-table-name>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches.
Description	Display policy-based route export information. Policy-based export simplifies the process of exchanging route information between routing instances.
Options	<p>none—(Same as brief.) Display standard information about policy-based export for all instances and routing tables on all systems.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>instance <instance-name>—(Optional) Display a particular routing instance for which policy-based export is currently enabled.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>routing-table-name—(Optional) Display information about policy-based export 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 export inet command).</p>
Required Privilege Level	view
List of Sample Output	show route export on page 334 show route export detail on page 334 show route export instance detail on page 334
Output Fields	Table 14 on page 333 lists the output fields for the show route export command. Output fields are listed in the approximate order in which they appear.

Table 14: show route export Output Fields

Field Name	Field Description	Level of Output
Table or <i>table-name</i>	Name of the routing tables that either import or export routes.	All levels
Routes	Number of routes exported from this table into other tables. If a particular route is exported to different tables, the counter will only increment by one.	brief none
Export	Whether the table is currently exporting routes to other tables: Y or N (Yes or No).	brief none

Table 14: show route export Output Fields (*continued*)

Field Name	Field Description	Level of Output
Import	Tables currently importing routes from the originator table. (Not displayed for tables that are not exporting any routes.)	detail
Flags	(instance keyword only) Flags for this feature on this instance: <ul style="list-style-type: none"> config auto-policy—The policy was deduced from the configured IGP export policies. cleanup—Configuration information for this instance is no longer valid. config—The instance was explicitly configured. 	detail
Options	(instance keyword only) Configured option displays the type of routing tables the feature handles: <ul style="list-style-type: none"> unicast—Indicates <i>instance.inet.0</i>. multicast—Indicates <i>instance.inet.2</i>. unicast multicast—Indicates <i>instance.inet.0</i> and <i>instance.inet.2</i>. 	detail
Import policy	(instance keyword only) Policy that route export uses to construct the import-export matrix. Not displayed if the instance type is vrf .	detail
Instance	(instance keyword only) Name of the routing instance.	detail
Type	(instance keyword only) Type of routing instance: forwarding , non-forwarding , or vrf .	detail

Sample Output

show route export

```

user@host> show route export
Table      Export      Routes
inet.0     N             0
black.inet.0 Y             3
red.inet.0 Y             4

```

show route export detail

```

user@host> show route export detail
inet.0                                Routes:      0
black.inet.0                          Routes:      3
  Import: [ inet.0 ]
red.inet.0                            Routes:      4
  Import: [ inet.0 ]

```

show route export instance detail

```

user@host> show route export instance detail
Instance: master                      Type: forwarding
  Flags: <config auto-policy> Options: <unicast multicast>
  Import policy: [ (ospf-master-from-red || isis-master-from-black) ]
Instance: black                       Type: non-forwarding
Instance: red                         Type: non-forwarding

```


show route export vrf-target

Syntax	show route export vrf-target <brief detail> <community <i>community--regular-expression</i> > <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display the VPN routing and forwarding (VRF) target communities for which policy-based route export is currently distributing routes. This command is relevant when there are overlapping virtual private networks (VPNs).
Options	<p>none—Display standard information about all target communities.</p> <p>brief detail—(Optional) Display the specified level of output. If you do not specify a level of output, the system defaults to brief.</p> <p>community <i>community-regular-expression</i>—(Optional) Display information about the specified community.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show route export vrf-target on page 337 show route export vrf-target community on page 337 show route export vrf-target detail on page 337
Output Fields	Table 15 on page 336 lists the output fields for the show route export vrf-target command. Output fields are listed in the approximate order in which they appear.

Table 15: show route export vrf-target Output Fields

Field Name	Field Description	Level of Output
Route target	Target communities for which auto-export is currently distributing routes.	brief none
Family	Routing table entries for the specified family.	brief none
<i>type-of-routing-table(s)</i>	Type of routing tables the feature handles: <ul style="list-style-type: none"> unicast—Indicates <i>instance.inet.0</i>. multicast—Indicates <i>instance.inet.2</i>. unicast multicast—Indicates <i>instance.inet.0</i> and <i>instance.inet.2</i>. 	brief none
Import	Number of routing tables that are currently importing routes with this target community. Omitted for tables that are not importing routes.	brief none

Table 15: show route export vrf-target Output Fields (*continued*)

Field Name	Field Description	Level of Output
Export	Number of routing tables that are currently exporting routes with this target community. Omitted for tables that are not exporting routes.	brief none
Target	Target communities, family, and options for which auto-export is currently distributing routes.	detail
Import table(s)	Name of the routing tables that are importing a particular route target.	detail
Export table(s)	Name of the routing tables that are exporting a particular route target.	detail

Sample Output

show route export vrf-target

```

user@host> show route export vrf-target
Route Target          Family      Import      Export
69:1                  inet        unicast     2           2
69:2                  inet        unicast     2           2

```

show route export vrf-target community

```

user@host> show route export vrf-target community target:69:1
Route Target          Family      Import      Export
69:1                  inet        unicast     2           2

```

show route export vrf-target detail

```

user@host> show route export vrf-target detail
Target: 1:12          inet        unicast
  Import table(s): vrf-11.inet.0 vrf-12.inet.0
  Export table(s): vrf-12.inet.0
Target: 1:13          inet        unicast
  Import table(s): vrf-12.inet.0 vrf-13.inet.0
  Export table(s): vrf-13.inet.0

```

show route forwarding-table interface-name

Syntax	<code>show route forwarding-table interface-name <i>interface-name</i></code> <code><detail extensive></code> <code><all></code>
Release Information	Command introduced in Junos OS Release 9.6.
Description	Display the interfaces in the Routing Engine's forwarding table.
Options	<p>none—Display information for the specified interface.</p> <p>detail extensive—(Optional) Display the specified level of output.</p> <p>all—(Optional) Display all interfaces in the routing table.</p>
Required Privilege Level	view
List of Sample Output	<p>show route forwarding-table interface-name fe-0/1/1 on page 339</p> <p>show route forwarding-table interface-name all on page 339</p> <p>show route forwarding-table interface-name all detail on page 340</p>
Output Fields	Table 16 on page 338 lists the output fields for the show route forwarding-table interface-name command. Output fields are listed in the approximate order in which they appear.

Table 16: show route forwarding-table interface-name Output Fields

Field Name	Field Description	Level of Output
Name	Name of the interface (for example fe-0/1/1 , lo0 , ae0 , and so on).	All levels
MTU	Interface's maximum transmission unit (MTU).	All levels
Afam	Configured address family (for example inet , tnp , inet6 , and so on).	detail extensive
Network	Network information: <ul style="list-style-type: none"> • <Link>—Physical interface, not a logical interface. • <PtoP>—Point-to-point network. • ipaddress—Network address. 	All levels
Address	Address of the interface. The address can be a MAC address, IPv4 address, IPv6 address, and so on.	All levels
IPkts	Number of packets received on the interface.	All levels
Ierr	Number of packets received on the interface with errors.	All levels
Opkts	Number of packets transmitted or sent from the interface.	All levels

Table 16: show route forwarding-table interface-name Output Fields (*continued*)

Field Name	Field Description	Level of Output
Oerr	Number of packets transmitted or sent from the interface with errors.	All levels
Coll	Number of packets that experienced collisions on the interface.	All levels

Sample Output

show route forwarding-table interface-name fe-0/1/1

```

user@host> show route forwarding-table interface-name fe-0/1/1
Name      Mtu Network      Address      IpKts Ierr      Opkts Oerr  Coll
fe-0/1/1  1514 <Link>      00.05.85.88.cc.20      0    0        0    0    0

```

show route forwarding-table interface-name all

```

user@host> show route forwarding-table interface-name all
Name      Mtu Network      Address      IpKts Ierr      Opkts Oerr  Coll
fxp0      1514 <Link>      00.a0.a5.56.03.83      180965    0      39907    0    0

  unit 0
fxp1      1514 <Link>      02.00.00.00.00.04      33010497    0      30110800    0    0

  unit 0
    1500 192.168.187.0/ 192.168.187.10
fxp1      1514 <Link>      02.00.00.00.00.04      33010497    0      30110800    0    0

  unit 0
    1500 10.0.0.0/8      10.0.0.1
    10.0.0.0/8      10.0.0.4
    128.0.0.0/2      128.0.0.1
    128.0.0.0/2      128.0.0.4
    1500 fe80::/64      fe80::200:ff:fe0
    fec0::/64      fec0::a:0:0:4
    1500      4
lsi       1496 <Link>
dsc       max <Link>
lo0       max <Link>
                                8980    0      8980    0    0

  unit 0
    max 127.0.0.1/8      127.0.0.1
    192.168.0.1/8      192.168.0.1
  unit 16384 max 127.0.0.1/8      127.0.0.1
  unit 16385 max
gre       max <Link>
ipip     max <Link>
tap       max <Link>
pime     max <Link>
pimd     max <Link>
mtun     max <Link>
so-0/0/0 4474 <Link>
                                1679900    0      1068611    0    0

  unit 0
0         4470 <PtoP>      10.0.60.2
                                0    0        0    0
so-0/0/1 4474 <Link>
                                0    0        0    0    0

  unit 0
0         4470 <PtoP>      10.0.80.2
                                0    0        0    0
so-0/0/2 4474 <Link>
                                0    0        0    0    0
so-0/0/3 4474 <Link>
                                0    0        0    0    0
fe-0/1/0 1514 <Link>      00.05.85.88.cc.1f      523120    0      623044    0    0

  unit 0
    1500 10.0.90.12/30 10.0.90.14
                                0    0        0    0

```

```

0
fe-0/1/1 1514 <Link> 00.05.85.88.cc.20 0 0 0 0 0
fe-0/1/2 1514 <Link> 00.05.85.88.cc.21 0 0 0 0 0

```

```
...
```

show route forwarding-table interface-name all detail

```

user@host> show route forwarding-table interface-name all detail
Name      Mtu AFam  Network      Address      Ipkts Ierr  Opkts
Oerr Coll
fxp0      1514      <Link> 00.a0.a5.56.03.83 181005 0 39948
0 0
unit 0    1500 inet  192.168.187.0/ 192.168.187.10
fxp1      1514      <Link> 02.00.00.00.00.04 33012676 0 30112468
0 0
unit 0    1500 inet  10.0.0.0/8     10.0.0.1
                        10.0.0.0/8     10.0.0.4
                        128.0.0.0/2    128.0.0.1
                        128.0.0.0/2    128.0.0.4
                        1500 inet6  fe80::/64      fe80::200:ff:fe0
                        fec0::/64      fec0::a:0:0:4
                        1500 tnp
lsi        1496      <Link>
dsc         max      <Link> 0 0 0
0 0
lo0         max      <Link> 8980 0 8980
0 0
unit 0      max inet  127.0.0.1/8    127.0.0.1
                        192.168.0.1/8  192.168.0.1
unit 16384 max inet  127.0.0.1/8    127.0.0.1
unit 16385 max inet
gre         max      <Link>
ipip        max      <Link>
tap         max      <Link>
pime        max      <Link>
pimd        max      <Link>
mtun        max      <Link>
so-0/0/0    4474      <Link> 1679980 0 1068661
0 0
unit 0      4470 inet  <PtoP> 10.0.60.2 0 0 0
0 0
...

```


show route hidden

Syntax	show route hidden <brief detail extensive terse> <logical-system (all <i>logical-system-name</i>)>
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	<p>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.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • <i>Understanding Hidden Routes</i>
List of Sample Output	show route hidden on page 341 show route hidden detail on page 342 show route hidden extensive on page 342 show route hidden terse on page 342
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.13vpn.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 342](#).

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                >100.0

```

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 inactive-path

Syntax	<code>show route inactive-path</code> <code><brief detail extensive terse></code> <code><logical-system (all <i>logical-system-name</i>)></code>
Syntax (EX Series Switches)	<code>show route inactive-path</code> <code><brief detail extensive terse></code>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches.
Description	Display routes for destinations that have no active route. An inactive route is a route that was not selected as the best path.
Options	none —Display all inactive routes. 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 <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
List of Sample Output	show route inactive-path on page 344 show route inactive-path detail on page 345 show route inactive-path extensive on page 346 show route inactive-path terse on page 346
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 inactive-path

```
user@host> show route inactive-path

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

10.12.100.12/30      [OSPF/10] 03:57:28, metric 1
> via so-0/3/0.0

private1__inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.0/8          [Direct/0] 04:39:56
> via fxp1.0
```

```

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

10.12.80.0/30      [BGP/170] 04:38:17, localpref 100
                  AS path: 100 I
                  > to 10.12.80.1 via ge-6/3/2.0

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

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 inactive-path detail

```

user@host> show route inactive-path detail

inet.0: 25 destinations, 26 routes (24 active, 0 holddown, 1 hidden)
Restart Complete

10.12.100.12/30 (2 entries, 1 announced)
  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:      1
         Age: 3:58:24   Metric: 1
         Area: 0.0.0.0
         Task: OSPF
         AS path: I

private1___.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

10.0.0.0/8 (2 entries, 0 announced)
  Direct Preference: 0
         Next hop type: Interface
         Next-hop reference count: 1
         Next hop: via fxp1.0, selected
         State: <NotBest Int>
         Inactive reason: No difference
         Age: 4:40:52
         Task: IF
         AS path: I

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

10.12.80.0/30 (2 entries, 1 announced)
  BGP   Preference: 170/-101
        Next-hop reference count: 6
        Source: 10.12.80.1

```

```

Next hop: 10.12.80.1 via ge-6/3/2.0, selected
State: <Ext>
Inactive reason: Route Preference
Peer AS: 100
Age: 4:39:13
Task: BGP_100.10.12.80.1+179
AS path: 100 I
Localpref: 100
Router ID: 10.0.0.0

```

show route inactive-path extensive

The output for the **show route inactive-path extensive** command is identical to that of the **show route inactive-path detail** command. For sample output, see [show route inactive-path detail on page 345](#).

show route inactive-path terse

```
user@host> show route inactive-path 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
	10.12.100.12/30	0	10	1		>so-0/3/0.0	

```
private1__inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)
```

```
+ = Active Route, - = Last Active, * = Both
```

A	Destination	P	Prf	Metric 1	Metric 2	Next hop	AS path
	10.0.0.0/8	D	0			>fxp1.0	

```
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
	10.12.80.0/30	B	170	100		>10.12.80.1	100 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
```

```
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 instance

Syntax	<pre>show route instance <brief detail summary> <instance-name> <logical-system (all logical-system-name)> <operational></pre>
Syntax (EX Series Switches and QFX Series)	<pre>show route instance <brief detail summary> <instance-name> <operational></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Display routing instance information.
Options	<p>none—(Same as brief) Display standard information about all routing instances.</p> <p>brief detail summary—(Optional) Display the specified level of output. If you do not specify a level of output, the system defaults to brief. (These options are not available with the operational keyword.)</p> <p>instance-name—(Optional) Display information for all routing instances whose name begins with this string (for example, cust1, cust11, and cust111 are all displayed when you run the show route instance cust1 command).</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>operational—(Optional) Display operational routing instances.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • <i>Example: Transporting IPv6 Traffic Across IPv4 Using Filter-Based Tunneling</i> • <i>Example: Configuring the Helper Capability Mode for OSPFv3 Graceful Restart</i>
List of Sample Output	<p>show route instance on page 348</p> <p>show route instance detail (Graceful Restart Complete) on page 349</p> <p>show route instance detail (Graceful Restart Incomplete) on page 351</p> <p>show route instance detail (VPLS Routing Instance) on page 352</p> <p>show route instance operational on page 353</p> <p>show route instance summary on page 353</p>
Output Fields	<p>Table 17 on page 348 lists the output fields for the show route instance command. Output fields are listed in the approximate order in which they appear.</p>

Table 17: show route instance Output Fields

Field Name	Field Description	Level of Output
Instance or <i>instance-name</i>	Name of the routing instance.	All levels
Operational Routing Instances	(operational keyword only) Names of all operational routing instances.	—
Type	Type of routing instance: forwarding , l2vpn , no-forwarding , vpls , virtual-router , or vrf .	All levels
State	State of the routing instance: active or inactive .	brief detail none
Interfaces	Name of interfaces belonging to this routing instance.	brief detail none
Restart State	Status of graceful restart for this instance: Pending or Complete .	detail
Path selection timeout	Maximum amount of time, in seconds, remaining until graceful restart is declared complete. The default is 300 .	detail
Tables	Tables (and number of routes) associated with this routing instance.	brief detail none
Route-distinguisher	Unique route distinguisher associated with this routing instance.	detail
Vrf-import	VPN routing and forwarding instance import policy name.	detail
Vrf-export	VPN routing and forwarding instance export policy name.	detail
Vrf-import-target	VPN routing and forwarding instance import target community name.	detail
Vrf-export-target	VPN routing and forwarding instance export target community name.	detail
Fast-reroute-priority	Fast reroute priority setting for a VPLS routing instance: high , medium , or low . The default is low .	detail
Restart State	Restart state: <ul style="list-style-type: none"> Pending;protocol-name—List of protocols that have not yet completed graceful restart for this routing table. Complete—All protocols have restarted for this routing table. 	detail
Primary rib	Primary table for this routing instance.	brief none summary
Active/holddown/hidden	Number of active, hold-down, and hidden routes.	All levels

Sample Output

show route instance

```

user@host> show route instance
Instance          Type
                  Primary RIB
Active/holddown/hidden

```



```

master          forwarding
    inet.0              16/0/1
    iso.0               1/0/0
    mpls.0              0/0/0
    inet6.0             2/0/0
    l2circuit.0         0/0/0
__juniper_private1__ forwarding
    __juniper_private1__.inet.0  12/0/0
    __juniper_private1__.inet6.0  1/0/0

```

show route instance detail (Graceful Restart Complete)

```

user@host> show route instance detail
master:
  Router ID: 10.255.14.176
  Type: forwarding      State: Active
  Restart State: Complete Path selection timeout: 300
  Tables:
    inet.0              : 17 routes (15 active, 0 holddown, 1 hidden)
    Restart Complete
    inet.3              : 2 routes (2 active, 0 holddown, 0 hidden)
    Restart Complete
    iso.0               : 1 routes (1 active, 0 holddown, 0 hidden)
    Restart Complete
    mpls.0              : 19 routes (19 active, 0 holddown, 0 hidden)
    Restart Complete
    bgp.l3vpn.0         : 10 routes (10 active, 0 holddown, 0 hidden)
    Restart Complete
    inet6.0             : 2 routes (2 active, 0 holddown, 0 hidden)
    Restart Complete
    bgp.l2vpn.0         : 1 routes (1 active, 0 holddown, 0 hidden)
    Restart Complete
  BGP-INET:
    Router ID: 10.69.103.1
    Type: vrf            State: Active
    Restart State: Complete Path selection timeout: 300
    Interfaces:
      t3-0/0/0.103
    Route-distinguisher: 10.255.14.176:103
    Vrf-import: [ BGP-INET-import ]
    Vrf-export: [ BGP-INET-export ]
    Tables:
      BGP-INET.inet.0    : 4 routes (4 active, 0 holddown, 0 hidden)
      Restart Complete
  BGP-L:
    Router ID: 10.69.104.1
    Type: vrf            State: Active
    Restart State: Complete Path selection timeout: 300
    Interfaces:
      t3-0/0/0.104
    Route-distinguisher: 10.255.14.176:104
    Vrf-import: [ BGP-L-import ]
    Vrf-export: [ BGP-L-export ]
    Tables:
      BGP-L.inet.0       : 4 routes (4 active, 0 holddown, 0 hidden)
      Restart Complete
      BGP-L.mpls.0       : 3 routes (3 active, 0 holddown, 0 hidden)
      Restart Complete
  L2VPN:
    Router ID: 0.0.0.0
    Type: l2vpn          State: Active

```

```
Restart State: Complete Path selection timeout: 300
Interfaces:
  t3-0/0/0.512
Route-distinguisher: 10.255.14.176:512
Vrf-import: [ L2VPN-import ]
Vrf-export: [ L2VPN-export ]
Tables:
  L2VPN.l2vpn.0          : 2 routes (2 active, 0 holddown, 0 hidden)
Restart Complete
LDP:
Router ID: 10.69.105.1
Type: vrf                State: Active
Restart State: Complete Path selection timeout: 300
Interfaces:
  t3-0/0/0.105
Route-distinguisher: 10.255.14.176:105
Vrf-import: [ LDP-import ]
Vrf-export: [ LDP-export ]
Tables:
  LDP.inet.0             : 5 routes (4 active, 0 holddown, 0 hidden)
Restart Complete
OSPF:
Router ID: 10.69.101.1
Type: vrf                State: Active
Restart State: Complete Path selection timeout: 300
Interfaces:
  t3-0/0/0.101
Route-distinguisher: 10.255.14.176:101
Vrf-import: [ OSPF-import ]
Vrf-export: [ OSPF-export ]
Vrf-import-target: [ target:11111
Tables:
  OSPF.inet.0            : 8 routes (7 active, 0 holddown, 0 hidden)
Restart Complete
RIP:
Router ID: 10.69.102.1
Type: vrf                State: Active
Restart State: Complete Path selection timeout: 300
Interfaces:
  t3-0/0/0.102
Route-distinguisher: 10.255.14.176:102
Vrf-import: [ RIP-import ]
Vrf-export: [ RIP-export ]
Tables:
  RIP.inet.0             : 6 routes (6 active, 0 holddown, 0 hidden)
Restart Complete
STATIC:
Router ID: 10.69.100.1
Type: vrf                State: Active
Restart State: Complete Path selection timeout: 300
Interfaces:
  t3-0/0/0.100
Route-distinguisher: 10.255.14.176:100
Vrf-import: [ STATIC-import ]
Vrf-export: [ STATIC-export ]
Tables:
  STATIC.inet.0          : 4 routes (4 active, 0 holddown, 0 hidden)
Restart Complete
```

show route instance detail (Graceful Restart Incomplete)

```

user@host> show route instance detail
master:
  Router ID: 10.255.14.176
  Type: forwarding          State: Active
  Restart State: Pending    Path selection timeout: 300
  Tables:
    inet.0                  : 17 routes (15 active, 1 holddown, 1 hidden)
    Restart Pending: OSPF LDP
    inet.3                  : 2 routes (2 active, 0 holddown, 0 hidden)
    Restart Pending: OSPF LDP
    iso.0                   : 1 routes (1 active, 0 holddown, 0 hidden)
    Restart Complete
    mpls.0                  : 23 routes (23 active, 0 holddown, 0 hidden)
    Restart Pending: LDP VPN
    bgp.l3vpn.0             : 10 routes (10 active, 0 holddown, 0 hidden)
    Restart Pending: BGP VPN
    inet6.0                 : 2 routes (2 active, 0 holddown, 0 hidden)
    Restart Complete
    bgp.l2vpn.0             : 1 routes (1 active, 0 holddown, 0 hidden)
    Restart Pending: BGP VPN
BGP-INET:
  Router ID: 10.69.103.1
  Type: vrf                 State: Active
  Restart State: Pending    Path selection timeout: 300
  Interfaces:
    t3-0/0/0.103
  Route-distinguisher: 10.255.14.176:103
  Vrf-import: [ BGP-INET-import ]
  Vrf-export: [ BGP-INET-export ]
  Tables:
    BGP-INET.inet.0         : 6 routes (5 active, 0 holddown, 0 hidden)
    Restart Pending: VPN
BGP-L:
  Router ID: 10.69.104.1
  Type: vrf                 State: Active
  Restart State: Pending    Path selection timeout: 300
  Interfaces:
    t3-0/0/0.104
  Route-distinguisher: 10.255.14.176:104
  Vrf-import: [ BGP-L-import ]
  Vrf-export: [ BGP-L-export ]
  Tables:
    BGP-L.inet.0            : 6 routes (5 active, 0 holddown, 0 hidden)
    Restart Pending: VPN
    BGP-L.mpls.0            : 2 routes (2 active, 0 holddown, 0 hidden)
    Restart Pending: VPN
L2VPN:
  Router ID: 0.0.0.0
  Type: l2vpn               State: Active
  Restart State: Pending    Path selection timeout: 300
  Interfaces:
    t3-0/0/0.512
  Route-distinguisher: 10.255.14.176:512
  Vrf-import: [ L2VPN-import ]
  Vrf-export: [ L2VPN-export ]
  Tables:
    L2VPN.l2vpn.0           : 2 routes (2 active, 0 holddown, 0 hidden)
    Restart Pending: VPN L2VPN
LDP:

```

```

Router ID: 10.69.105.1
Type: vrf                      State: Active
Restart State: Pending Path selection timeout: 300
Interfaces:
  t3-0/0/0.105
Route-distinguisher: 10.255.14.176:105
Vrf-import: [ LDP-import ]
Vrf-export: [ LDP-export ]
Tables:
  LDP.inet.0                  : 5 routes (4 active, 1 holddown, 0 hidden)
Restart Pending: OSPF LDP VPN

OSPF:
  Router ID: 10.69.101.1
  Type: vrf                      State: Active
  Restart State: Pending Path selection timeout: 300
  Interfaces:
    t3-0/0/0.101
  Route-distinguisher: 10.255.14.176:101
  Vrf-import: [ OSPF-import ]
  Vrf-export: [ OSPF-export ]
  Tables:
    OSPF.inet.0              : 8 routes (7 active, 1 holddown, 0 hidden)
Restart Pending: OSPF VPN

RIP:
  Router ID: 10.69.102.1
  Type: vrf                      State: Active
  Restart State: Pending Path selection timeout: 300
  Interfaces:
    t3-0/0/0.102
  Route-distinguisher: 10.255.14.176:102
  Vrf-import: [ RIP-import ]
  Vrf-export: [ RIP-export ]
  Tables:
    RIP.inet.0               : 8 routes (6 active, 2 holddown, 0 hidden)
Restart Pending: RIP VPN

STATIC:
  Router ID: 10.69.100.1
  Type: vrf                      State: Active
  Restart State: Pending Path selection timeout: 300
  Interfaces:
    t3-0/0/0.100
  Route-distinguisher: 10.255.14.176:100
  Vrf-import: [ STATIC-import ]
  Vrf-export: [ STATIC-export ]
  Tables:
    STATIC.inet.0           : 4 routes (4 active, 0 holddown, 0 hidden)
Restart Pending: VPN

```

show route instance detail (VPLS Routing Instance)

```

user@host> show route instance detail test-vpls
test-vpls:
  Router ID: 0.0.0.0
  Type: vpls                      State: Active
  Interfaces:
    lsi.1048833
    lsi.1048832
    fe-0/1/0.513
  Route-distinguisher: 10.255.37.65:1
  Vrf-import: [ __vrf-import-test-vpls-internal__ ]
  Vrf-export: [ __vrf-export-test-vpls-internal__ ]

```

```

Vrf-import-target: [ target:300:1 ]
Vrf-export-target: [ target:300:1 ]
Fast-reroute-priority: high
Tables:
  test-vpls.l2vpn.0          : 3 routes (3 active, 0 holddown, 0 hidden)

```

show route instance operational

```

user@host> show route instance operational
Operational Routing Instances:

```

```

master
default

```

show route instance summary

```

user@host> show route instance summary

```

Instance	Type	Primary rib	Active/holddown/hidden
master	forwarding	inet.0	15/0/1
		iso.0	1/0/0
		mpls.0	35/0/0
		l3vpn.0	0/0/0
		inet6.0	2/0/0
		l2vpn.0	0/0/0
		l2circuit.0	0/0/0
BGP-INET	vrf	BGP-INET.inet.0	5/0/0
		BGP-INET.iso.0	0/0/0
		BGP-INET.inet6.0	0/0/0
BGP-L	vrf	BGP-L.inet.0	5/0/0
		BGP-L.iso.0	0/0/0
		BGP-L.mpls.0	4/0/0
		BGP-L.inet6.0	0/0/0
L2VPN	l2vpn	L2VPN.inet.0	0/0/0
		L2VPN.iso.0	0/0/0
		L2VPN.inet6.0	0/0/0
		L2VPN.l2vpn.0	2/0/0
LDP	vrf	LDP.inet.0	4/0/0
		LDP.iso.0	0/0/0
		LDP.mpls.0	0/0/0
		LDP.inet6.0	0/0/0
		LDP.l2circuit.0	0/0/0
OSPF	vrf	OSPF.inet.0	7/0/0
		OSPF.iso.0	0/0/0
		OSPF.inet6.0	0/0/0
RIP	vrf	RIP.inet.0	6/0/0
		RIP.iso.0	0/0/0
		RIP.inet6.0	0/0/0
STATIC	vrf	STATIC.inet.0	4/0/0
		STATIC.iso.0	0/0/0
		STATIC.inet6.0	0/0/0

show route label-switched-path

Syntax	<code>show route label-switched-path <i>path-name</i></code> <brief detail extensive terse> <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	<code>show route label-switched-path <i>path-name</i></code> <brief detail extensive terse>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.5 for EX Series switches.
Description	Display the routes used in an MPLS label-switched path (LSP).
Options	brief detail extensive terse —(Optional) Display the specified level of output. <i>path-name</i> —LSP tunnel name. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
List of Sample Output	show route label-switched-path on page 354
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 label-switched-path

```

user@host> show route label-switched-path sf-to-ny
inet.0: 29 destinations, 29 routes (29 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

1.1.1.1/32          [MPLS/7] 00:00:06, metric 0
> to 111.222.1.9 via s0-0/0/0, label-switched-path sf-to-ny
3.3.3.3/32          *[MPLS/7] 00:00:06, metric 0
> to 111.222.1.9 via s0-0/0/0, label-switched-path sf-to-ny

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

2.2.2.2/32          *[MPLS/7] 00:00:06, metric 0
> to 111.222.1.9 via s0-0/0/0, label-switched-path sf-to-ny
4.4.4.4/32          *[MPLS/7] 00:00:06, metric 0
> to 111.222.1.9 via s0-0/0/0, label-switched-path abc
> to 111.222.1.9 via s0-0/0/0, label-switched-path xyz
> to 111.222.1.9 via s0-0/0/0, label-switched-path sf-to-ny
111.222.1.9/32      [MPLS/7] 00:00:06, metric 0
> to 111.222.1.9 via s0-0/0/0, label-switched-path sf-to-ny

```

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

mpls.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
```

show route localization

Syntax	show route localization
Release Information	Command introduced in Junos OS Release 11.4 for T-Series routers. Command introduced in Junos OS Release 12.3 for MX Series routers.
Description	(T320, T640, and T1600 routers only) Display route localization details.
Options	detail —Display detailed output.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> <i>Example: Configuring Packet Forwarding Engine FIB Localization</i>
Output Fields	Table 18 on page 356 lists the output fields for the show route localization command. Output fields are listed in the approximate order in which they appear.

Table 18: show route localization Output Fields

Field Name	Field Description
FIB-local	FPCs configured as FIB-local.
FIB-remote	FPCs configured as FIB-remote.
Normal	FPCs neither configured as FIB-local or FIB-remote .
Protocols	IPv4 (inet) or IPv6 (inet6) traffic configured for route localization.

Sample Output

```

user@R0> show route localization
FIB localization ready FPCs (and FIB-local Forwarding Engine addresses)
  FIB-local:  FPC2(4,5)
  FIB-remote: FPC0, FPC1
  Normal:     FPC3, FPC4, FPC5, FPC6, FPC7

user@R0> show route localization detail
FIB localization ready FPCs (and FIB-local Forwarding Engine addresses)
  FIB-local:  FPC2(4,5)
  FIB-remote: FPC0, FPC1
  Normal:     FPC3, FPC4, FPC5, FPC6, FPC7
FIB localization configuration
  Protocols:  inet, inet6
  FIB-local:  FPC2
  FIB-remote: FPC0, FPC1
Forwarding Engine addresses
  FPC0: 1
  FPC1: 2
  FPC2: 4, 5

```


FPC3: 6
FPC4: 8
FPC5: 11
FPC6: 13
FPC7: 15

show route martians

Syntax	show route martians <logical-system (all <i>logical-system-name</i>)> <table <i>routing-table-name</i> >
Syntax (EX Series Switches)	show route martians <table <i>routing-table-name</i> >
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 martian (invalid and ignored) entries associated with each routing table.
Options	<p>none—Display standard information about route martians for all routing tables.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>table <i>routing-table-name</i>—(Optional) Display information about route martians 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 martians table inet command).</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring Martian Addresses on page 145
List of Sample Output	show route martians on page 358
Output Fields	Table 19 on page 358 lists the output fields for the show route martians command. Output fields are listed in the approximate order in which they appear

Table 19: show route martians Output Fields

Field Name	Field Description
<i>table-name</i>	Name of the route table in which the route martians reside.
<i>destination-prefix</i>	Route destination.
<i>match value</i>	Route match parameter.
<i>status</i>	Status of the route: allowed or disallowed .

Sample Output

show route martians

```
user@host> show route martians
```

```
inet.0:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- disallowed
    224.0.0.0/4 exact -- disallowed
    224.0.0.0/24 exact -- disallowed

inet.1:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- disallowed

inet.2:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- disallowed
    224.0.0.0/4 exact -- disallowed
    224.0.0.0/24 exact -- disallowed

inet.3:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- disallowed
    224.0.0.0/4 exact -- disallowed
    224.0.0.0/24 exact -- disallowed

...

inet6.0:
    ::1/128 exact -- disallowed
    ff00::/8 exact -- disallowed
    ff02::/16 exact -- disallowed

inet6.1:
    ::1/128 exact -- disallowed

inet6.2:
    ::1/128 exact -- disallowed
    ff00::/8 exact -- disallowed
    ff02::/16 exact -- disallowed

inet6.3:
    ::1/128 exact -- disallowed
    ff00::/8 exact -- disallowed
    ff02::/16 exact -- disallowed

...
```

show route next-hop

Syntax	<code>show route next-hop <i>next-hop</i></code> <brief detail extensive terse> <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	<code>show route next-hop <i>next-hop</i></code> <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 entries in the routing table that are being sent to the specified next-hop address.
Options	brief detail extensive terse —(Optional) Display the specified level of output. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system. <i>next-hop</i> —Next-hop address.
Required Privilege Level	view
List of Sample Output	show route next-hop on page 360 show route next-hop detail on page 361 show route next-hop extensive on page 363 show route next-hop terse on page 364
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 next-hop

```

user@host> show route next-hop 192.168.71.254

inet.0: 18 destinations, 18 routes (17 active, 0 holddown, 1 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

10.10.0.0/16      *[Static/5] 06:26:25
                  > to 192.168.71.254 via fxp0.0
10.209.0.0/16    *[Static/5] 06:26:25
                  > to 192.168.71.254 via fxp0.0
172.16.0.0/12    *[Static/5] 06:26:25
                  > to 192.168.71.254 via fxp0.0
192.168.0.0/16   *[Static/5] 06:26:25
                  > to 192.168.71.254 via fxp0.0
192.168.102.0/23 *[Static/5] 06:26:25
                  > to 192.168.71.254 via fxp0.0

```

```

207.17.136.0/24    *[Static/5] 06:26:25
                  > to 192.168.71.254 via fxp0.0
207.17.136.192/32 *[Static/5] 06:26:25
                  > to 192.168.71.254 via fxp0.0

private1___.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

red.inet.0: 4 destinations, 5 routes (4 active, 0 holddown, 0 hidden)
Restart Complete

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

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 next-hop detail

```

user@host> show route next-hop 192.168.71.254 detail

inet.0: 18 destinations, 18 routes (17 active, 0 holddown, 1 hidden)
Restart Complete
10.10.0.0/16 (1 entry, 1 announced)
    *Static Preference: 5
        Next-hop reference count: 36
        Next hop: 192.168.71.254 via fxp0.0, selected
        State: <Active NoReadvrt Int Ext>
        Local AS:    1
        Age: 6:27:41
        Task: RT
        Announcement bits (3): 0-KRT 3-Resolve tree 1 5-Resolve tree 2
        AS path: I

10.209.0.0/16 (1 entry, 1 announced)
    *Static Preference: 5
        Next-hop reference count: 36
        Next hop: 192.168.71.254 via fxp0.0, selected
        State: <Active NoReadvrt Int Ext>
        Local AS:    1
        Age: 6:27:41
        Task: RT
        Announcement bits (3): 0-KRT 3-Resolve tree 1 5-Resolve tree 2
        AS path: I

172.16.0.0/12 (1 entry, 1 announced)
    *Static Preference: 5
        Next-hop reference count: 36
        Next hop: 192.168.71.254 via fxp0.0, selected
        State: <Active NoReadvrt Int Ext>
        Local AS:    1
        Age: 6:27:41
        Task: RT
        Announcement bits (3): 0-KRT 3-Resolve tree 1 5-Resolve tree 2
        AS path: I

192.168.0.0/16 (1 entry, 1 announced)

```

```
*Static Preference: 5
  Next-hop reference count: 36
  Next hop: 192.168.71.254 via fxp0.0, selected
  State: <Active NoReadvrt Int Ext>
  Local AS: 1
  Age: 6:27:41
  Task: RT
  Announcement bits (3): 0-KRT 3-Resolve tree 1 5-Resolve tree 2
  AS path: I

192.168.102.0/23 (1 entry, 1 announced)
  *Static Preference: 5
    Next-hop reference count: 36
    Next hop: 192.168.71.254 via fxp0.0, selected
    State: <Active NoReadvrt Int Ext>
    Local AS: 1
    Age: 6:27:41
    Task: RT
    Announcement bits (3): 0-KRT 3-Resolve tree 1 5-Resolve tree 2
    AS path: I

207.17.136.0/24 (1 entry, 1 announced)
  *Static Preference: 5
    Next-hop reference count: 36
    Next hop: 192.168.71.254 via fxp0.0, selected
    State: <Active NoReadvrt Int Ext>
    Local AS: 1
    Age: 6:27:41
    Task: RT
    Announcement bits (3): 0-KRT 3-Resolve tree 1 5-Resolve tree 2
    AS path: I

207.17.136.192/32 (1 entry, 1 announced)
  *Static Preference: 5
    Next-hop reference count: 36
    Next hop: 192.168.71.254 via fxp0.0, selected
    State: <Active NoReadvrt Int Ext>
    Local AS: 1
    Age: 6:27:41
    Task: RT
    Announcement bits (3): 0-KRT 3-Resolve tree 1 5-Resolve tree 2
    AS path: I

private1___.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

red.inet.0: 4 destinations, 5 routes (4 active, 0 holddown, 0 hidden)
Restart Complete

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

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 next-hop extensive

```
user@host> show route next-hop 192.168.71.254 extensive
```

```
inet.0: 18 destinations, 18 routes (17 active, 0 holddown, 1 hidden)
```

```
10.10.0.0/16 (1 entry, 1 announced)
```

```
TSI:
```

```
KRT in-kernel 10.10.0.0/16 -> {192.168.71.254}
```

```
*Static Preference: 5
```

```
Next-hop reference count: 22
```

```
Next hop: 192.168.71.254 via fxp0.0, selected
```

```
State: <Active NoReadvrt Int Ext>
```

```
Local AS: 69
```

```
Age: 2:02:28
```

```
Task: RT
```

```
Announcement bits (1): 0-KRT
```

```
AS path: I
```

```
10.209.0.0/16 (1 entry, 1 announced)
```

```
TSI:
```

```
KRT in-kernel 10.209.0.0/16 -> {192.168.71.254}
```

```
*Static Preference: 5
```

```
Next-hop reference count: 22
```

```
Next hop: 192.168.71.254 via fxp0.0, selected
```

```
State: <Active NoReadvrt Int Ext>
```

```
Local AS: 69
```

```
Age: 2:02:28
```

```
Task: RT
```

```
Announcement bits (1): 0-KRT
```

```
AS path: I
```

```
172.16.0.0/12 (1 entry, 1 announced)
```

```
TSI:
```

```
KRT in-kernel 172.16.0.0/12 -> {192.168.71.254}
```

```
*Static Preference: 5
```

```
Next-hop reference count: 22
```

```
Next hop: 192.168.71.254 via fxp0.0, selected
```

```
State: <Active NoReadvrt Int Ext>
```

```
Local AS: 69
```

```
Age: 2:02:28
```

```
Task: RT
```

```
Announcement bits (1): 0-KRT
```

```
AS path: I
```

```
192.168.0.0/16 (1 entry, 1 announced)
```

```
TSI:
```

```
KRT in-kernel 192.168.0.0/16 -> {192.168.71.254}
```

```
*Static Preference: 5
```

```
Next-hop reference count: 22
```

```
Next hop: 192.168.71.254 via fxp0.0, selected
```

```
State: <Active NoReadvrt Int Ext>
```

```
Local AS: 69
```

```
Age: 2:02:28
```

```
Task: RT
```

```
Announcement bits (1): 0-KRT
```

```
AS path: I
```

```
192.168.102.0/23 (1 entry, 1 announced)
```

```
TSI:
```

```
KRT in-kernel 192.168.102.0/23 -> {192.168.71.254}
```

```
*Static Preference: 5
```

```

Next-hop reference count: 22
Next hop: 192.168.71.254 via fxp0.0, selected
State: <Active NoReadvrt Int Ext>
Local AS: 69
Age: 2:02:28
Task: RT
Announcement bits (1): 0-KRT
AS path: I

207.17.136.0/24 (1 entry, 1 announced)
TSI:
KRT in-kerne1 207.17.136.0/24 -> {192.168.71.254}
*Static Preference: 5
Next-hop reference count: 22
Next hop: 192.168.71.254 via fxp0.0, selected
State: <Active NoReadvrt Int Ext>
Local AS: 69
Age: 2:02:28
Task: RT
Announcement bits (1): 0-KRT
AS path: I

207.17.136.192/32 (1 entry, 1 announced)
TSI:
KRT in-kerne1 207.17.136.192/32 -> {192.168.71.254}
*Static Preference: 5
Next-hop reference count: 22
Next hop: 192.168.71.254 via fxp0.0, selected
State: <Active NoReadvrt Int Ext>
Local AS: 69
Age: 2:02:28
Task: RT
Announcement bits (1): 0-KRT
AS path: I

private1___.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

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

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

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

private1___.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

green.l2vpn.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)

red.l2vpn.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

```

show route next-hop terse

```

user@host> show route next-hop 192.168.71.254 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
* 10.10.0.0/16     S  5              >192.168.71.254
* 10.209.0.0/16    S  5              >192.168.71.254
* 172.16.0.0/12    S  5              >192.168.71.254

```



```
* 192.168.0.0/16      S   5                >192.168.71.254
* 192.168.102.0/23   S   5                >192.168.71.254
* 207.17.136.0/24    S   5                >192.168.71.254
* 207.17.136.192/32  S   5                >192.168.71.254

private1___.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

red.inet.0: 4 destinations, 5 routes (4 active, 0 holddown, 0 hidden)
Restart Complete

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

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 protocol

Syntax	<code>show route protocol <i>protocol</i></code> <code><brief detail extensive terse></code> <code><logical-system (all <i>logical-system-name</i>)></code>
Syntax (EX Series Switches)	<code>show route protocol <i>protocol</i></code> <code><brief detail extensive terse></code>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. ospf2 and ospf3 options introduced in Junos OS Release 9.2. ospf2 and ospf3 options introduced in Junos OS Release 9.2 for EX Series switches. flow option introduced in Junos OS Release 10.0. flow option introduced in Junos OS Release 10.0 for EX Series switches.
Description	Display the route entries in the routing table that were learned from a particular protocol.
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 <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system. <i>protocol</i> —Protocol from which the route was learned: <ul style="list-style-type: none">• access—Access route for use by DHCP application• access-internal—Access-internal route for use by DHCP application• aggregate—Locally generated aggregate route• arp—Route learned through the Address Resolution Protocol• atmvpn—Asynchronous Transfer Mode virtual private network• bgp—Border Gateway Protocol• ccc—Circuit cross-connect• direct—Directly connected route• dvmrp—Distance Vector Multicast Routing Protocol• esis—End System-to-Intermediate System• flow—Locally defined flow-specification route• frr—Precomputed protection route or backup route used when a link goes down• isis—Intermediate System-to-Intermediate System• ldp—Label Distribution Protocol• l2circuit—Layer 2 circuit• l2vpn—Layer 2 virtual private network

- **local**—Local address
- **mpls**—Multiprotocol Label Switching
- **msdp**—Multicast Source Discovery Protocol
- **ospf**—Open Shortest Path First versions 2 and 3
- **ospf2**—Open Shortest Path First versions 2 only
- **ospf3**—Open Shortest Path First version 3 only
- **pim**—Protocol Independent Multicast
- **rip**—Routing Information Protocol
- **ripng**—Routing Information Protocol next generation
- **rsvp**—Resource Reservation Protocol
- **rtarget**—Local route target virtual private network
- **static**—Statically defined route
- **tunnel**—Dynamic tunnel
- **vpn**—Virtual private network



NOTE: EX Series switches run a subset of these protocols. See the switch CLI for details.

Required Privilege Level	view
List of Sample Output	show route protocol access on page 368 show route protocol access-internal extensive on page 368 show route protocol arp on page 368 show route protocol bgp on page 369 show route protocol bgp detail on page 369 show route protocol bgp extensive on page 369 show route protocol bgp terse on page 370 show route protocol direct on page 370 show route protocol frr on page 371 show route protocol l2circuit detail on page 371 show route protocol l2vpn extensive on page 372 show route protocol ldp on page 373 show route protocol ldp extensive on page 373 show route protocol ospf (Layer 3 VPN) on page 374 show route protocol ospf detail on page 375 show route protocol rip on page 375 show route protocol rip detail on page 375 show route protocol ripng table inet6 on page 376 show route protocol static detail on page 376

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 protocol access

```
user@host> show route protocol access
inet.0: 30380 destinations, 30382 routes (30379 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

13.160.0.3/32      *[Access/13] 00:00:09
                  > to 13.160.0.2 via fe-0/0/0.0
13.160.0.4/32      *[Access/13] 00:00:09
                  > to 13.160.0.2 via fe-0/0/0.0
13.160.0.5/32      *[Access/13] 00:00:09
                  > to 13.160.0.2 via fe-0/0/0.0
```

show route protocol access-internal extensive

```
user@host> show route protocol access-internal 13.160.0.19 extensive
inet.0: 100020 destinations, 100022 routes (100019 active, 0 holddown, 1 hidden)
13.160.0.19/32 (1 entry, 1 announced)
TSI:
KRT in-kernel 13.160.0.19/32 -> {13.160.0.2}
    *Access-internal Preference: 12
        Next-hop reference count: 200000
        Next hop: 13.160.0.2 via fe-0/0/0.0, selected
        State: <Active Int>
    Age: 36
        Task: RPD Unix Domain Server./var/run/rpd_serv.local
        Announcement bits (1): 0-KRT
        AS path: I
```

show route protocol arp

```
user@host> show route protocol arp
inet.0: 43 destinations, 43 routes (42 active, 0 holddown, 1 hidden)

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

cust1.inet.0: 1033 destinations, 2043 routes (1033 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

20.20.1.3/32      [ARP/4294967293] 00:04:35, from 20.20.1.1
                  Unusable
20.20.1.4/32      [ARP/4294967293] 00:04:35, from 20.20.1.1
                  Unusable
20.20.1.5/32      [ARP/4294967293] 00:04:32, from 20.20.1.1
                  Unusable
20.20.1.6/32      [ARP/4294967293] 00:04:34, from 20.20.1.1
                  Unusable
20.20.1.7/32      [ARP/4294967293] 00:04:35, from 20.20.1.1
                  Unusable
20.20.1.8/32      [ARP/4294967293] 00:04:35, from 20.20.1.1
                  Unusable
20.20.1.9/32      [ARP/4294967293] 00:04:35, from 20.20.1.1
                  Unusable
20.20.1.10/32     [ARP/4294967293] 00:04:35, from 20.20.1.1
```

```

Unusable
20.20.1.11/32      [ARP/4294967293] 00:04:33, from 20.20.1.1
Unusable
20.20.1.12/32      [ARP/4294967293] 00:04:33, from 20.20.1.1
Unusable
20.20.1.13/32      [ARP/4294967293] 00:04:33, from 20.20.1.1
Unusable
...

```

show route protocol bgp

```

user@host> show route protocol bgp 192.168.64.0/21
inet.0: 335832 destinations, 335833 routes (335383 active, 0 holddown, 450 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.64.0/21      *[BGP/170] 6d 10:41:16, localpref 100, from 192.168.69.71
AS path: 10458 14203 2914 4788 4788 I
> to 192.168.167.254 via fxp0.0

```

show route protocol bgp detail

```

user@host> show route protocol bgp 66.117.63.0/24 detail
inet.0: 335805 destinations, 335806 routes (335356 active, 0 holddown, 450 hidden)
66.117.63.0/24      (1 entry, 1 announced)
    *BGP      Preference: 170/-101
                Next hop type: Indirect
                Next-hop reference count: 1006436
                Source: 192.168.69.71
                Next hop type: Router, Next hop index: 324
                Next hop: 192.168.167.254 via fxp0.0, selected
                Protocol next hop: 192.168.69.71
                Indirect next hop: 8e166c0 342
                State: <Active Ext>
                Local AS: 69 Peer AS: 10458
                Age: 6d 10:42:42      Metric2: 0
                Task: BGP_10458.192.168.69.71+179
                Announcement bits (3): 0-KRT 2-BGP RT Background 3-Resolve tree

1
    AS path: 10458 14203 2914 4788 4788 I
    Communities: 2914:410 2914:2403 2914:3400
    Accepted
    Localpref: 100
    Router ID: 207.17.136.192

```

show route protocol bgp extensive

```

user@host> show route protocol bgp 192.168.64.0/21 extensive

inet.0: 335827 destinations, 335828 routes (335378 active, 0 holddown, 450 hidden)
192.168.64.0/21 (1 entry, 1 announced)
TSI:
KRT in-kernel 1.9.0.0/16 -> {indirect(342)}
Page 0 idx 1 Type 1 val db31a80
  Nexthop: Self
  AS path: [69] 10458 14203 2914 4788 4788 I
  Communities: 2914:410 2914:2403 2914:3400
Path 1.9.0.0 from 192.168.69.71 Vector len 4. Val: 1
    *BGP      Preference: 170/-101
                Next hop type: Indirect
                Next-hop reference count: 1006502
                Source: 192.168.69.71
                Next hop type: Router, Next hop index: 324

```

```

Next hop: 192.168.167.254 via fxp0.0, selected
Protocol next hop: 192.168.69.71
Indirect next hop: 8e166c0 342
State: <Active Ext>
Local AS: 69 Peer AS: 10458
Age: 6d 10:44:45 Metric2: 0
Task: BGP_10458.192.168.69.71+179
Announcement bits (3): 0-KRT 2-BGP RT Background 3-Resolve tree
1
AS path: 10458 14203 2914 4788 4788 I
Communities: 2914:410 2914:2403 2914:3400
Accepted
Localpref: 100
Router ID: 207.17.136.192
Indirect next hops: 1
  Protocol next hop: 192.168.69.71
  Indirect next hop: 8e166c0 342
  Indirect path forwarding next hops: 1
    Next hop type: Router
    Next hop: 192.168.167.254 via fxp0.0
  192.168.0.0/16 Originating RIB: inet.0
  Node path count: 1
  Forwarding nexthops: 1
    Nexthop: 192.168.167.254 via fxp0.0

```

show route protocol bgp terse

```

user@host> show route protocol bgp 192.168.64.0/21 terse

inet.0: 24 destinations, 32 routes (23 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

A Destination      P Prf  Metric 1  Metric 2  Next hop      AS path
192.168.64.0/21   B 170      100          >100.1.3.2    10023 21 I

```

show route protocol direct

```

user@host> show route protocol direct

inet.0: 335843 destinations, 335844 routes (335394 active, 0 holddown, 450 hidden)
+ = Active Route, - = Last Active, * = Both

8.8.8.0/24          *[Direct/0] 17w0d 10:31:49
> via fe-1/3/1.0
10.255.165.1/32     *[Direct/0] 25w4d 04:13:18
> via lo0.0
30.30.30.0/24       *[Direct/0] 17w0d 23:06:26
> via fe-1/3/2.0
192.168.164.0/22    *[Direct/0] 25w4d 04:13:20
> via fxp0.0

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

47.0005.80ff.f800.0000.0108.0001.0102.5516.5001/152
*[Direct/0] 25w4d 04:13:21
> via lo0.0

inet6.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```

```

abcd::10:255:165:1/128
    *[Direct/0] 25w4d 04:13:21
    > via lo0.0
fe80::2a0:a5ff:fe12:ad7/128
    *[Direct/0] 25w4d 04:13:21
    > via lo0.0

```

show route protocol frr

```

user@host> show route protocol frr
inet.0: 43 destinations, 43 routes (42 active, 0 holddown, 1 hidden)

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

cust1.inet.0: 1033 destinations, 2043 routes (1033 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

20.20.1.3/32      *[FRR/200] 00:05:38, from 20.20.1.1
                  > to 20.20.1.3 via ge-4/1/0.0
                  to 10.10.15.1 via ge-0/2/4.0, Push 16, Push 299792(top)
20.20.1.4/32      *[FRR/200] 00:05:38, from 20.20.1.1
                  > to 20.20.1.4 via ge-4/1/0.0
                  to 10.10.15.1 via ge-0/2/4.0, Push 16, Push 299792(top)
20.20.1.5/32      *[FRR/200] 00:05:35, from 20.20.1.1
                  > to 20.20.1.5 via ge-4/1/0.0
                  to 10.10.15.1 via ge-0/2/4.0, Push 16, Push 299792(top)
20.20.1.6/32      *[FRR/200] 00:05:37, from 20.20.1.1
                  > to 20.20.1.6 via ge-4/1/0.0
                  to 10.10.15.1 via ge-0/2/4.0, Push 16, Push 299792(top)
20.20.1.7/32      *[FRR/200] 00:05:38, from 20.20.1.1
                  > to 20.20.1.7 via ge-4/1/0.0
                  to 10.10.15.1 via ge-0/2/4.0, Push 16, Push 299792(top)
20.20.1.8/32      *[FRR/200] 00:05:38, from 20.20.1.1
                  > to 20.20.1.8 via ge-4/1/0.0
                  to 10.10.15.1 via ge-0/2/4.0, Push 16, Push 299792(top)
20.20.1.9/32      *[FRR/200] 00:05:38, from 20.20.1.1
                  > to 20.20.1.9 via ge-4/1/0.0
                  to 10.10.15.1 via ge-0/2/4.0, Push 16, Push 299792(top)
20.20.1.10/32     *[FRR/200] 00:05:38, from 20.20.1.1
...

```

show route protocol l2circuit detail

```

user@host> show route protocol l2circuit detail

mpls.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
100000 (1 entry, 1 announced)
    *L2CKT Preference: 7
        Next hop: via ge-2/0/0.0, selected
        Label operation: Pop      Offset: 4
        State: <Active Int>
        Local AS: 99
        Age: 9:52
        Task: Common L2 VC
        Announcement bits (1): 0-KRT
        AS path: I

ge-2/0/0.0 (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, Push 100000(top)[0] Offset: -4
Protocol next hop: 10.245.255.63
Push 100000 Offset: -4
  Indirect next hop: 86af0c0 298
State: <Active Int>
Local AS: 99
Age: 9:52
Task: Common L2 VC
Announcement bits (2): 0-KRT 1-Common L2 VC
AS path: I

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 protocol l2vpn extensive

```

user@host> show route protocol l2vpn extensive

inet.0: 14 destinations, 15 routes (13 active, 0 holddown, 1 hidden)

inet.3: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

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

mpls.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
800001 (1 entry, 1 announced)
TSI:
KRT in-kernel 800001 /36 -> {so-0/0/0.0}
  *L2VPN Preference: 7
    Next hop: via so-0/0/0.0 weight 49087 balance 97%, selected
    Label operation: Pop Offset: 4
    State: <Active Int>
    Local AS: 69
    Age: 7:48
    Task: Common L2 VC
    Announcement bits (1): 0-KRT
    AS path: I

so-0/0/0.0 (1 entry, 1 announced)
TSI:
KRT in-kernel so-0/0/0.0 /16 -> {indirect(288)}
  *L2VPN Preference: 7
    Next hop: via so-0/0/1.0, selected
    Label operation: Push 800000 Offset: -4
    Protocol next hop: 10.255.14.220
    Push 800000 Offset: -4
    Indirect next hop: 85142a0 288
    State: <Active Int>

```



```

Local AS: 69
Age: 7:48
Task: Common L2 VC
Announcement bits (2): 0-KRT 1-Common L2 VC
AS path: I
Communities: target:69:1 Layer2-info: encaps:PPP,
control flags:2, mtu: 0

```

show route protocol ldp

```

user@host> show route protocol ldp
inet.0: 12 destinations, 13 routes (12 active, 0 holddown, 0 hidden)

inet.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.16.1/32    *[LDP/9] 1d 23:03:35, metric 1
                  > via t1-4/0/0.0, Push 100000
192.168.17.1/32    *[LDP/9] 1d 23:03:35, metric 1
                  > via t1-4/0/0.0

private1___.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)

mpls.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

100064            *[LDP/9] 1d 23:03:35, metric 1
                  > via t1-4/0/0.0, Pop
100064(S=0)        *[LDP/9] 1d 23:03:35, metric 1
                  > via t1-4/0/0.0, Pop
100080            *[LDP/9] 1d 23:03:35, metric 1
                  > via t1-4/0/0.0, Swap 100000

```

show route protocol ldp extensive

```

user@host> show route protocol ldp extensive
192.168.16.1/32 (1 entry, 1 announced)
  State: <FlashAll>
  *LDP    Preference: 9
          Next-hop reference count: 3
          Next hop: via t1-4/0/0.0, selected
          Label operation: Push 100000
          State: <Active Int>
          Local AS: 65500
          Age: 1d 23:03:58      Metric: 1
          Task: LDP
          Announcement bits (2): 0-Resolve tree 1 2-Resolve tree 2
          AS path: I

192.168.17.1/32 (1 entry, 1 announced)
  State: <FlashAll>
  *LDP    Preference: 9
          Next-hop reference count: 3
          Next hop: via t1-4/0/0.0, selected
          State: <Active Int>
          Local AS: 65500
          Age: 1d 23:03:58      Metric: 1
          Task: LDP
          Announcement bits (2): 0-Resolve tree 1 2-Resolve tree 2
          AS path: I

```

```
private1__inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
```

```
mpls.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
```

```
100064 (1 entry, 1 announced)
```

```
TSI:
```

```
KRT in-kernel 100064 /36 -> {t1-4/0/0.0}
```

```
*LDP      Preference: 9
           Next-hop reference count: 2
           Next hop: via t1-4/0/0.0, selected
           State: <Active Int>
           Local AS: 65500
           Age: 1d 23:03:58      Metric: 1
           Task: LDP
           Announcement bits (1): 0-KRT
           AS path: I
           Prefixes bound to route: 192.168.17.1/32
```

```
100064(S=0) (1 entry, 1 announced)
```

```
TSI:
```

```
KRT in-kernel 100064 /40 -> {t1-4/0/0.0}
```

```
*LDP      Preference: 9
           Next-hop reference count: 2
           Next hop: via t1-4/0/0.0, selected
           Label operation: Pop
           State: <Active Int>
           Local AS: 65500
           Age: 1d 23:03:58      Metric: 1
           Task: LDP
           Announcement bits (1): 0-KRT
           AS path: I
```

```
100080 (1 entry, 1 announced)
```

```
TSI:
```

```
KRT in-kernel 100080 /36 -> {t1-4/0/0.0}
```

```
*LDP      Preference: 9
           Next-hop reference count: 2
           Next hop: via t1-4/0/0.0, selected
           Label operation: Swap 100000
           State: <Active Int>
           Local AS: 65500
           Age: 1d 23:03:58      Metric: 1
           Task: LDP
           Announcement bits (1): 0-KRT
           AS path: I
           Prefixes bound to route: 192.168.16.1/32
```

show route protocol ospf (Layer 3 VPN)

```
user@host> show route protocol ospf
```

```
inet.0: 40 destinations, 40 routes (39 active, 0 holddown, 1 hidden)
```

```
+ = Active Route, - = Last Active, * = Both
```

```
10.39.1.4/30      *[OSPF/10] 00:05:18, metric 4
                  > via t3-3/2/0.0
10.39.1.8/30      [OSPF/10] 00:05:18, metric 2
                  > via t3-3/2/0.0
10.255.14.171/32  *[OSPF/10] 00:05:18, metric 4
                  > via t3-3/2/0.0
10.255.14.179/32  *[OSPF/10] 00:05:18, metric 2
                  > via t3-3/2/0.0
```

```

224.0.0.5/32      *[OSPF/10] 20:25:55, metric 1

VPN-AB.inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.39.1.16/30      [OSPF/10] 00:05:43, metric 1
                  > via so-0/2/2.0
10.255.14.173/32   *[OSPF/10] 00:05:43, metric 1
                  > via so-0/2/2.0
224.0.0.5/32      *[OSPF/10] 20:26:20, metric 1

```

show route protocol ospf detail

```

user@host> show route protocol ospf detail
VPN-AB.inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.39.1.16/30 (2 entries, 0 announced)
   OSPF      Preference: 10
             Nexthop: via so-0/2/2.0, selected
             State: <Int>
             Inactive reason: Route Preference
             Age: 6:25      Metric: 1
             Area: 0.0.0.0
             Task: VPN-AB-OSPF
             AS path: I
             Communities: Route-Type:0.0.0.0:1:0

...

```

show route protocol rip

```

user@host> show route protocol rip
inet.0: 26 destinations, 27 routes (25 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

VPN-AB.inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.14.177/32   *[RIP/100] 20:24:34, metric 2
                  > to 10.39.1.22 via t3-0/2/2.0
224.0.0.9/32      *[RIP/100] 00:03:59, metric 1

```

show route protocol rip detail

```

user@host> show route protocol rip detail
inet.0: 26 destinations, 27 routes (25 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

VPN-AB.inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.14.177/32 (1 entry, 1 announced)
   *RIP      Preference: 100
             Nexthop: 10.39.1.22 via t3-0/2/2.0, selected
             State: <Active Int>
             Age: 20:25:02  Metric: 2
             Task: VPN-AB-RIPv2
             Announcement bits (2): 0-KRT 2-BGP.0.0.0.0+179
             AS path: I
             Route learned from 10.39.1.22 expires in 96 seconds

```

show route protocol ripng table inet6

```

user@host> show route protocol ripng table inet6
inet6.0: 4215 destinations, 4215 routes (4214 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

1111::1/128      *[RIPng/100] 02:13:33, metric 2
                  > to fe80::2a0:a5ff:fe3d:56 via t3-0/2/0.0
1111::2/128      *[RIPng/100] 02:13:33, metric 2
                  > to fe80::2a0:a5ff:fe3d:56 via t3-0/2/0.0
1111::3/128      *[RIPng/100] 02:13:33, metric 2
                  > to fe80::2a0:a5ff:fe3d:56 via t3-0/2/0.0
1111::4/128      *[RIPng/100] 02:13:33, metric 2
                  > to fe80::2a0:a5ff:fe3d:56 via t3-0/2/0.0
1111::5/128      *[RIPng/100] 02:13:33, metric 2
                  > to fe80::2a0:a5ff:fe3d:56 via t3-0/2/0.0
1111::6/128      *[RIPng/100] 02:13:33, metric 2
                  > to fe80::2a0:a5ff:fe3d:56 via t3-0/2/0.0

```

show route protocol static detail

```

user@host> show route protocol static detail
inet.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
10.5.0.0/16 (1 entry, 1 announced)
    *Static Preference: 5
        Next hop type: Router, Next hop index: 324
        Address: 0x9274010
        Next-hop reference count: 27
        Next hop: 192.168.187.126 via fxp0.0, selected
        Session Id: 0x0
        State: <Active NoReadvrt Int Ext>
        Age: 7w3d 21:24:25
        Validation State: unverified
        Task: RT
        Announcement bits (1): 0-KRT
        AS path: I

10.10.0.0/16 (1 entry, 1 announced)
    *Static Preference: 5
        Next hop type: Router, Next hop index: 324
        Address: 0x9274010
        Next-hop reference count: 27
        Next hop: 192.168.187.126 via fxp0.0, selected
        Session Id: 0x0
        State: <Active NoReadvrt Int Ext>
        Age: 7w3d 21:24:25
        Validation State: unverified
        Task: RT
        Announcement bits (1): 0-KRT
        AS path: I

10.13.10.0/23 (1 entry, 1 announced)
    *Static Preference: 5
        Next hop type: Router, Next hop index: 324
        Address: 0x9274010
        Next-hop reference count: 27
        Next hop: 192.168.187.126 via fxp0.0, selected
        Session Id: 0x0
        State: <Active NoReadvrt Int Ext>
        Age: 7w3d 21:24:25
        Validation State: unverified

```

Task: RT
Announcement bits (1): 0-KRT
AS path: I

show route range

Syntax	<pre>show route range <brief detail extensive terse> <destination-prefix> <logical-system (all logical-system-name)></pre>
Syntax (EX Series Switches)	<pre>show route range <brief detail extensive terse> <destination-prefix></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p>
Description	Display routing table entries using a prefix range.
Options	<p>none—Display standard information about all routing table entries using a prefix range.</p> <p>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.</p> <p>destination-prefix—Destination and prefix mask for the range.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	<p>show route range on page 378</p> <p>show route range destination-prefix on page 379</p> <p>show route range detail on page 379</p> <p>show route range extensive on page 380</p> <p>show route range terse on page 381</p>
Output Fields	For information about output fields, see the output field tables for the show route command, the show route detail command, the <i>show route extensive</i> command, or the show route terse command.

Sample Output

show route range

```
user@host> show route range

inet.0: 11 destinations, 11 routes (10 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

10.10.0.0/16      *[Static/5] 00:30:01
                  > to 192.168.71.254 via fxp0.0
10.209.0.0/16    *[Static/5] 00:30:01
                  > to 192.168.71.254 via fxp0.0
10.255.71.14/32  *[Direct/0] 00:30:01
                  > via lo0.0
```

```

172.16.0.0/12      *[Static/5] 00:30:01
                  > to 192.168.71.254 via fxp0.0
192.168.0.0/16    *[Static/5] 00:30:01
                  > to 192.168.71.254 via fxp0.0
192.168.64.0/21   *[Direct/0] 00:30:01
                  > via fxp0.0
192.168.71.14/32  *[Local/0] 00:30:01
                  Local via fxp0.0
192.168.102.0/23  *[Static/5] 00:30:01
                  > to 192.168.71.254 via fxp0.0
...

```

show route range destination-prefix

```

user@host> show route range 192.168.0.0/16

inet.0: 11 destinations, 11 routes (10 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.0.0/16    *[Static/5] 00:31:14
                  > to 192.168.71.254 via fxp0.0
192.168.64.0/21   *[Direct/0] 00:31:14
                  > via fxp0.0
192.168.71.14/32  *[Local/0] 00:31:14
                  Local via fxp0.0
192.168.102.0/23  *[Static/5] 00:31:14
                  > to 192.168.71.254 via fxp0.0

```

show route range detail

```

user@host> show route range detail

inet.0: 11 destinations, 11 routes (10 active, 0 holddown, 1 hidden)
10.10.0.0/16 (1 entry, 1 announced)
  *Static Preference: 5
    Next-hop reference count: 22
    Next hop: 192.168.71.254 via fxp0.0, selected
    State: <Active NoReadvrt Int Ext>
    Age: 30:05
    Task: RT
    Announcement bits (1): 0-KRT
    AS path: I

10.209.0.0/16 (1 entry, 1 announced)
  *Static Preference: 5
    Next-hop reference count: 22
    Next hop: 192.168.71.254 via fxp0.0, selected
    State: <Active NoReadvrt Int Ext>
    Age: 30:05
    Task: RT
    Announcement bits (1): 0-KRT
    AS path: I

10.255.71.14/32 (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>
    Age: 30:05
    Task: IF

```

```
AS path: I
172.16.0.0/12 (1 entry, 1 announced)
  *Static Preference: 5
    Next-hop reference count: 22
    Next hop: 192.168.71.254 via fxp0.0, selected
    State: <Active NoReadvrt Int Ext>
    Age: 30:05
    Task: RT
    Announcement bits (1): 0-KRT
    AS path: I
```

...

show route range extensive

```
user@host> show route range extensive

inet.0: 11 destinations, 11 routes (10 active, 0 holddown, 1 hidden)
10.10.0.0/16 (1 entry, 1 announced)
TSI:
KRT in-kernel 10.10.0.0/16 -> {192.168.71.254}
  *Static Preference: 5
    Next-hop reference count: 22
    Next hop: 192.168.71.254 via fxp0.0, selected
    State: <Active NoReadvrt Int Ext>
    Age: 30:17
    Task: RT
    Announcement bits (1): 0-KRT
    AS path: I

10.209.0.0/16 (1 entry, 1 announced)
TSI:
KRT in-kernel 10.209.0.0/16 -> {192.168.71.254}
  *Static Preference: 5
    Next-hop reference count: 22
    Next hop: 192.168.71.254 via fxp0.0, selected
    State: <Active NoReadvrt Int Ext>
    Age: 30:17
    Task: RT
    Announcement bits (1): 0-KRT
    AS path: I

10.255.71.14/32 (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>
    Age: 30:17
    Task: IF
    AS path: I

172.16.0.0/12 (1 entry, 1 announced)
TSI:
KRT in-kernel 172.16.0.0/12 -> {192.168.71.254}
  *Static Preference: 5
    Next-hop reference count: 22
    Next hop: 192.168.71.254 via fxp0.0, selected
    State: <Active NoReadvrt Int Ext>
    Age: 30:17
```


Task: RT
 Announcement bits (1): 0-KRT
 AS path: I

...

show route range terse

user@host> show route range terse

inet.0: 11 destinations, 11 routes (10 active, 0 holddown, 1 hidden)
 + = Active Route, - = Last Active, * = Both

A Destination	P Prf	Metric 1	Metric 2	Next hop	AS path
* 10.10.0.0/16	S 5			>192.168.71.254	
* 10.209.0.0/16	S 5			>192.168.71.254	
* 10.255.71.14/32	D 0			>lo0.0	
* 172.16.0.0/12	S 5			>192.168.71.254	
* 192.168.0.0/16	S 5			>192.168.71.254	
* 192.168.64.0/21	D 0			>fxp0.0	
* 192.168.71.14/32	L 0			Local	
* 192.168.102.0/23	S 5			>192.168.71.254	
* 207.17.136.0/24	S 5			>192.168.71.254	
* 207.17.136.192/32	S 5			>192.168.71.254	

__juniper_private1__.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, * = Both

A Destination	P Prf	Metric 1	Metric 2	Next hop	AS path
* 10.0.0.0/8	D 0			>fxp2.0	
	D 0			>fxp1.0	
* 10.0.0.4/32	L 0			Local	

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

+ = Active Route, - = Last Active, * = Both

A Destination	P Prf	Metric 1	Metric 2	Next hop	AS path
47.0005.80ff.f800.0000.0108.0001.0102.5507.1014/152					
*	D 0			>lo0.0	

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

+ = Active Route, - = Last Active, * = Both

A Destination	P Prf	Metric 1	Metric 2	Next hop	AS path
abcd::10:255:71:14/128					
*	D 0			>lo0.0	
fe80::280:42ff:fe11:226f/128					
*	D 0			>lo0.0	

__juniper_private1__.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, * = Both

A Destination	P Prf	Metric 1	Metric 2	Next hop	AS path
fe80::280:42ff:fe11:226f/128					
*	D 0			>lo0.16385	

show route resolution

Syntax	<code>show route resolution</code> <code><brief detail extensive summary></code> <code><index <i>index</i>></code> <code><logical-system (all <i>logical-system-name</i>)></code> <code><prefix></code> <code><table <i>routing-table-name</i>></code> <code><unresolved></code>
Syntax (EX Series Switches)	<code>show route resolution</code> <code><brief detail extensive summary></code> <code><index <i>index</i>></code> <code><prefix></code> <code><table <i>routing-table-name</i>></code> <code><unresolved></code>
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 entries in the next-hop resolution database. This database provides for recursive resolution of next hops through other prefixes in the routing table.
Options	none —Display standard information about all entries in the next-hop resolution database. brief detail extensive summary —(Optional) Display the specified level of output. index <i>index</i> —(Optional) Show the index of the resolution tree. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system. prefix <i>network/destination-prefix</i> —(Optional) Display database entries for the specified address. table <i>routing-table-name</i> —(Optional) Display information about a particular routing table (for example, inet.0) where policy-based export is currently enabled. unresolved —(Optional) Display routes that could not be resolved.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none">• <i>Example: Configuring Route Resolution on PE Routers</i>
List of Sample Output	show route resolution detail on page 383 show route resolution summary on page 384 show route resolution unresolved on page 384

Output Fields Table 20 on page 383 describes the output fields for the **show route resolution** command. Output fields are listed in the approximate order in which they appear.

Table 20: show route resolution Output Fields

Field Name	Field Description
<i>routing-table-name</i>	Name of the routing table whose prefixes are resolved using the entries in the route resolution database. For routing table groups, this is the name of the primary routing table whose prefixes are resolved using the entries in the route resolution database.
Tree index	Tree index identifier.
Nodes	Number of nodes in the tree.
Reference count	Number of references made to the next hop.
Contributing routing tables	Routing tables used for next-hop resolution.
Originating RIB	Name of the routing table whose active route was used to determine the forwarding next-hop entry in the resolution database. For example, in the case of inet.0 resolving through inet.0 and inet.3 , this field indicates which routing table, inet.0 or inet.3 , provided the best path for a particular prefix.
Metric	Metric associated with the forwarding next hop.
Node path count	Number of nodes in the path.
Forwarding next hops	Number of forwarding next hops. The forwarding next hop is the network layer address of the directly reachable neighboring system (if applicable) and the interface used to reach it.

Sample Output

show route resolution detail

```

user@host> show route resolution detail
Tree Index: 1, Nodes 0, Reference Count 1
Contributing routing tables: inet.3
Tree Index: 2, Nodes 23, Reference Count 1
Contributing routing tables: inet.0 inet.3
10.10.0.0/16 Originating RIB: inet.0
  Node path count: 1
  Forwarding nexthops: 1
10.31.1.0/30 Originating RIB: inet.0
  Node path count: 1
  Forwarding nexthops: 1
10.31.1.1/32 Originating RIB: inet.0
  Node path count: 1
  Forwarding nexthops: 0
10.31.1.4/30 Originating RIB: inet.0
  Node path count: 1
  Forwarding nexthops: 1
10.31.1.5/32 Originating RIB: inet.0

```

```
Node path count: 1
Forwarding nexthops: 0
10.31.2.0/30 Originating RIB: inet.0
Metric: 2 Node path count: 1
Forwarding nexthops: 2
10.31.11.0/24 Originating RIB: inet.0
Node path count: 1
Forwarding nexthops: 1
```

show route resolution summary

```
user@host> show route resolution summary
Tree Index: 1, Nodes 24, Reference Count 1
Contributing routing tables: :voice.inet.0 :voice.inet.3
Tree Index: 2, Nodes 2, Reference Count 1
Contributing routing tables: inet.3
Tree Index: 3, Nodes 43, Reference Count 1
Contributing routing tables: inet.0 inet.3
```

show route resolution unresolved

```
user@host> show route resolution unresolved
Tree Index 1
vt-3/2/0.32769.0      /16
    Protocol Nexthop: 10.255.71.238 Push 800000
    Indirect nexthop: 0 -
vt-3/2/0.32772.0      /16
    Protocol Nexthop: 10.255.70.103 Push 800008
    Indirect nexthop: 0 -
Tree Index 2
```

show route snooping

Syntax	<pre>show route snooping <brief detail extensive terse> <all> <best address/prefix> <exact address> <range prefix-range> <summary> <table table-name></pre>
Release Information	<p>Command introduced in Junos OS Release 8.5.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p>
Description	Display the entries in the routing table that were learned from snooping.
Options	<p>none—Display the entries in the routing table that were learned from snooping.</p> <p>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.</p> <p>all—(Optional) Display all entries, including hidden entries.</p> <p>best address/prefix—(Optional) Display the longest match for the provided address and optional prefix.</p> <p>exact address/prefix—(Optional) Display exact matches for the provided address and optional prefix.</p> <p>range prefix-range—(Optional) Display information for the provided address range.</p> <p>summary—(Optional) Display route snooping summary statistics.</p> <p>table table-name—(Optional) Display information for the named table.</p>
Required Privilege Level	view
List of Sample Output	show route snooping detail on page 385
Output Fields	For information about output fields, see the output field tables for the show route command, the show route detail command, the <i>show route extensive</i> command, or the show route terse command.

Sample Output

show route snooping detail

```
user@host> show route snooping detail
__+domainAll__.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
224.0.0.2/32 (1 entry, 1 announced)
  *IGMP    Preference: 0
           Next hop type: MultiRecv
           Next-hop reference count: 4
           State: <Active NoReadvrt Int>
```

```
Age: 2:24
Task: IGMP
Announcement bits (1): 0-KRT
AS path: I

224.0.0.22/32 (1 entry, 1 announced)
  *IGMP Preference: 0
    Next hop type: MultiRecv
    Next-hop reference count: 4
    State: <Active NoReadvrt Int>
    Age: 2:24
    Task: IGMP
    Announcement bits (1): 0-KRT
    AS path: I

__+domainAll__.inet.1: 36 destinations, 36 routes (36 active, 0 holddown, 0 hidden)

224.0.0.0.0.0.0.0.0/24 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4), Next hop index: 1048584
    Next-hop reference count: 4
    State: <Active Int>
    Age: 2:24
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

225.0.0.2.11.11.11.100.3.9.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:13
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

225.0.0.3.11.11.11.100.3.9.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:15
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

225.0.0.4.11.11.11.100.3.9.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:17
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

225.0.0.5.11.11.11.100.3.9.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
```

```
State: <Active Int>
Age: 1:58
Task: MC
Announcement bits (1): 0-KRT
AS path: I

225.0.0.6.11.11.11.100.3.9.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:14
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

225.0.0.7.11.11.11.100.3.9.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:12
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

225.0.0.9.11.11.11.100.3.9.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:13
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

225.0.0.10.11.11.11.100.3.9.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:15
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

226.0.0.1.11.11.11.100.3.10.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:09
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

226.0.0.2.11.11.11.100.3.10.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
```

```
Age: 8
Task: MC
Announcement bits (1): 0-KRT
AS path: I

226.0.0.4.11.11.11.100.3.10.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:10
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

226.0.0.8.11.11.11.100.3.10.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:12
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

226.0.0.10.11.11.11.100.3.10.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 1:56
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

227.0.0.1.11.11.11.100.3.11.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:10
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

227.0.0.2.11.11.11.100.3.11.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:13
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

227.0.0.3.11.11.11.100.3.11.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:16
```



```
Task: MC
Announcement bits (1): 0-KRT
AS path: I

227.0.0.4.11.11.11.100.3.11.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:15
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

227.0.0.5.11.11.11.100.3.11.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 1:57
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

227.0.0.7.11.11.11.100.3.11.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 1:57
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

227.0.0.8.11.11.11.100.3.11.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:10
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

227.0.0.10.11.11.11.100.3.11.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:15
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

228.0.0.1.11.11.11.100.3.12.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:09
    Task: MC
```

```
Announcement bits (1): 0-KRT
AS path: I

228.0.0.2.11.11.11.100.3.12.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:18
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

228.0.0.7.11.11.11.100.3.12.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:11
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

228.0.0.8.11.11.11.100.3.12.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:17
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

228.0.0.9.11.11.11.100.3.12.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 8
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

228.0.0.10.11.11.11.100.3.12.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:12
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

229.0.0.3.11.11.11.100.3.13.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:09
    Task: MC
    Announcement bits (1): 0-KRT
```

```
AS path: I

229.0.0.4.11.11.11.100.3.13.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:12
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

229.0.0.5.11.11.11.100.3.13.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 9
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

229.0.0.6.11.11.11.100.3.13.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:15
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

229.0.0.7.11.11.11.100.3.13.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:15
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

229.0.0.8.11.11.11.100.3.13.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:15
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I

229.0.0.9.11.11.11.100.3.13.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:14
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I
```

```
229.0.0.10.11.11.11.100.3.13.0.0/80 (1 entry, 1 announced)
  *Multicast Preference: 180
    Next hop type: Multicast (IPv4)
    Next-hop reference count: 113
    State: <Active Int>
    Age: 2:13
    Task: MC
    Announcement bits (1): 0-KRT
    AS path: I
```

show route source-gateway

Syntax	<code>show route source-gateway <i>address</i></code> <brief detail extensive terse> <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	<code>show route source-gateway <i>address</i></code> <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 entries in the routing table that were learned from a particular address. The Source field in the <code>show route detail</code> command output lists the source for each route, if known.
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 . <i>address</i> —IP address of the system. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
List of Sample Output	show route source-gateway on page 393 show route source-gateway detail on page 394 show route source-gateway extensive on page 396
Output Fields	For information about output fields, see the output field tables for the show route command, the show route detail command, the <i>show route extensive</i> command, or the show route terse command.

Sample Output

show route source-gateway

```

user@host> show route source-gateway 10.255.70.103
inet.0: 24 destinations, 25 routes (23 active, 0 holddown, 1 hidden)
Restart Complete

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

private1___.inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

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

mpls.0: 7 destinations, 7 routes (5 active, 0 holddown, 2 hidden)
Restart Complete

```

```

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

private1__inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

green.l2vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

10.255.70.103:1:3:1/96
    *[BGP/170] 12:12:24, localpref 100, from 10.255.70.103
    AS path: I
    > via so-0/3/0.0, label-switched-path green-r1-r3

red.l2vpn.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

10.255.70.103:2:3:1/96
    *[BGP/170] 12:12:24, localpref 0, from 10.255.70.103
    AS path: I
    > via so-0/3/0.0, label-switched-path green-r1-r3

bgp.l2vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
Restart Complete
+ = Active Route, - = Last Active, * = Both

10.255.70.103:1:3:1/96
    *[BGP/170] 12:12:24, localpref 100, from 10.255.70.103
    AS path: I
    > via so-0/3/0.0, label-switched-path green-r1-r3

10.255.70.103:2:3:1/96
    *[BGP/170] 12:12:24, localpref 0, from 10.255.70.103
    AS path: I
    > via so-0/3/0.0, label-switched-path green-r1-r3

```

show route source-gateway detail

```

user@host> show route source-gateway 10.255.70.103 detail
inet.0: 24 destinations, 25 routes (23 active, 0 holddown, 1 hidden)
Restart Complete

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

private1__inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

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

mpls.0: 7 destinations, 7 routes (5 active, 0 holddown, 2 hidden)
Restart Complete

inet6.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
Restart Complete
green.l2vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)

Restart Complete
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: 12:14:00 Metric2: 1
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

red.l2vpn.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
Restart Complete

10.255.70.103:2:3:1/96 (1 entry, 1 announced)
*BGP Preference: 170/-1
Route Distinguisher: 10.255.70.103:2
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: 12:14:00 Metric2: 1
Task: BGP_69.10.255.70.103+179
Announcement bits (1): 0-red-l2vpn
AS path: I
Communities: target:11111:2 Layer2-info: encaps:VPLS,
control flags:Site-Down, mtu: 0
Label-base: 800016, range: 8
Localpref: 0
Router ID: 10.255.70.103
Primary Routing Table bgp.l2vpn.0

bgp.l2vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
Restart Complete

10.255.70.103:1:3:1/96 (1 entry, 0 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: <Active Int Ext>
Local AS: 69 Peer AS: 69
Age: 12:14:00 Metric2: 1
Task: BGP_69.10.255.70.103+179
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

```

```

Secondary Tables: green.l2vpn.0
10.255.70.103:2:3:1/96 (1 entry, 0 announced)
  *BGP Preference: 170/-1
    Route Distinguisher: 10.255.70.103:2
    Next-hop reference count: 7
    Source: 10.255.70.103
    Protocol next hop: 10.255.70.103
    Indirect next hop: 2 no-forward
    State: <Active Int Ext>
    Local AS: 69 Peer AS: 69
    Age: 12:14:00 Metric2: 1
    Task: BGP_69.10.255.70.103+179
    AS path: I
    Communities: target:11111:2 Layer2-info: encaps:VPLS,
    control flags:Site-Down,
    mtu: 0
    Label-base: 800016, range: 8
    Localpref: 0
    Router ID: 10.255.70.103
    Secondary Tables: red.l2vpn.0

```

show route source-gateway extensive

```

user@host> show route source-gateway 10.255.70.103 extensive
inet.0: 24 destinations, 25 routes (23 active, 0 holddown, 1 hidden)
Restart Complete

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

private1__inet.0: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)

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

mpls.0: 7 destinations, 7 routes (5 active, 0 holddown, 2 hidden)
Restart Complete

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

green.l2vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
Restart Complete
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: 12:15:24 Metric2: 1
    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

red.l2vpn.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
Restart Complete

10.255.70.103:2:3:1/96 (1 entry, 1 announced)

```
*BGP      Preference: 170/-1
          Route Distinguisher: 10.255.70.103:2
          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: 12:15:24 Metric2: 1
          Task: BGP_69.10.255.70.103+179
          Announcement bits (1): 0-red-l2vpn
          AS path: I
          Communities: target:11111:2 Layer2-info: encaps:VPLS,
          control flags:Site-Down, mtu: 0
          Label-base: 800016, range: 8
          Localpref: 0
          Router ID: 10.255.70.103
          Primary Routing Table bgp.l2vpn.0
```

bgp.l2vpn.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
Restart Complete

10.255.70.103:1:3:1/96 (1 entry, 0 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: <Active Int Ext>
          Local AS: 69 Peer AS: 69
          Age: 12:15:24 Metric2: 1
          Task: BGP_69.10.255.70.103+179
          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
          Secondary Tables: green.l2vpn.0
          Indirect next hops: 1
            Protocol next hop: 10.255.70.103 Metric: 2
            Indirect next hop: 2 no-forward
            Indirect path forwarding next hops: 1
          Next hop:      via so-0/3/0.0 weight 0x1
            10.255.70.103/32 Originating RIB: inet.3
              Metric: 2 Node path count: 1
              Forwarding nexthops: 1
                Nexthop: via so-0/3/0.0
```

10.255.70.103:2:3:1/96 (1 entry, 0 announced)

```
*BGP      Preference: 170/-1
          Route Distinguisher: 10.255.70.103:2
          Next-hop reference count: 7
          Source: 10.255.70.103
```

```
Protocol next hop: 10.255.70.103
Indirect next hop: 2 no-forward
State: <Active Int Ext>
Local AS: 69 Peer AS: 69
Age: 12:15:24 Metric2: 1
Task: BGP_69.10.255.70.103+179
AS path: I
Communities: target:11111:2 Layer2-info: encaps:VPLS,
control flags:Site-Down,
mtu: 0
Label-base: 800016, range: 8
Localpref: 0
Router ID: 10.255.70.103
Secondary Tables: red.12vpn.0
Indirect next hops: 1
    Protocol next hop: 10.255.70.103 Metric: 2
    Indirect next hop: 2 no-forward
    Indirect path forwarding next hops: 1
Next hop:      via so-0/3/0.0 weight 0x1
    10.255.70.103/32 Originating RIB: inet.3
    Metric: 2 Node path count: 1
    Forwarding nexthops: 1
    Nexthop: via so-0/3/0.0
```

show route summary

Syntax	show route summary <logical-system (all <i>logical-system-name</i>)> <table <i>routing-table-name</i> >
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	<p>Display summary statistics about the entries in the routing table.</p> <p>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).</p>
Options	<p>none—Display summary statistics about the entries in the routing table.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>table <i>routing-table-name</i>—(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.</p>
Required Privilege Level	view
List of Sample Output	show route summary on page 400 show route summary table on page 401 show route summary table (with Route Limits Configured for the Routing Table) on page 401
Output Fields	Table 21 on page 399 lists the output fields for the show route summary command. Output fields are listed in the approximate order in which they appear.

Table 21: show route summary Output Fields

Field Name	Field Description
Router ID	Address of the local routing device.
<i>routing-table-name</i>	Name of the routing table (for example, inet.0).

Table 21: 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: <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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	<pre>show route table <i>routing-table-name</i> <brief detail extensive terse> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switches)	<pre>show route table <i>routing-table-name</i> <brief detail extensive terse></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p>
Description	Display the route entries in a particular routing table.
Options	<p>brief detail extensive terse—(Optional) Display the specified level of output.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p><i>routing-table-name</i>—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).</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show route summary on page 399
List of Sample Output	<p>show route table bgp.l2.vpn on page 404</p> <p>show route table bgp.l3vpn.0 on page 404</p> <p>show route table bgp.l3vpn.0 detail on page 404</p> <p>show route table bgp.rtarget.0 (When Proxy BGP Route Target Filtering Is Configured) on page 406</p> <p>show route table inet.0 on page 406</p> <p>show route table inet6.0 on page 406</p> <p>show route table inet6.3 on page 407</p> <p>show route table inetflow detail on page 407</p> <p>show route table l2circuit.0 on page 407</p> <p>show route table mpls on page 408</p> <p>show route table mpls extensive on page 408</p> <p>show route table mpls.0 on page 408</p> <p>show route table mpls.0 detail (PTX Series) on page 409</p> <p>show route table mpls.0 extensive (PTX Series) on page 409</p> <p>show route table mpls.0 (RSVP Route—Transit LSP) on page 410</p> <p>show route table vpls_1 detail on page 410</p> <p>show route table vpn-a on page 411</p> <p>show route table vpn-a.mdt.0 on page 411</p> <p>show route table VPN-A detail on page 411</p> <p>show route table VPN-AB.inet.0 on page 412</p>

[show route table VPN_blue.mvpn-inet6.0 on page 412](#)

[show route table vrf1.mvpn.0 extensive on page 413](#)

[show route table inetflow detail on page 413](#)

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.l2vpn

```
user@host> show route table bgp.l2vpn
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 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 Target Filtering Is Configured)

```
user@host> show route table bgp.rtarget.0
bgp.rtarget.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

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 detail (PTX Series)

```

user@host> show route table mpls.0 detail
ge-0/0/2.600 (1 entry, 1 announced)
  *L2VPN Preference: 7
    Next hop type: Indirect
    Address: 0x9438f34
    Next-hop reference count: 2
    Next hop type: Router, Next hop index: 567
    Next hop: 3.0.0.1 via ge-0/0/1.0, selected
    Label operation: Push 299808
    Label TTL action: prop-ttl
    Load balance label: Label 299808:None;
    Session Id: 0x1
    Protocol next hop: 10.255.255.1
    Label operation: Push 299872 Offset: 252
    Label TTL action: no-prop-ttl
    Load balance label: Label 299872:Flow label PUSH;
    Composite next hop: 0x9438ed8 570 INH Session ID: 0x2
    Indirect next hop: 0x9448208 262142 INH Session ID: 0x2
    State: <Active Int>
    Age: 21 Metric2: 1
    Validation State: unverified
    Task: Common L2 VC
    Announcement bits (2): 0-KRT 2-Common L2 VC
    AS path: I

```

show route table mpls.0 extensive (PTX Series)

```

user@host> show route table mpls.0 extensive
ge-0/0/2.600 (1 entry, 1 announced)
TSI:
KRT in-kernel ge-0/0/2.600.0 /32 -> {composite(570)}
  *L2VPN Preference: 7
    Next hop type: Indirect
    Address: 0x9438f34
    Next-hop reference count: 2
    Next hop type: Router, Next hop index: 567
    Next hop: 3.0.0.1 via ge-0/0/1.0, selected
    Label operation: Push 299808
    Label TTL action: prop-ttl
    Load balance label: Label 299808:None;
    Session Id: 0x1
    Protocol next hop: 10.255.255.1
    Label operation: Push 299872 Offset: 252
    Label TTL action: no-prop-ttl
    Load balance label: Label 299872:Flow label PUSH;
    Composite next hop: 0x9438ed8 570 INH Session ID: 0x2
    Indirect next hop: 0x9448208 262142 INH Session ID: 0x2
    State: <Active Int>
    Age: 47 Metric2: 1
    Validation State: unverified
    Task: Common L2 VC
    Announcement bits (2): 0-KRT 2-Common L2 VC

```

```

AS path: I
Composite next hops: 1
  Protocol next hop: 10.255.255.1 Metric: 1
  Label operation: Push 299872 Offset: 252
  Label TTL action: no-prop-ttl
  Load balance label: Label 299872:Flow label PUSH;
  Composite next hop: 0x9438ed8 570 INH Session ID: 0x2
  Indirect next hop: 0x9448208 262142 INH Session ID: 0x2
  Indirect path forwarding next hops: 1
    Next hop type: Router
    Next hop: 3.0.0.1 via ge-0/0/1.0
    Session Id: 0x1
  10.255.255.1/32 Originating RIB: inet.3
  Metric: 1 Node path count: 1
  Forwarding nexthops: 1
  Nexthop: 3.0.0.1 via ge-0/0/1.0

```

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.12vpn.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.13vpn.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 vrf1.mvpn.0 extensive

```

user@host> show route table vrf1.mvpn.0 extensive
1:10.255.50.77:1:10.255.50.77/240 (1 entry, 1 announced)
    *MVPN    Preference: 70
              PMSI: Flags 0x0: Label 0: RSVP-TE:
Session_13[10.255.50.77:0:25624:10.255.50.77]
    Next hop type: Indirect
    Address: 0xbb2c944
    Next-hop reference count: 360
    Protocol next hop: 10.255.50.77
    Indirect next hop: 0x0 - INH Session ID: 0x0
    State: <Active Int Ext>
    Age: 53:03      Metric2: 1
    Validation State: unverified
    Task: mvpn global task
    Announcement bits (3): 0-PIM.vrf1 1-mvpn global task 2-rt-export

    AS path: I

```

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.13vpn.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.13vpn.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
    
```

show route terse


Syntax	show route terse <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	show route 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 a high-level summary of the routes in the routing table.
<div>  <p>NOTE: For BGP routes, the show route terse command displays the local preference attribute and MED instead of the metric1 and metric2 values. This is mostly due to historical reasons.</p> <p>To display the metric1 and metric2 value of a BGP route, use the show route extensive command.</p> </div>	
Options	<p>none—Display a high-level summary of the routes in the routing table.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show route terse on page 419
Output Fields	Table 22 on page 417 describes the output fields for the show route terse command. Output fields are listed in the approximate order in which they appear.

Table 22: show route terse Output Fields

Field Name	Field Description
<i>routing-table-name</i>	Name of the routing table (for example, inet.0).
<i>number destinations</i>	Number of destinations for which there are routes in the routing table.
<i>number routes</i>	Number of routes in the routing table and total number of routes in the following states: <ul style="list-style-type: none"> 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 22: show route terse Output Fields (*continued*)

Field Name	Field Description
<i>route key</i>	Key for the state of the route: <ul style="list-style-type: none"> • +—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.
A	Active route. An asterisk (*) indicates this is the active route.
V	Validation status of the route: <ul style="list-style-type: none"> • ?—Not evaluated. Indicates that the route was not learned through BGP. • I—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. • N—Unknown. Indicates that the prefix is not among the prefixes or prefix ranges in the database. • V—Valid. Indicates that the prefix and autonomous system pair are found in the database.
Destination	Destination of the route.
P	Protocol through which the route was learned: <ul style="list-style-type: none"> • A—Aggregate • B—BGP • C—CCC • D—Direct • G—GMPLS • I—IS-IS • L—L2CKT, L2VPN, LDP, Local • K—Kernel • M—MPLS, MSDP • O—OSPF • P—PIM • R—RIP, RIPng • S—Static • T—Tunnel
Prf	Preference value of 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.
Metric 1	First metric value in the route. For routes learned from BGP, this is the MED metric.
Metric 2	Second metric value in the route. For routes learned from BGP, this is the IGP metric.

Table 22: show route terse Output Fields (*continued*)

Field Name	Field Description
Next hop	Next hop to the destination. An angle bracket (>) indicates that the route is the selected route.
AS path	<p>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:</p> <ul style="list-style-type: none"> I—IGP. E—EGP. ?—Incomplete; typically, the AS path was aggregated.

Sample Output

show route terse

```

user@host> show route terse
inet.0: 10 destinations, 12 routes (10 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

A V Destination      P Prf  Metric 1  Metric 2  Next hop      AS path
* ? 1.0.1.1/32        0 10      1           >10.0.0.2      I
?                               B 170      100           >10.0.0.2      I
  unverified
* ? 1.1.1.1/32        D 0           >10.0.0.2      200 I
* V 2.2.0.2/32        B 170     110           >10.0.0.2
  valid
* ? 10.0.0.0/30       D 0           >1t-1/2/0.1    I
?                               B 170     100           >10.0.0.2
  unverified
* ? 10.0.0.1/32       L 0           Local          I
* ? 10.0.0.4/30       B 170     100           >10.0.0.2      I
  unverified
* ? 10.0.0.8/30       B 170     100           >10.0.0.2      I
  unverified
* I 172.16.1.1/32     B 170      90           >10.0.0.2      200 I
  invalid
* N 192.168.2.3/32    B 170     100           >10.0.0.2      200 I
  unknown
* ? 224.0.0.5/32      O 10      1           MultiRecv

```


PART 4

Troubleshooting

- [Network Troubleshooting on page 423](#)
- [Routing Protocol Process Memory FAQs on page 429](#)

CHAPTER 10

Network Troubleshooting

- [Working with Problems on Your Network on page 423](#)
- [Isolate a Broken Network Connection on page 423](#)
- [Identify the Symptoms on page 425](#)
- [Isolate the Causes on page 426](#)
- [Take Appropriate Action on page 426](#)
- [Evaluate the Solution on page 427](#)

Working with Problems on Your Network

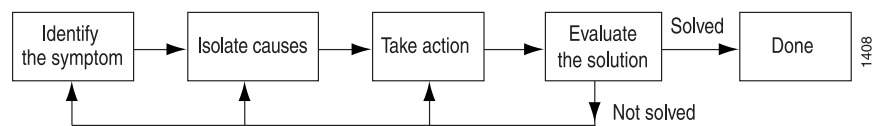
Problem This checklist provides links to troubleshooting basics, an example network, and includes a summary of the commands you might use to diagnose problems with the router and network.

Table 23: Checklist for Working with Problems on Your Network

Tasks	Command or Action
“Isolate a Broken Network Connection” on page 423	
1. Identify the Symptoms on page 425	<code>ping (ip-address hostname)</code> <code>show route (ip-address hostname)</code> <code>tracert (ip-address hostname)</code>
2. Isolate the Causes on page 426	<code>show < configuration interfaces protocols route ></code>
3. Take Appropriate Action on page 426	<code>[edit]</code> <code>delete routing options static route destination-prefix</code> <code>commit and-quit</code> <code>show route destination-prefix</code>
4. Evaluate the Solution on page 427	<code>show route (ip-address hostname)</code> <code>ping (ip-address hostname) count 3</code> <code>tracert (ip-address hostname)</code>

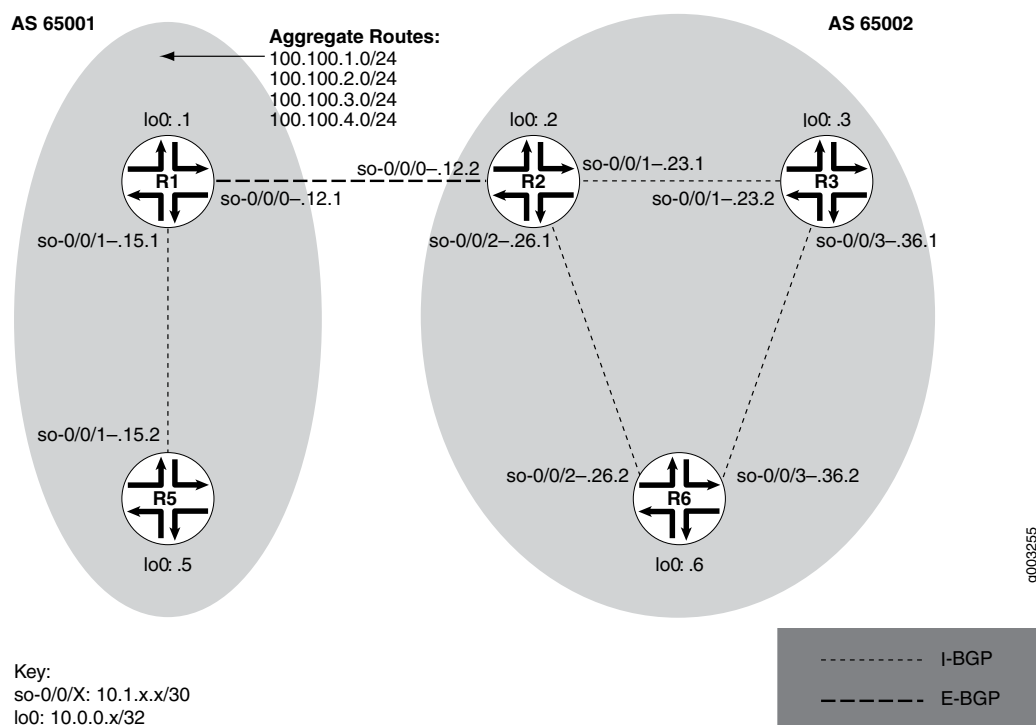
Isolate a Broken Network Connection

Purpose By applying the standard four-step process illustrated in [Figure 17 on page 424](#), you can isolate a failed node in the network.

Figure 17: Process for Diagnosing Problems in Your Network

Before you embark on the four-step process, however, it is important that you are prepared for the inevitable problems that occur on all networks. While you might find a solution to a problem by simply trying a variety of actions, you can reach an appropriate solution more quickly if you are systematic in your approach to the maintenance and monitoring of your network. To prepare for problems on your network, understand how the network functions under normal conditions, have records of baseline network activity, and carefully observe the behavior of your network during a problem situation.

Figure 18 on page 424 shows the network topology used in this topic to illustrate the process of diagnosing problems in a network.

Figure 18: Network with a Problem

The network in Figure 18 on page 424 consists of two autonomous systems (ASs). AS 65001 includes two routers, and AS 65002 includes three routers. The border router (R1) in AS 65001 announces aggregated prefixes 100.100.0/24 to the AS 65002 network. The problem in this network is that R6 does not have access to R5 because of a loop between R2 and R6.

To isolate a failed connection in your network, follow these steps:

Identify the Symptoms

Problem The symptoms of a problem in your network are usually quite obvious, such as the failure to reach a remote host.

Solution To identify the symptoms of a problem on your network, start at one end of your network and follow the routes to the other end, entering all or one of the following Junos OS command-line interfaces (CLI) operational mode commands:

```
user@host> ping (ip-address | host-name)
user@host> show route (ip-address | host-name)
user@host> traceroute (ip-address | host-name)
```

Sample Output

```
user@R6> ping 10.0.0.5
PING 10.0.0.5 (10.0.0.5): 56 data bytes
36 bytes from 10.1.26.1: Time to live exceeded
Vr HL TOS Len ID Flg off TTL Pro cks Src Dst
 4 5 00 0054 e2db 0 0000 01 01 a8c6 10.1.26.2 10.0.0.5

36 bytes from 10.1.26.1: Time to live exceeded
Vr HL TOS Len ID Flg off TTL Pro cks Src Dst
 4 5 00 0054 e2de 0 0000 01 01 a8c3 10.1.26.2 10.0.0.5

36 bytes from 10.1.26.1: Time to live exceeded
Vr HL TOS Len ID Flg off TTL Pro cks Src Dst
 4 5 00 0054 e2e2 0 0000 01 01 a8bf 10.1.26.2 10.0.0.5

^C
--- 10.0.0.5 ping statistics ---
3 packets transmitted, 0 packets received, 100% packet loss

user@R6> show route 10.0.0.5

inet.0: 20 destinations, 20 routes (20 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.5/32          *[IS-IS/165] 00:02:39, metric 10
                    > to 10.1.26.1 via so-0/0/2.0

user@R6> traceroute 10.0.0.5
traceroute to 10.0.0.5 (10.0.0.5), 30 hops max, 40 byte packets
 1 10.1.26.1 (10.1.26.1) 0.649 ms 0.521 ms 0.490 ms
 2 10.1.26.2 (10.1.26.2) 0.521 ms 0.537 ms 0.507 ms
 3 10.1.26.1 (10.1.26.1) 0.523 ms 0.536 ms 0.514 ms
 4 10.1.26.2 (10.1.26.2) 0.528 ms 0.551 ms 0.523 ms
 5 10.1.26.1 (10.1.26.1) 0.531 ms 0.550 ms 0.524 ms
```

Meaning The sample output shows an unsuccessful **ping** command in which the packets are being rejected because the time to live is exceeded. The output for the **show route** command shows the interface (10.1.26.1) that you can examine further for possible problems. The **traceroute** command shows the loop between 10.1.26.1 (R2) and 10.1.26.2 (R6), as indicated by the continuous repetition of the two interface addresses.

Isolate the Causes

Problem A particular symptom can be the result of one or more causes. Narrow down the focus of your search to find each individual cause of the unwanted behavior.

Solution To isolate the cause of a particular problem, enter one or all of the following Junos OS CLI operational mode command:

To isolate the cause of a particular problem, enter one or all of the following Junos OS CLI operational mode command:

```
user@host> show < configuration | bgp | interfaces | isis | ospf | route >
```

Your particular problem may require the use of more than just the commands listed above. See the appropriate command reference for a more exhaustive list of commonly used operational mode commands.

Sample Output

```
user@R6> show interfaces terse
Interface      Admin Link Proto Local Remote
so-0/0/0       up   up   inet  10.1.56.2/30
so-0/0/0.0     up   up   inet  10.1.56.2/30
                iso
so-0/0/2       up   up   inet  10.1.26.2/30
so-0/0/2.0     up   up   inet  10.1.26.2/30
                iso
so-0/0/3       up   up   inet  10.1.36.2/30
so-0/0/3.0     up   up   inet  10.1.36.2/30
                iso
[...Output truncated...]
```

The following sample output is from R2:

```
user@R2> show route 10.0.0.5

inet.0: 22 destinations, 25 routes (22 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.5/32      *[Static/5] 00:16:21
                  > to 10.1.26.2 via so-0/0/2.0
                  [BGP/170] 3d 20:23:35, MED 5, localpref 100
                  AS path: 65001 I
                  > to 10.1.12.1 via so-0/0/0.0
```

Meaning The sample output shows that all interfaces on R6 are up. The output from R2 shows that a static route **[Static/5]** configured on R2 points to R6 (10.1.26.2) and is the preferred route to R5 because of its low preference value. However, the route is looping from R2 to R6, as indicated by the missing reference to R5 (10.1.15.2).

Take Appropriate Action

Problem The appropriate action depends on the type of problem you have isolated. In this example, a static route configured on R2 is deleted from the **[routing-options]** hierarchy level. Other appropriate actions might include the following:

- Solution**
- Check the local router's configuration and edit it if appropriate.
 - Troubleshoot the intermediate router.
 - Check the remote host configuration and edit it if appropriate.
 - Troubleshoot routing protocols.
 - Identify additional possible causes.

To resolve the problem in this example, enter the following Junos OS CLI commands:

```
[edit]
user@R2# delete routing-options static route destination-prefix
user@R2# commit and-quit
user@R2# show route destination-prefix
```

Sample Output

```
[edit]
user@R2# delete routing-options static route 10.0.0.5/32
```

```
[edit]
user@R2# commit and-quit
commit complete
Exiting configuration mode
```

```
user@R2> show route 10.0.0.5
```

```
inet.0: 22 destinations, 24 routes (22 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.5/32          *[BGP/170] 3d 20:26:17, MED 5, localpref 100
                    AS path: 65001 I
                    > to 10.1.12.1 via so-0/0/0.0
```

- Meaning** The sample output shows the static route deleted from the **[routing-options]** hierarchy and the new configuration committed. The output for the **show route** command now shows the BGP route as the preferred route, as indicated by the asterisk (*).

Evaluate the Solution

- Problem** If the problem is solved, you are finished. If the problem remains or a new problem is identified, start the process over again.

You can address possible causes in any order. In relation to the network in [“Isolate a Broken Network Connection” on page 423](#), we chose to work from the local router toward the remote router, but you might start at a different point, particularly if you have reason to believe that the problem is related to a known issue, such as a recent change in configuration.

- Solution** To evaluate the solution, enter the following Junos OS CLI commands:

```
user@host> show route (ip-address | host-name)
user@host> ping (ip-address | host-name)
user@host> traceroute (ip-address | host-name)
```

Sample Output

```
user@R6> show route 10.0.0.5

inet.0: 20 destinations, 20 routes (20 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.5/32          *[BGP/170] 00:01:35, MED 5, localpref 100, from 10.0.0.2
                    AS path: 65001 I
                    > to 10.1.26.1 via so-0/0/2.0

user@R6> ping 10.0.0.5
PING 10.0.0.5 (10.0.0.5): 56 data bytes
64 bytes from 10.0.0.5: icmp_seq=0 ttl=253 time=0.866 ms
64 bytes from 10.0.0.5: icmp_seq=1 ttl=253 time=0.837 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=253 time=0.796 ms
^C
--- 10.0.0.5 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.796/0.833/0.866/0.029 ms

user@R6> traceroute 10.0.0.5
traceroute to 10.0.0.5 (10.0.0.5), 30 hops max, 40 byte packets
 1  10.1.26.1 (10.1.26.1)  0.629 ms  0.538 ms  0.497 ms
 2  10.1.12.1 (10.1.12.1)  0.534 ms  0.538 ms  0.510 ms
 3  10.0.0.5 (10.0.0.5)   0.776 ms  0.705 ms  0.672 ms
```

Meaning The sample output shows that there is now a connection between **R6** and **R5**. The **show route** command shows that the BGP route to **R5** is preferred, as indicated by the asterisk (*). The **ping** command is successful and the **traceroute** command shows that the path from **R6** to **R5** is through **R2** (10.1.26.1), and then through **R1** (10.1.12.1).

Routing Protocol Process Memory FAQs

- [Routing Protocol Process Memory FAQs Overview on page 429](#)
- [Routing Protocol Process Memory FAQs on page 430](#)

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 430](#)

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 24 on page 432](#) 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 24 on page 432 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 24: 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. <ul style="list-style-type: none"> • 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, inactive 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 25 on page 433](#) 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 25 on page 433](#) describes the output fields for the **show task memory** command. Output fields are listed in the approximate order in which they appear.

Table 25: 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 429](#)

PART 5

Index

- [Index on page 439](#)

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