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Junos<sup>®</sup> OS

## LDP Feature Guide for Routing Devices

Release

14.1



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*Junos<sup>®</sup> OS LDP Feature Guide for Routing Devices*

14.1

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## Documentation and Release Notes

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## Supported Platforms

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

- [T Series](#)
- [MX Series](#)
- [M Series](#)
- [PTX Series](#)

## Using the Examples in This Manual

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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 xv 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
<b>Bold text like this</b>	Represents text that you type.	To enter configuration mode, type the <b>configure</b> command:  user@host> <b>configure</b>
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> <b>show chassis alarms</b>  No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> <li>Introduces or emphasizes important new terms.</li> <li>Identifies guide names.</li> <li>Identifies RFC and Internet draft titles.</li> </ul>	<ul style="list-style-type: none"> <li>A policy <i>term</i> is a named structure that defines match conditions and actions.</li> <li><i>Junos OS CLI User Guide</i></li> <li>RFC 1997, <i>BGP Communities Attribute</i></li> </ul>
<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@# <b>set system domain-name</b> <i>domain-name</i>
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"> <li>To configure a stub area, include the <b>stub</b> statement at the [edit protocols ospf area area-id] hierarchy level.</li> <li>The console port is labeled <b>CONSOLE</b>.</li> </ul>
< > (angle brackets)	Encloses optional keywords or variables.	<b>stub &lt;default-metric metric&gt;;</b>
(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.	<b>broadcast   multicast</b>  <b>(string1   string2   string3)</b>
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	<b>rsvp { # Required for dynamic MPLS only</b>
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	<b>community name members [ community-ids ]</b>
Indentation and braces ( { } )	Identifies a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	

---

#### GUI Conventions

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

Convention	Description	Examples
<b>Bold text like this</b>	Represents graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> <li>In the Logical Interfaces box, select <b>All Interfaces</b>.</li> <li>To cancel the configuration, click <b>Cancel</b>.</li> </ul>
<b>&gt;</b> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select <b>Protocols&gt;Ospf</b> .

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- Find product documentation: <http://www.juniper.net/techpubs/>
- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>
- Download the latest versions of software and review release notes: <http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <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 LDP on page 3](#)



## CHAPTER 1

# Introduction to LDP

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## LDP Introduction

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The Label Distribution Protocol (LDP) is a protocol for distributing labels in non-traffic-engineered applications. LDP allows routers to establish label-switched paths (LSPs) through a network by mapping network-layer routing information directly to data link layer-switched paths.

These LSPs might have an endpoint at a directly attached neighbor (comparable to IP hop-by-hop forwarding), or at a network egress node, enabling switching through all intermediary nodes. LSPs established by LDP can also traverse traffic-engineered LSPs created by RSVP.

LDP associates a forwarding equivalence class (FEC) with each LSP it creates. The FEC associated with an LSP specifies which packets are mapped to that LSP. LSPs are extended through a network as each router chooses the label advertised by the next hop for the FEC and splices it to the label it advertises to all other routers. This process forms a tree of LSPs that converge on the egress router.

## Junos OS LDP Protocol Implementation

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The Junos OS implementation of LDP supports LDP version 1. The Junos OS supports a simple mechanism for tunneling between routers in an interior gateway protocol (IGP), to eliminate the required distribution of external routes within the core. The Junos OS allows an MPLS tunnel next hop to all egress routers in the network, with only an IGP running in the core to distribute routes to egress routers. Edge routers run BGP but do not distribute external routes to the core. Instead, the recursive route lookup at the edge resolves to an LSP switched to the egress router. No external routes are necessary on the transit LDP routers.

## LDP Operation

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You must configure LDP for each interface on which you want LDP to run. LDP creates LSP trees rooted at each egress router for the router ID address that is the subsequent BGP next hop. The ingress point is at every router running LDP. This process provides an inet.3 route to every egress router. If BGP is running, it will attempt to resolve next hops by using the inet.3 table first, which binds most, if not all, of the BGP routes to MPLS tunnel next hops.

Two adjacent routers running LDP become neighbors. If the two routers are connected by more than one interface, they become neighbors on each interface. When LDP routers become neighbors, they establish an LDP session to exchange label information. If per-router labels are in use on both routers, only one LDP session is established between them, even if they are neighbors on multiple interfaces. For this reason, an LDP session is not related to a particular interface.

LDP operates in conjunction with a unicast routing protocol. LDP installs LSPs only when both LDP and the routing protocol are enabled. For this reason, you must enable both LDP and the routing protocol on the same set of interfaces. If this is not done, LSPs might not be established between each egress router and all ingress routers, which might result in loss of BGP-routed traffic.

You can apply policy filters to labels received from and distributed to other routers through LDP. Policy filters provide you with a mechanism to control the establishment of LSPs.

For LDP to run on an interface, MPLS must be enabled on a logical interface on that interface. For more information, see the *Logical Interfaces*.

**Related Documentation**

- [Logical Interfaces](#)

## Tunneling LDP LSPs in RSVP LSPs

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You can tunnel LDP LSPs over RSVP LSPs. The following sections describe how tunneling of LDP LSPs in RSVP LSPs works:

- [Tunneling LDP LSPs in RSVP LSPs Overview on page 5](#)
- [Label Operations on page 5](#)

## Tunneling LDP LSPs in RSVP LSPs Overview

---

If you are using RSVP for traffic engineering, you can run LDP simultaneously to eliminate the distribution of external routes in the core. The LSPs established by LDP are tunneled through the LSPs established by RSVP. LDP effectively treats the traffic-engineered LSPs as single hops.

When you configure the router to run LDP across RSVP-established LSPs, LDP automatically establishes sessions with the router at the other end of the LSP. LDP control packets are routed hop-by-hop, rather than carried through the LSP. This routing allows you to use simplex (one-way) traffic-engineered LSPs. Traffic in the opposite direction flows through LDP-established LSPs that follow unicast routing rather than through traffic-engineered tunnels.

If you configure LDP over RSVP LSPs, you can still configure multiple OSPF areas and IS-IS levels in the traffic engineered core and in the surrounding LDP cloud.

## Label Operations

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[Figure 1 on page 6](#) depicts an LDP LSP being tunneled through an RSVP LSP. (For definitions of label operations, see *Label Description*.) The shaded inner oval represents the RSVP domain, whereas the outer oval depicts the LDP domain. RSVP establishes an LSP through routers B, C, D, and E, with the sequence of labels L3, L4. LDP establishes an LSP through Routers A, B, E, F, and G, with the sequence of labels L1, L2, L5. LDP views the RSVP LSP between Routers B and E as a single hop.

When the packet arrives at Router A, it enters the LSP established by LDP, and a label (L1) is pushed onto the packet. When the packet arrives at Router B, the label (L1) is swapped with another label (L2). Because the packet is entering the traffic-engineered LSP established by RSVP, a second label (L3) is pushed onto the packet.

This outer label (L3) is swapped with a new label (L4) at the intermediate router (C) within the RSVP LSP tunnel, and when the penultimate router (D) is reached, the top label is popped. Router E swaps the label (L2) with a new label (L5), and the penultimate router for the LDP-established LSP (F) pops the last label.

Figure 1: Swap and Push When LDP LSPs Are Tunneled Through RSVP LSPs

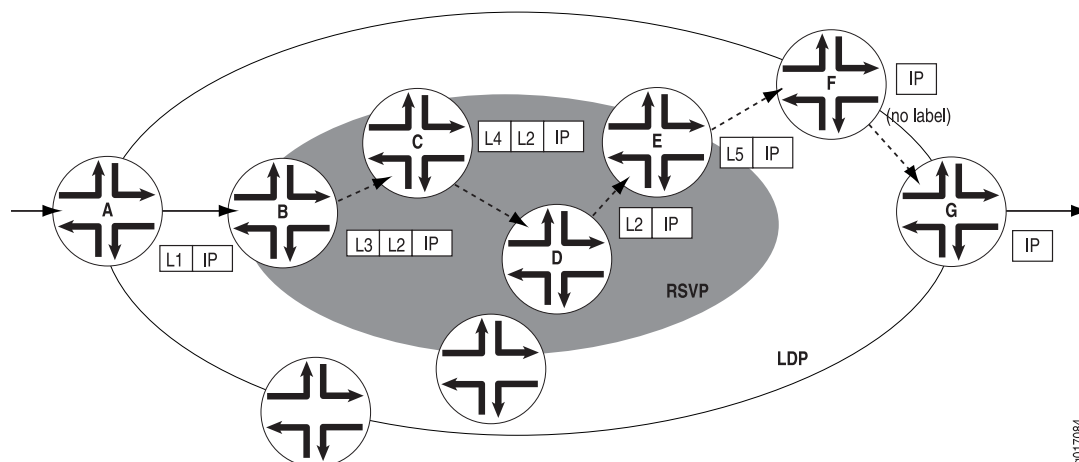
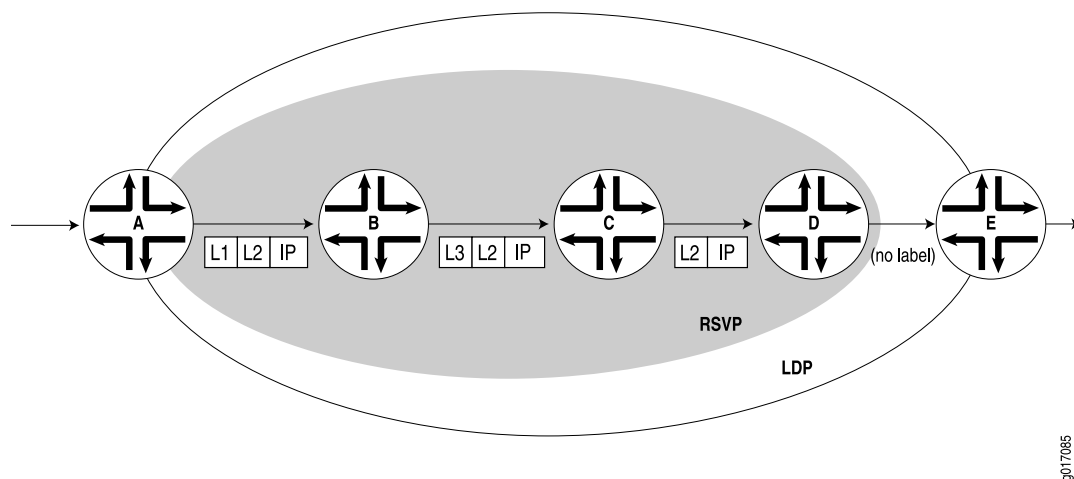


Figure 2 on page 6 depicts a double push label operation (L1L2). A double push label operation is used when the ingress router (A) for both the LDP LSP and the RSVP LSP tunneled through it is the same device. Note that Router D is the penultimate hop for the LDP-established LSP, so L2 is popped from the packet by Router D.

Figure 2: Double Push When LDP LSPs Are Tunneled Through RSVP LSPs



## LDP Message Types

LDP uses the message types described in the following sections to establish and remove mappings and to report errors. All LDP messages have a common structure that uses a type, length, and value (TLV) encoding scheme.

- [Discovery Messages on page 7](#)
- [Session Messages on page 7](#)
- [Advertisement Messages on page 7](#)
- [Notification Messages on page 7](#)



## Discovery Messages

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Discovery messages announce and maintain the presence of a router in a network. Routers indicate their presence in a network by sending hello messages periodically. Hello messages are transmitted as UDP packets to the LDP port at the group multicast address for all routers on the subnet.

LDP uses the following discovery procedures:

- Basic discovery—A router periodically sends LDP link hello messages through an interface. LDP link hello messages are sent as UDP packets addressed to the LDP discovery port. Receipt of an LDP link hello message on an interface identifies an adjacency with the LDP peer router.
- Extended discovery—LDP sessions between routers not directly connected are supported by LDP extended discovery. A router periodically sends LDP targeted hello messages to a specific address. Targeted hello messages are sent as UDP packets addressed to the LDP discovery port at the specific address. The targeted router decides whether to respond to or ignore the targeted hello message. A targeted router that chooses to respond does so by periodically sending targeted hello messages to the initiating router.

## Session Messages

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Session messages establish, maintain, and terminate sessions between LDP peers. When a router establishes a session with another router learned through the hello message, it uses the LDP initialization procedure over TCP transport. When the initialization procedure is completed successfully, the two routers are LDP peers and can exchange advertisement messages.

## Advertisement Messages

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Advertisement messages create, change, and delete label mappings for forwarding equivalence classes (FECs). Requesting a label or advertising a label mapping to a peer is a decision made by the local router. In general, the router requests a label mapping from a neighboring router when it needs one and advertises a label mapping to a neighboring router when it wants the neighbor to use a label.

## Notification Messages

---

Notification messages provide advisory information and signal error information. LDP sends notification messages to report errors and other events of interest. There are two kinds of LDP notification messages:

- Error notifications, which signal fatal errors. If a router receives an error notification from a peer for an LDP session, it terminates the LDP session by closing the TCP transport connection for the session and discarding all label mappings learned through the session.

- Advisory notifications, which pass information to a router about the LDP session or the status of some previous message received from the peer.

## LDP Session Protection

---

LDP session protection is based on the LDP targeted hello functionality defined in RFC 5036, *LDP Specification*, and is supported by the Junos OS as well as the LDP implementations of most other vendors. It involves sending unicast User Datagram Protocol (UDP) hello packets to a remote neighbor address and receiving similar packets from the neighbor router.

If you configure LDP session protection on a router, the LDP sessions are maintained as follows:

1. An LDP session is established between a router and a remote neighboring router.
2. If all of the direct links between the routers go down, the LDP session remains up so long as there is IP connectivity between the routers based on another connection over the network.
3. When the direct link between the routers is reestablished, the LDP session is not restarted. The routers simply exchange LDP hellos with each other over the direct link. They can then begin forwarding LDP-signaled MPLS packets using the original LDP session.

By default, LDP targeted hellos are set to the remote neighbor so long as the LDP session is up, even if there are no more link neighbors to that router. You can also specify the duration you would like to maintain the remote neighbor connection in the absence of link neighbors. When the last link neighbor for a session goes down, the Junos OS starts an LDP session protection timer. If this timer expires before any of the link neighbors come back up, the remote neighbor connection is taken down and the LDP session is terminated. If you configure a different value for the timer while it is currently running, the Junos OS updates the timer to the specified value without disrupting the current state of the LDP session.

## LDP Graceful Restart

---

LDP graceful restart enables a router whose LDP control plane is undergoing a restart to continue to forward traffic while recovering its state from neighboring routers. It also enables a router on which helper mode is enabled to assist a neighboring router that is attempting to restart LDP.

During session initialization, a router advertises its ability to perform LDP graceful restart or to take advantage of a neighbor performing LDP graceful restart by sending the graceful restart TLV. This TLV contains two fields relevant to LDP graceful restart: the reconnect time and the recovery time. The values of the reconnect and recovery times indicate the graceful restart capabilities supported by the router.

When a router discovers that a neighboring router is restarting, it waits until the end of the recovery time before attempting to reconnect. The recovery time is the length of time a router waits for LDP to restart gracefully. The recovery time period begins when an

initialization message is sent or received. This time period is also typically the length of time that a neighboring router maintains its information about the restarting router, allowing it to continue to forward traffic.

You can configure LDP graceful restart in both the master instance for the LDP protocol and for a specific routing instance. You can disable graceful restart at the global level for all protocols, at the protocol level for LDP only, and on a specific routing instance. LDP graceful restart is disabled by default, because at the global level, graceful restart is disabled by default. However, helper mode (the ability to assist a neighboring router attempting a graceful restart) is enabled by default.

The following are some of the behaviors associated with LDP graceful restart:

- Outgoing labels are not maintained in restarts. New outgoing labels are allocated.
- When a router is restarting, no label-map messages are sent to neighbors that support graceful restart until the restarting router has stabilized (label-map messages are immediately sent to neighbors that do not support graceful restart). However, all other messages (keepalive, address-message, notification, and release) are sent as usual. Distributing these other messages prevents the router from distributing incomplete information.
- Helper mode and graceful restart are independent. You can disable graceful restart in the configuration, but still allow the router to cooperate with a neighbor attempting to restart gracefully.

## Understanding Multicast-Only Fast Reroute

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Multicast-only fast reroute (MoFRR) minimizes packet loss in a network when there is a link failure. It works by enhancing multicast routing protocols like Protocol Independent Multicast (PIM) and multipoint Label Distribution Protocol (multipoint LDP). MoFRR is supported on MX Series routers with MPC line cards. As a prerequisite, the router must be set to **network-services enhanced-ip** mode, and all the line-cards in the router must be MPCs.

With MoFRR enabled, join messages are sent on primary and backup upstream paths. Data packets are received from both the primary path and the backup paths. The redundant packets are discarded based on priority (weights that are assigned to the primary and backup paths). When a failure is detected on the primary path, the repair is made by changing the interface on which packets are accepted to the secondary interface. Because the repair is local, it is fast—greatly improving convergence times in the event of a link failure on the primary path.

Currently, the most likely real-world application for MoFRR is streaming IPTV. IPTV streams are multicast as UDP streams. Therefore, any lost packets are not retransmitted, and this can result in a less-than-satisfactory user experience. MoFRR can be used to improve this situation.

When fast reroute is applied to unicast streams, an upstream router preestablishes MPLS label-switched paths (LSPs) or precomputes an IP loop-free alternate (LFA) fast reroute backup path to handle failure of a segment in the downstream path.

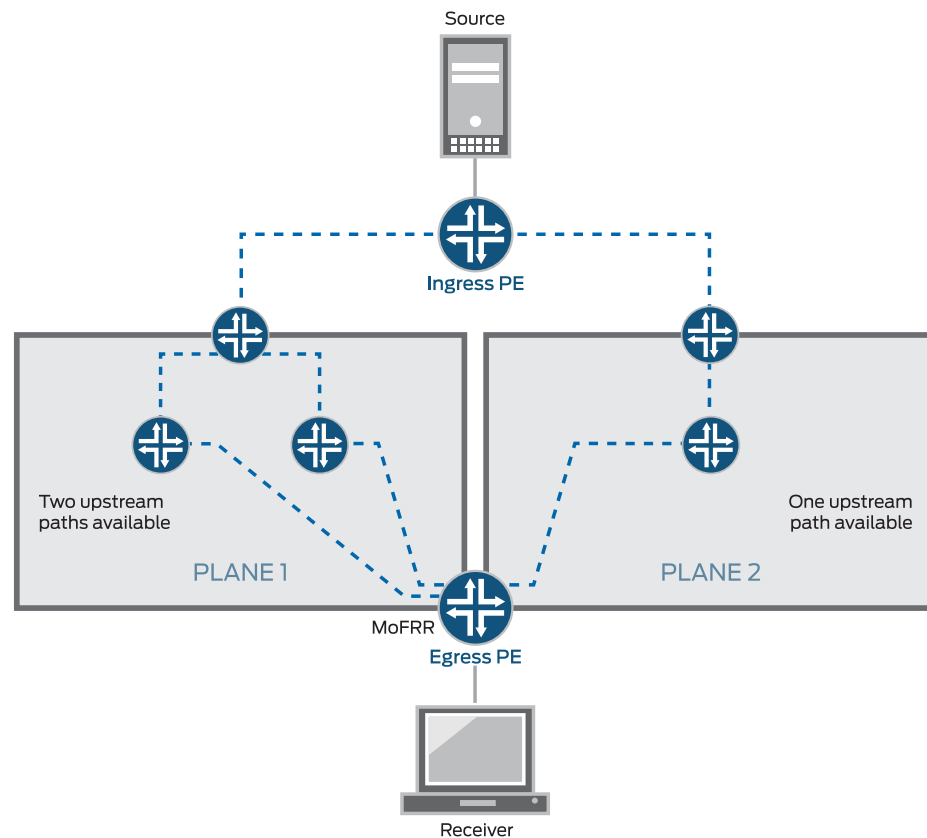
In multicast routing, the traffic distribution graphs are usually originated by the receiver. This is unlike unicast routing, which usually establishes the path from the source to the receiver. Protocols that are capable of establishing multicast distribution graphs are PIM (for IP), multipoint LDP (for MPLS), and RSVP-TE (for MPLS). Of these, PIM and multipoint LDP receivers initiate the distribution graph setup, and therefore these are the two multicast protocols for which MoFRR is supported.

In a multicast tree, performing a reactive repair upon detection of a network-component failure can lead to significant traffic loss due to delay in setting up the alternative path. MoFRR reduces traffic loss in a multicast distribution tree when a network component fails. With MoFRR, one of the downstream routers that supports this feature sets up an alternative path toward the source to receive a backup live stream of the same multicast traffic. When a failure is detected on the primary stream, the MoFRR router switches to the backup stream.

With MoFRR enabled, for each (S,G) entry, two of the available upstream interfaces are used to send a join message and to receive multicast traffic. The protocol attempts to select two disjoint paths if two such paths are available. If disjoint paths are not available, the protocol selects two nondisjoint paths. If two nondisjoint paths are not available, only a primary path is selected with no backup. MoFRR is supported for both IPv4 and IPv6 protocol families.

[Figure 3 on page 11](#) shows two paths from the egress provider edge (PE) router to the ingress PE router.

Figure 3: : MoFRR Sample Topology



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When enabled with MoFRR functionality, the egress router sets up two multicast trees, a primary path and a backup path, toward the multicast source for each (S,G). In other words, the egress router propagates the same (S,G) join messages toward two different upstream neighbors, thus creating two multicast trees.

One of the multicast trees goes through plane 1 and the other through plane 2, as shown in [Figure 3 on page 11](#). For each (S,G), the egress PE router forwards traffic received on the primary path and drops traffic received on the backup path.

MoFRR is supported on both equal-cost multipath (ECMP) paths and non-ECMP paths. Unicast loop-free alternate (LFA) routes need to be enabled to support MoFRR on non-ECMP paths. LFA routes are enabled with the **link-protection** statement in the interior gateway protocol (IGP) configuration. When you enable link protection on an OSPF or IS-IS interface, Junos OS creates a backup LFA path to the primary next hop for all destination routes that traverse the protected interface.

Junos OS implements MoFRR in the IP network for IP MoFRR and at the MPLS label-edge router (LER) for multipoint LDP MoFRR.

Multipoint LDP MoFRR is used at the egress node of an MPLS network, where the packets are forwarded to an IP network. In the case of multipoint LDP MoFRR, the two paths toward the upstream PE router are established for receiving two streams of MPLS packets at the LER. One of the streams (the primary) is accepted, and the other one (the backup)

is dropped at the LER. The backup stream is accepted if the primary path fails. A prerequisite for this feature is inband signaling support, as described in [“Understanding Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs” on page 89](#).

## PIM Functionality

Junos OS supports MoFRR for shortest-path tree (SPT) joins in PIM source-specific multicast (SSM) and any-source multicast (ASM). MoFRR is supported for both SSM and ASM ranges. To enable MoFRR for (\*G) joins, the `mofrr-asm-starg` configuration statement needs to be included. For each group G, either (S,G) or (\*G) (not both) will undergo MoFRR. (S,G) always takes precedence over (\*G).

With MoFRR enabled, a PIM router propagates join messages on two upstream RPF interfaces to receive multicast traffic on both links for the same join request. Preference is given to two paths that do not converge to the same immediate upstream router. PIM installs appropriate multicast routes with upstream RPF next hops with two (primary and backup) interfaces.

When the primary path fails, the backup path is upgraded to primary, and traffic is forwarded accordingly. If there are alternate paths available, a new backup path is calculated and the appropriate multicast route is updated or installed.

MoFRR can be enabled along with PIM join load balancing (with the `join-load-balance automatic` statement). However, in such cases the distribution of join messages among the links might not be even. When a new ECMP link is added, join messages on the primary path are redistributed and load-balanced. The join messages on the backup path might still follow the same path and might not be evenly redistributed.

MoFRR is enabled with a `[edit routing-options multicast stream-protection]` configuration and is managed by a set of filter policies. When an egress PIM router receives a join message or an IGMP report, the router checks for the MoFRR configuration.

If the MoFRR configuration is not present, PIM sends a join message upstream toward one upstream neighbor (for example, plane 2 in [Figure 3 on page 11](#)).

If the MoFRR configuration is present, Junos OS checks for a policy configuration.

If a policy is not present, Junos OS checks for primary and backup paths (upstream interfaces), and takes the following actions:

- If primary and backup paths are not available—PIM sends a join message upstream toward one upstream neighbor (for example, plane 2 in [Figure 3 on page 11](#)).
- If primary and backup paths are available—PIM sends the join message upstream toward two of the available upstream neighbors. Junos OS sets up primary and secondary multicast paths to receive multicast traffic (for example, plane 1 in [Figure 3 on page 11](#)).

If a policy is present, Junos OS checks whether the policy allows MoFRR for this (S,G), and takes the following actions:

- If the policy check fails—PIM sends a join message upstream toward one upstream neighbor (for example, plane 2 in [Figure 3 on page 11](#)).

- If the policy check passes—Junos OS checks for primary and backup paths (upstream interfaces).
- If the primary and backup paths are not available, PIM sends a join message upstream toward one upstream neighbor (for example, plane 2 in [Figure 3 on page 11](#)).
- If the primary and backup paths are available, PIM sends the join message upstream toward two of the available upstream neighbors. Junos OS sets up primary and secondary multicast paths to receive multicast traffic (for example, plane 1 in [Figure 3 on page 11](#)).

## Multipoint LDP Functionality

To avoid MPLS traffic duplication, the usual implementation of multipoint LDP selects only one upstream path. (See section 2.4.1.1. Determining One's 'upstream LSR' in RFC 6388, *Label Distribution Protocol Extensions for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths*.)

For multipoint LDP MoFRR, the multipoint LDP node selects two separate upstream peers and sends two separate labels, one to each upstream peer. The same algorithm described in RFC 6388 is used to select the primary upstream path. The backup upstream path selection again uses the same algorithm but excludes the primary upstream LSR as a candidate. Two streams of MPLS traffic are sent to the egress node from the two different upstream peers. The MPLS traffic from only one of the upstream neighbors is selected as the primary path to accept the traffic, and the other path becomes the backup path. The traffic on the backup path is dropped. When the primary upstream path fails, the traffic from the backup path is then accepted. The multipoint LDP node selects the two upstream paths based on the interior gateway protocol (IGP) root node next hop.

A forwarding equivalency class (FEC) is a group of IP packets that are forwarded in the same manner, over the same path, and with the same forwarding treatment. Normally, the label that is put on a particular packet represents the FEC to which that packet is assigned. In MoFRR, two routes are placed into the mpls.0 table for each FEC—one route for the primary label and the other route for the backup label.

If there are parallel links toward the same immediate upstream node, both parallel links are considered to be the primary. At any point in time, the upstream node sends traffic on only one of the multiple parallel links.

A bud node is an LSR that is an egress LSR, but also has one or more directly connected downstream LSRs. In the case of a bud node, the traffic from the primary upstream path is forwarded to a downstream LSR. If the primary upstream path fails, the MPLS traffic from the backup upstream path is forwarded to the downstream LSR. This means that the downstream LSR next hop is added to both MPLS routes along with the egress next hop.

MoFRR for multipoint LDP is enabled with a **[edit routing-options multicast stream-protection]** configuration and is managed by a set of filter policies.

If the multipoint LDP point-to-multipoint FEC is enabled for MoFRR, the following additional considerations are factored into upstream path selection:

- The targeted LDP sessions are skipped if there is a nontargeted LDP session. If there is a single targeted LDP session, the targeted LDP session is selected, but the corresponding point-to-multipoint FEC loses the MoFRR capability because there is no interface associated with the targeted LDP session.
- All interfaces that belong to the same upstream LSR are considered to be the primary path.
- For any root-node route updates, the upstream path is changed based on the latest next hops from the IGP. If a better path is available, multipoint LDP attempts to switch to the better path.

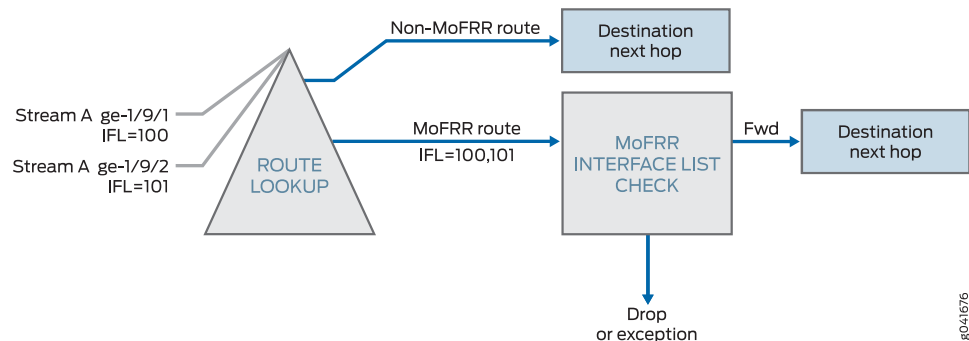
## Packet Forwarding

For both PIM and multipoint LDP, multicast source stream selection is performed at the incoming interface. This prevents duplicate streams from being sent across the fabric and prevents multiple route lookups that result in drops, thus preserving fabric bandwidth and maximizing forwarding performance.

For PIM, each IP multicast stream contains the same destination address. Regardless of the interface on which the packets arrive, the packets have the same route. An interface list is attached to the route. Junos OS checks the interface upon which each packet arrives and forwards only those that are from the primary interface. If the interface matches a secondary interface, the packets are dropped. If no match is found, the packets are handled as exceptions in the control plane.

This process is shown in [Figure 4 on page 14](#).

**Figure 4: : MoFRR IP Route Lookup in the Packet Forwarding Engine**

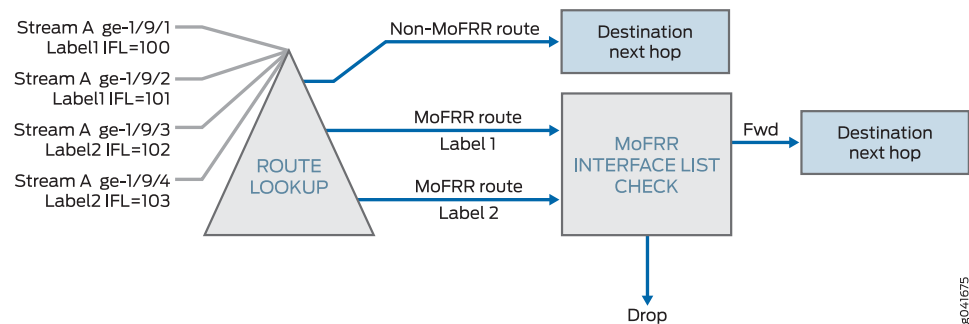


For multipoint LDP, multiple MPLS labels are used to control MoFRR stream selection. Each label represents a separate route, but each references the same interface list check. Only the primary label is forwarded while all others are dropped. Multiple interfaces can receive packets using the same label.

This process is shown in [Figure 5 on page 15](#).



Figure 5: : MoFRR MPLS Route Lookup in the Packet Forwarding Engine



## Limitations and Caveats

MoFRR has the following limitations and caveats:

- MoFRR failure detection is supported for immediate link protection of the router on which MoFRR is enabled and not on all the links (end-to-end) in the multicast traffic path.
- MoFRR supports FRR on two selected disjoint paths toward the source. Two of the selected upstream neighbors cannot be on the same interface—in other words, two upstream neighbors on a LAN segment. The same is true if the upstream interface happens to be a multicast tunnel interface.
- Detection of the maximum end-to-end disjoint upstream paths is not supported. The egress router only makes sure that there is a disjoint upstream node (the immediate previous hop). PIM and multipoint LDP do not support the equivalent of explicit route objects (EROs). Hence, disjoint upstream path detection is limited to control over the immediately previous hop node. Because of this limitation, the path to the upstream node of the previous hop selected as primary and backup might be shared.
- MoFRR does not apply to multipoint LDP traffic received on an RSVP tunnel because the RSVP tunnel is not associated with any interface.
- Some traffic loss is seen in the following scenarios:
  - A better upstream path becomes available on an egress node.
  - MoFRR is enabled or disabled on the egress node while there is an active traffic stream flowing.
- PIM join load balancing for join messages for backup paths are not supported.
- For a multicast group G, MoFRR is not allowed for both (S,G) and (\*,G) join messages. (S,G) join messages have precedence over (\*,G).
- MoFRR is not supported for multicast traffic streams that use two different multicast groups. Each (S,G) combination is treated as a unique multicast traffic stream.
- The bidirectional PIM range is not supported for MoFRR.
- PIM dense-mode is not supported for MoFRR.

- Mixed upstream MoFRR is not supported. This refers to PIM multipoint LDP in-band signaling, wherein one upstream path is through multipoint LDP and the second upstream path is through PIM.
- Multicast statistics for the backup traffic stream are not maintained by PIM and therefore are not available in the operational output of **show** commands.
- Multipoint LDP labels as inner labels are not supported.
- If the source is reachable through multiple ingress provider edge (PE) routers, multipoint LDP MoFRR is not supported.
- Targeted upstream sessions are not selected as the upstream node for MoFRR.
- Rate monitoring is not supported.
- Multipoint LDP link protection on the backup path is not supported because there is no support for MoFRR inner labels.

**Related  
Documentation**

- [Configuring Multicast-Only Fast Reroute on page 79](#)
- *Example: Configuring Multicast-Only Fast Reroute in a PIM Domain*
- [Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119](#)

## PART 2

# Configuration

- [LDP Configuration Guidelines on page 19](#)
- [LDP Examples on page 83](#)
- [LDP Configuration Statements on page 137](#)



## CHAPTER 2

# LDP Configuration Guidelines

- [Minimum LDP Configuration on page 20](#)
- [Enabling and Disabling LDP on page 20](#)
- [Configuring the LDP Timer for Hello Messages on page 20](#)
- [Configuring the Delay Before LDP Neighbors Are Considered Down on page 21](#)
- [Enabling Strict Targeted Hello Messages for LDP on page 23](#)
- [Configuring the Interval for LDP Keepalive Messages on page 23](#)
- [Configuring the LDP Keepalive Timeout on page 23](#)
- [Configuring LDP Route Preferences on page 24](#)
- [Configuring LDP Graceful Restart on page 24](#)
- [Filtering Inbound LDP Label Bindings on page 26](#)
- [Filtering Outbound LDP Label Bindings on page 28](#)
- [Specifying the Transport Address Used by LDP on page 30](#)
- [Configuring the Prefixes Advertised into LDP from the Routing Table on page 31](#)
- [Configuring FEC Deaggregation on page 32](#)
- [Configuring Policers for LDP FECs on page 32](#)
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- [Configuring BFD for LDP LSPs on page 34](#)
- [Configuring ECMP-Aware BFD for LDP LSPs on page 37](#)
- [Configuring a Failure Action for the BFD Session on an LDP LSP on page 37](#)
- [Configuring the Holddown Interval for the BFD Session on page 38](#)
- [Configuring OAM Ingress Policies for LDP on page 38](#)
- [Configuring LDP LSP Traceroute on page 39](#)
- [Collecting LDP Statistics on page 40](#)
- [Tracing LDP Protocol Traffic on page 42](#)
- [Configuring Miscellaneous LDP Properties on page 45](#)
- [Example: Configuring LDP Link Protection on page 51](#)
- [Configuring LDP Link Protection on page 77](#)
- [Configuring Multicast-Only Fast Reroute on page 79](#)

## Minimum LDP Configuration

---

To enable LDP on a single interface, include the **ldp** statement and specify the interface using the **interface** statement. This is the minimum LDP configuration. All other LDP configuration statements are optional.

```
ldp {  
    interface interface-name;  
}
```

To enable LDP on all interfaces, specify **all** for *interface-name*.

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

## Enabling and Disabling LDP

---

LDP is routing-instance-aware. To enable LDP on a specific interface, include the following statements:

```
ldp {  
    interface interface-name;  
}
```

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

To enable LDP on all interfaces, specify **all** for *interface-name*.

If you have configured interface properties on a group of interfaces and want to disable LDP on one of the interfaces, include the **interface** statement with the **disable** option:

```
interface interface-name {  
    disable;  
}
```

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

## Configuring the LDP Timer for Hello Messages

---

LDP hello messages enable LDP nodes to discover one another and to detect the failure of a neighbor or the link to the neighbor. Hello messages are sent periodically on all interfaces where LDP is enabled.

There are two types of LDP hello messages:

- Link hello messages—Sent through the LDP interface as UDP packets addressed to the LDP discovery port. Receipt of an LDP link hello message on an interface identifies an adjacency with the LDP peer router.
- Targeted hello messages—Sent as UDP packets addressed to the LDP discovery port at a specific address. Targeted hello messages are used to support LDP sessions

between routers that are not directly connected. A targeted router determines whether to respond or ignore a targeted hello message. A targeted router that chooses to respond does so by periodically sending targeted hello messages back to the initiating router.

By default, LDP sends hello messages every 5 seconds for link hello messages and every 15 seconds for targeted hello messages. You can configure the LDP timer to alter how often both types of hello messages are sent. However, you cannot configure a time for the LDP timer that is greater than the LDP hold time. For more information, see [“Configuring the Delay Before LDP Neighbors Are Considered Down” on page 21](#).

### Configuring the LDP Timer for Link Hello Messages

To modify how often LDP sends link hello messages, specify a new link hello message interval for the LDP timer using the **hello-interval** statement:

```
hello-interval seconds;
```

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

### Configuring the LDP Timer for Targeted Hello Messages

To modify how often LDP sends targeted hello messages, specify a new targeted hello message interval for the LDP timer by configuring the **hello-interval** statement as an option for the **targeted-hello** statement:

```
targeted-hello {
  hello-interval seconds;
}
```

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

### Configuring the Delay Before LDP Neighbors Are Considered Down

The hold time determines how long an LDP node should wait for a hello message before declaring a neighbor to be down. This value is sent as part of a hello message so that each LDP node tells its neighbors how long to wait. The values sent by each neighbor do not have to match.

The hold time should normally be at least three times the hello interval. The default is 15 seconds for link hello messages and 45 seconds for targeted hello messages. However, it is possible to configure an LDP hold time that is close to the value for the hello interval.



**NOTE:** By configuring an LDP hold time close to the hello interval (less than three times the hello interval), LDP neighbor failures might be detected more quickly. However, this also increases the possibility that the router might declare an LDP neighbor down that is still functioning normally. For more information, see [“Configuring the LDP Timer for Hello Messages” on page 20](#).

The LDP hold time is also negotiated automatically between LDP peers. When two LDP peers advertise different LDP hold times to one another, the smaller value is used. If an LDP peer router advertises a shorter hold time than the value you have configured, the peer router's advertised hold time is used. This negotiation can affect the LDP keepalive interval as well.

If the local LDP hold time is not shortened during LDP peer negotiation, the user-configured keepalive interval is left unchanged. However, if the local hold time is reduced during peer negotiation, the keepalive interval is recalculated. If the LDP hold time has been reduced during peer negotiation, the keepalive interval is reduced to one-third of the new hold time value. For example, if the new hold-time value is 45 seconds, the keepalive interval is set to 15 seconds.

This automated keepalive interval calculation can cause different keepalive intervals to be configured on each peer router. This enables the routers to be flexible in how often they send keepalive messages, because the LDP peer negotiation ensures they are sent more frequently than the LDP hold time.

When you reconfigure the hold-time interval, changes do not take effect until after the session is reset. The hold time is negotiated when the LDP peering session is initiated and cannot be renegotiated as long as the session is up (required by RFC 5036, *LDP Specification*). To manually force the LDP session to reset, issue the **clear ldp session** command.

## Configuring the LDP Hold Time for Link Hello Messages

To modify how long an LDP node should wait for a link hello message before declaring the neighbor down, specify a new time in seconds using the **hold-time** statement:

```
hold-time seconds;
```

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

## Configuring the LDP Hold Time for Targeted Hello Messages

To modify how long an LDP node should wait for a targeted hello message before declaring the neighbor down, specify a new time in seconds using the **hold-time** statement as an option for the **targeted-hello** statement:

```
targeted-hello {  
  hold-time seconds;  
}
```

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



## Enabling Strict Targeted Hello Messages for LDP

---

Use strict targeted hello messages to prevent LDP sessions from being established with remote neighbors that have not been specifically configured. If you configure the **strict-targeted-hellos** statement, an LDP peer does not respond to targeted hello messages coming from a source that is not one of its configured remote neighbors. Configured remote neighbors can include:

- Endpoints of RSVP tunnels for which LDP tunneling is configured
- Layer 2 circuit neighbors

If an unconfigured neighbor sends a hello message, the LDP peer ignores the message and logs an error (with the **error** trace flag) indicating the source. For example, if the LDP peer received a targeted hello from the Internet address 10.0.0.1 and no neighbor with this address is specifically configured, the following message is printed to the LDP log file:

LDP: Ignoring targeted hello from 10.0.0.1

To enable strict targeted hello messages, include the **strict-targeted-hellos** statement:

**strict-targeted-hellos;**

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

## Configuring the Interval for LDP Keepalive Messages

---

The keepalive interval determines how often a message is sent over the session to ensure that the keepalive timeout is not exceeded. If no other LDP traffic is sent over the session in this much time, a keepalive message is sent. The default is 10 seconds. The minimum value is 1 second.

The value configured for the keepalive interval can be altered during LDP session negotiation if the value configured for the LDP hold time on the peer router is lower than the value configured locally. For more information, see [“Configuring the Delay Before LDP Neighbors Are Considered Down” on page 21](#).

To modify the keepalive interval, include the **keepalive-interval** statement:

**keepalive-interval** *seconds*;

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

## Configuring the LDP Keepalive Timeout

---

After an LDP session is established, messages must be exchanged periodically to ensure that the session is still working. The keepalive timeout defines the amount of time that the neighbor LDP node waits before deciding that the session has failed. This value is usually set to at least three times the keepalive interval. The default is 30 seconds.

To modify the keepalive interval, include the **keepalive-timeout** statement:

**keepalive-timeout** *seconds*;

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

The value configured for the **keepalive-timeout** statement is displayed as the hold time when you issue the **show ldp session detail** command.

---

## Configuring LDP Route Preferences

When several protocols calculate routes to the same destination, route preferences are used to select which route is installed in the forwarding table. The route with the lowest preference value is selected. The preference value can be a number in the range 0 through 255. By default, LDP routes have a preference value of 9.

To modify the route preferences, include the **preference** statement:

**preference** *preference*;

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

---

## Configuring LDP Graceful Restart

When you alter the graceful restart configuration at either the **[edit routing-options graceful-restart]** or **[edit protocols ldp graceful-restart]** hierarchy levels, any running LDP session is automatically restarted to apply the graceful restart configuration. This behavior mirrors the behavior of BGP when you alter its graceful restart configuration.

By default, graceful restart helper mode is enabled, but graceful restart is disabled. Thus, the default behavior of a router is to assist neighboring routers attempting a graceful restart, but not to attempt a graceful restart itself.

To configure LDP graceful restart, see the following sections:

- [Enabling Graceful Restart on page 24](#)
- [Disabling LDP Graceful Restart or Helper Mode on page 25](#)
- [Configuring Reconnect Time on page 25](#)
- [Configuring Recovery Time and Maximum Recovery Time on page 26](#)

### Enabling Graceful Restart

To enable LDP graceful restart, you also need to enable graceful restart on the router. To enable graceful restart, include the **graceful-restart** statement:

**graceful-restart**;

You can include this statement at the following hierarchy levels:

- **[edit routing-options]**

- [edit logical-systems *logical-system-name* routing-options]

The **graceful-restart** statement enables graceful restart for all protocols supporting this feature on the router. For more information about graceful restart, see the *Junos OS Routing Protocols Library for Routing Devices*.

By default, LDP graceful restart is enabled when you enable graceful restart at both the LDP protocol level and on all the routing instances. However, you can disable both LDP graceful restart and LDP graceful restart helper mode.

## Disabling LDP Graceful Restart or Helper Mode

To disable LDP graceful restart and recovery, include the **disable** statement:

```
ldp {
  graceful-restart {
    disable;
  }
}
```

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

You can disable helper mode at the LDP protocols level only. You cannot disable helper mode for a specific routing instance. To disable LDP helper mode, include the **helper-disable** statement:

```
ldp {
  graceful-restart {
    helper-disable;
  }
}
```

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

The following LDP graceful restart configurations are possible:

- LDP graceful restart and helper mode are both enabled.
- LDP graceful restart is disabled but helper mode is enabled. A router configured in this way cannot restart gracefully but can help a restarting neighbor.
- LDP graceful restart and helper mode are both disabled. The router does not use LDP graceful restart or the graceful restart type, length, and value (TLV) sent in the initialization message. The router behaves as a router that cannot support LDP graceful restart.

A configuration error is issued if you attempt to enable graceful restart and disable helper mode.

## Configuring Reconnect Time

After the LDP connection between neighbors fails, neighbors wait a certain amount of time for the gracefully restarting router to resume sending LDP messages. After the wait

period, the LDP session can be reestablished. You can configure the wait period in seconds. This value is included in the fault tolerant session TLV sent in LDP initialization messages when LDP graceful restart is enabled.

Suppose that Router A and Router B are LDP neighbors. Router A is the restarting Router. The reconnect time is the time that Router A tells Router B to wait after Router B detects that Router A restarted.

To configure the reconnect time, include the **reconnect-time** statement:

```
graceful-restart {  
    reconnect-time seconds;  
}
```

You can set the reconnect time to a value in the range from 30 through 300 seconds. By default, it is 60 seconds.

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

## Configuring Recovery Time and Maximum Recovery Time

The recovery time is the amount of time a router waits for LDP to restart gracefully. The recovery time period begins when an initialization message is sent or received. This period is also typically the amount of time that a neighboring router maintains its information about the restarting router, allowing it to continue to forward traffic.

To prevent a neighboring router from being adversely affected if it receives a false value for the recovery time from the restarting router, you can configure the maximum recovery time on the neighboring router. A neighboring router maintains its state for the shorter of the two times. For example, Router A is performing an LDP graceful restart. It has sent a recovery time of 900 seconds to neighboring Router B. However, Router B has its maximum recovery time configured at 400 seconds. Router B will only wait for 400 seconds before it purges its LDP information from Router A.

To configure recovery time, include the **recovery-time** statement and the **maximum-neighbor-recovery-time** statement:

```
graceful-restart {  
    maximum-neighbor-recovery-time seconds;  
    recovery-time seconds;  
}
```

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

---

## Filtering Inbound LDP Label Bindings

You can filter received LDP label bindings, applying policies to accept or deny bindings advertised by neighboring routers. To configure received-label filtering, include the **import** statement:

```
import [ policy-names ];
```

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

The named policy (configured at the **[edit policy-options]** hierarchy level) is applied to all label bindings received from all LDP neighbors. All filtering is done with **from** statements. [Table 3 on page 27](#) lists the only **from** operators that apply to LDP received-label filtering.

**Table 3: from Operators That Apply to LDP Received-Label Filtering**

from Operator	Description
<b>interface</b>	Matches on bindings received from a neighbor that is adjacent over the specified interface
<b>neighbor</b>	Matches on bindings received from the specified LDP router ID
<b>next-hop</b>	Matches on bindings received from a neighbor advertising the specified interface address
<b>route-filter</b>	Matches on bindings with the specified prefix

If a binding is filtered, it still appears in the LDP database, but is not considered for installation as part of a label-switched path (LSP).

Generally, applying policies in LDP can be used only to block the establishment of LSPs, not to control their routing. This is because the path that an LSP follows is determined by unicast routing, and not by LDP. However, when there are multiple equal-cost paths to the destination through different neighbors, you can use LDP filtering to exclude some of the possible next hops from consideration. (Otherwise, LDP chooses one of the possible next hops at random.)

LDP sessions are not bound to interfaces or interface addresses. LDP advertises only per-router (not per-interface) labels; so if multiple parallel links exist between two routers, only one LDP session is established, and it is not bound to a single interface. When a router has multiple adjacencies to the same neighbor, take care to ensure that the filter does what is expected. (Generally, using **next-hop** and **interface** is not appropriate in this case.)

If a label has been filtered (meaning that it has been rejected by the policy and is not used to construct an LSP), it is marked as filtered in the database:

```
user@host> show ldp database
Input label database, 10.10.255.1:0-10.10.255.6:0
Label Prefix
3 10.10.255.6/32 (Filtered)
Output label database, 10.10.255.1:0-10.10.255.6:0
Label Prefix
3 10.10.255.1/32 (Filtered)
```

For more information about how to configure policies for LDP, see the *Routing Policy Feature Guide for Routing Devices*.

## Examples: Filtering Inbound LDP Label Bindings

Accept only /32 prefixes from all neighbors:

```
[edit]
protocols {
  ldp {
    import only-32;
    ...
  }
}
policy-options {
  policy-statement only-32 {
    term first {
      from {
        route-filter 0.0.0.0/0 upto /31;
      }
      then reject;
    }
    then accept;
  }
}
```

Accept 131.108/16 or longer from router ID 10.10.255.2 and accept all prefixes from all other neighbors:

```
[edit]
protocols {
  ldp {
    import nosy-neighbor;
    ...
  }
}
policy-options {
  policy-statement nosy-neighbor {
    term first {
      from {
        neighbor 10.10.255.2;
        route-filter 131.108.0.0/16 orlonger accept;
        route-filter 0.0.0.0/0 orlonger reject;
      }
    }
    then accept;
  }
}
```

---

## Filtering Outbound LDP Label Bindings

You can configure export policies to filter LDP outbound labels. You can filter outbound label bindings by applying routing policies to block bindings from being advertised to neighboring routers. To configure outbound label filtering, include the **export** statement:

```
export [policy-name];
```

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

The named export policy (configured at the **[edit policy-options]** hierarchy level) is applied to all label bindings transmitted to all LDP neighbors. The only **from** operator that applies to LDP outbound label filtering is **route-filter**, which matches bindings with the specified prefix. The only **to** operators that apply to outbound label filtering are the operators in [Table 4 on page 29](#).

**Table 4: to Operators for LDP Outbound-Label Filtering**

to Operator	Description
<b>interface</b>	Matches on bindings sent to a neighbor that is adjacent over the specified interface
<b>neighbor</b>	Matches on bindings sent to the specified LDP router ID
<b>next-hop</b>	Matches on bindings sent to a neighbor advertising the specified interface address

If a binding is filtered, the binding is not advertised to the neighboring router, but it can be installed as part of an LSP on the local router. You can apply policies in LDP to block the establishment of LSPs, but not to control their routing. The path an LSP follows is determined by unicast routing, not by LDP.

LDP sessions are not bound to interfaces or interface addresses. LDP advertises only per-router (not per-interface) labels. If multiple parallel links exist between two routers, only one LDP session is established, and it is not bound to a single interface.

Do not use the **next-hop** and **interface** operators when a router has multiple adjacencies to the same neighbor.

Filtered labels are marked in the database:

```
user@host> show ldp database
Input label database, 10.10.255.1:0-10.10.255.3:0
Label Prefix
100007 10.10.255.2/32
3 10.10.255.3/32
Output label database, 10.10.255.1:0-10.10.255.3:0
Label Prefix
3 10.10.255.1/32
100001 10.10.255.6/32 (Filtered)
```

For more information about how to configure policies for LDP, see the *Routing Policy Feature Guide for Routing Devices*.

## Examples: Filtering Outbound LDP Label Bindings

Block transmission of the route for **10.10.255.6/32** to any neighbors:

```
[edit protocols]
ldp {
  export block-one;
```

```
}
policy-options {
  policy-statement block-one {
    term first {
      from {
        route-filter 10.10.255.6/32 exact;
      }
      then reject;
    }
    then accept;
  }
}
```

Send only **131.108/16** or longer to router ID **10.10.255.2**, and send all prefixes to all other routers:

```
[edit protocols]
ldp {
  export limit-lsps;
}
policy-options {
  policy-statement limit-lsps {
    term allow-one {
      from {
        route-filter 131.108.0.0/16 orlonger;
      }
      to {
        neighbor 10.10.255.2;
      }
      then accept;
    }
    term block-the-rest {
      to {
        neighbor 10.10.255.2;
      }
      then reject;
    }
    then accept;
  }
}
```

---

## Specifying the Transport Address Used by LDP

Routers must first establish a TCP session between each other before they can establish an LDP session. The TCP session enables the routers to exchange the label advertisements needed for the LDP session. To establish the TCP session, each router must learn the other router's transport address. The transport address is an IP address used to identify the TCP session over which the LDP session will run.

To configure the LDP transport address, include the transport-address statement:

**transport-address** (router-id | interface);

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



If you specify the **router-id** option, the address of the router identifier is used as the transport address (unless otherwise configured, the router identifier is typically the same as the loopback address). If you specify the **interface** option, the interface address is used as the transport address for any LDP sessions to neighbors that can be reached over that interface. Note that the router identifier is used as the transport address by default.

You cannot specify the **interface** option when there are multiple parallel links to the same LDP neighbor, because the LDP specification requires that the same transport address be advertised on all interfaces to the same neighbor. If LDP detects multiple parallel links to the same neighbor, it disables interfaces to that neighbor one by one until the condition is cleared, either by disconnecting the neighbor on an interface or by specifying the **router-id** option.

Related Documentation

- [transport-address on page 191](#)

## Configuring the Prefixes Advertised into LDP from the Routing Table

You can control the set of prefixes that are advertised into LDP and cause the router to be the egress router for those prefixes. By default, only the loopback address is advertised into LDP. To configure the set of prefixes from the routing table to be advertised into LDP, include the **egress-policy** statement:

```
egress-policy policy-name;
```

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



**NOTE:** If you configure an egress policy for LDP that does not include the loopback address, it is no longer advertised in LDP. To continue to advertise the loopback address, you need to explicitly configure it as a part of the LDP egress policy.

The named policy (configured at the **[edit policy-options]** or **[edit logical-systems logical-system-name policy-options]** hierarchy level) is applied to all routes in the routing table. Those routes that match the policy are advertised into LDP. You can control the set of neighbors to which those prefixes are advertised by using the **export** statement. Only **from** operators are considered; you can use any valid **from** operator. For more information, see the *Junos OS Routing Protocols Library for Routing Devices*.

### Example: Configuring the Prefixes Advertised into LDP

Advertise all connected routes into LDP:

```
[edit protocols]
ldp {
  egress-policy connected-only;
}
policy-options {
  policy-statement connected-only {
    from {
```

```
        protocol direct;
    }
    then accept;
}
}
```

## Configuring FEC Deaggregation

---

When an LDP egress router advertises multiple prefixes, the prefixes are bound to a single label and aggregated into a single forwarding equivalence class (FEC). By default, LDP maintains this aggregation as the advertisement traverses the network.

Normally, because an LSP is not split across multiple next hops and the prefixes are bound into a single LSP, load-balancing across equal-cost paths does not occur. You can, however, load-balance across equal-cost paths if you configure a load-balancing policy and deaggregate the FECs.

Deaggregating the FECs causes each prefix to be bound to a separate label and become a separate LSP.

To configure deaggregated FECs, include the **deaggregate** statement:

**deaggregate;**

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

For all LDP sessions, you can configure deaggregated FECs only globally.

Deaggregating a FEC allows the resulting multiple LSPs to be distributed across multiple equal-cost paths and distributes LSPs across the multiple next hops on the egress segments but installs only one next hop per LSP.

To aggregate FECs, include the **no-deaggregate** statement:

**no-deaggregate;**

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

For all LDP sessions, you can configure aggregated FECs only globally.

### Related Documentation

- *Configuring Load Balancing Across RSVP LSPs*
- *Configuring Protocol-Independent Load Balancing in Layer 3 VPNs*
- *Configuring VPLS Load Balancing*
- *Example: Load Balancing BGP Traffic*

## Configuring Policers for LDP FECs

---

You can configure the Junos OS to track and police traffic for LDP FECs. LDP FEC policers can be used to do any of the following:

- Track or police the ingress traffic for an LDP FEC.
- Track or police the transit traffic for an LDP FEC.
- Track or police LDP FEC traffic originating from a specific forwarding class.
- Track or police LDP FEC traffic originating from a specific virtual routing and forwarding (VRF) site.
- Discard false traffic bound for a specific LDP FEC.

To police traffic for an LDP FEC, you must first configure a filter. Specifically, you need to configure either the **interface** statement or the **interface-set** statement at the **[edit firewall family protocol-family filter filter-name term term-name from]** hierarchy level. The **interface** statement allows you to match the filter to a single interface. The **interface-set** statement allows you to match the filter to multiple interfaces.

For more information on how to configure the **interface** statement, the **interface-set** statement, and policers for LDP FECs, see the *Routing Policy Feature Guide for Routing Devices*.

Once you have configured the filters, you need to include them in the **policing** statement configuration for LDP. To configure policers for LDP FECs, include the **policing** statement:

```
policing {
  fec fec-address {
    ingress-traffic filter-name;
    transit-traffic filter-name;
  }
}
```

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

The **policing** statement includes the following options:

- **fec**—Specify the FEC address for the LDP FEC you want to police.
- **ingress-filter**—Specify the name of the ingress traffic filter.
- **transit-traffic**—Specify the name of the transit traffic filter.

## Configuring LDP IPv4 FEC Filtering

By default, when a targeted LDP session is established, the Junos OS always exchanges both the IPv4 forwarding equivalence classes (FECs) and the Layer 2 circuit FECs over the targeted LDP session. For an LDP session to an indirectly connected neighbor, you might only want to export Layer 2 circuit FECs to the neighbor if the session was specifically configured to support Layer 2 circuits or VPLS.

In a mixed vendor network where all non-BGP prefixes are advertised into LDP, the LDP database can become large. For this type of environment, it can be useful to prevent the advertisement of IPv4 FECs over LDP sessions formed because of Layer 2 circuit or LDP VPLS configuration. Similarly, it can be useful to filter any IPv4 FECs received in this sort of environment.

If all the LDP neighbors associated with an LDP session are Layer 2 only, you can configure the Junos OS to advertise only Layer 2 circuit FECs by configuring the **l2-smart-policy** statement. This feature also automatically filters out the IPv4 FECs received on this session. If you have configured an explicit export or import policy, this feature is disabled.

If one of the LDP session's neighbors is formed because of a discovered adjacency or if the adjacency is formed because of an LDP tunneling configuration on one or more RSVP LSPs, the IPv4 FECs are advertised and received using the default behavior.

To prevent LDP from exporting IPv4 FECs over LDP sessions with Layer 2 neighbors only and to filter out IPv4 FECs received over such sessions, include the **l2-smart-policy** statement:

```
l2-smart-policy;
```

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

---

## Configuring BFD for LDP LSPs

You can configure Bidirectional Forwarding Detection (BFD) for LDP LSPs. The BFD protocol is a simple hello mechanism that detects failures in a network. Hello packets are sent at a specified, regular interval. A neighbor failure is detected when the router stops receiving a reply after a specified interval. BFD works with a wide variety of network environments and topologies. The failure detection timers for BFD have shorter time limits than the failure detection mechanisms of static routes, providing faster detection.

An error is logged whenever a BFD session for a path fails. The following shows how BFD for LDP LSP log messages might appear:

```
RPD_LDP_BFD_UP: LDP BFD session for FEC 10.255.16.14/32 is up
RPD_LDP_BFD_DOWN: LDP BFD session for FEC 10.255.16.14/32 is down
```

You can also configure BFD for RSVP LSPs, as described in *Configuring BFD for MPLS IPv4 LSPs*.

The BFD failure detection timers are adaptive and can be adjusted to be more or less aggressive. For example, the timers can adapt to a higher value if the adjacency fails, 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.

To enable BFD for LDP LSPs, include the **oam** and **bfd-liveness-detection** statements:

```
oam {
  bfd-liveness-detection {
    detection-time threshold milliseconds;
    ecmp;
```

```

failure-action {
    remove-nexthop;
    remove-route;
}
holddown-interval seconds;
ingress-policy ingress-policy-name;
minimum-interval milliseconds;
minimum-receive-interval milliseconds;
minimum-transmit-interval milliseconds;
multiplier detection-time-multiplier;
no-adaptation;
transmit-interval {
    minimum-interval milliseconds;
    threshold milliseconds;
}
version (0 | 1 | automatic);
}
fec fec-address {
    bfd-liveness-detection {
        detection-time threshold milliseconds;
        ecmp;
        failure-action {
            remove-nexthop;
            remove-route;
        }
        holddown-interval milliseconds;
        ingress-policy ingress-policy-name;
        minimum-interval milliseconds;
        minimum-receive-interval milliseconds;
        minimum-transmit-interval milliseconds;
        multiplier detection-time-multiplier;
        no-adaptation;
        transmit-interval {
            minimum-interval milliseconds;
            threshold milliseconds;
        }
        version (0 | 1 | automatic);
    }
    no-bfd-liveness-detection;
    periodic-traceroute {
        disable;
        exp exp-value;
        fanout fanout-value;
        frequency minutes;
        paths number-of-paths;
        retries retry-attempts;
        source address;
        ttl ttl-value;
        wait seconds;
    }
}
lsp-ping-interval seconds;
periodic-traceroute {
    disable;
    exp exp-value;
    fanout fanout-value;

```

```
frequency minutes;  
paths number-of-paths;  
retries retry-attempts;  
source address;  
ttl ttl-value;  
wait seconds;  
}  
}
```

You can enable BFD for the LDP LSPs associated with a specific forwarding equivalence class (FEC) by configuring the FEC address using the **fec** option at the **[edit protocols ldp]** hierarchy level. Alternatively, you can configure an Operation Administration and Management (OAM) ingress policy to enable BFD on a range of FEC addresses. For more information, see [“Configuring OAM Ingress Policies for LDP” on page 38](#).

You cannot enable BFD LDP LSPs unless their equivalent FEC addresses are explicitly configured or OAM is enabled on the FECs using an OAM ingress policy. If BFD is not enabled for any FEC addresses, the BFD session will not come up.

You can configure the **oam** statement at the following hierarchy levels:

- **[edit protocols ldp]**
- **[edit logical-systems *logical-system-name* protocols ldp]**

The **oam** statement includes the following options:

- **fec**—Specify the FEC address. You must either specify a FEC address or configure an OAM ingress policy to ensure that the BFD session comes up.
- **lsp-ping-interval**—Specify the duration of the LSP ping interval in seconds. To issue a ping on an LDP-signaled LSP, use the **ping mpls ldp** command. For more information, see the [CLI Explorer](#).

The **bfd-liveness-detection** statement includes the following options:

- **ecmp**—Cause LDP to establish BFD sessions for all ECMP paths configured for the specified FEC. If you configure the **ecmp** option, you must also configure the **periodic-traceroute** statement for the specified FEC. If you do not do so, the commit operation fails. You can configure the **periodic-traceroute** statement at the global hierarchy level (**[edit protocols ldp oam]**) while only configuring the **ecmp** option for a specific FEC (**[edit protocols ldp oam fec *address* bfd-liveness-detection]**).
- **holddown-interval**—Specify the duration the BFD session should remain up before adding the route or next hop. Specifying a time of 0 seconds causes the route or next hop to be added as soon as the BFD session comes back up.
- **minimum-interval**—Specify the minimum transmit and receive interval. If you configure the **minimum-interval** option, you do not need to configure the **minimum-receive-interval** option or the **minimum-transmit-interval** option.
- **minimum-receive-interval**—Specify the minimum receive interval. The range is from 1 through 255,000 milliseconds.

- **minimum-transmit-interval**—Specify the minimum transmit interval. The range is from 1 through 255,000 milliseconds.
- **multiplier**—Specify the detection time multiplier. The range is from 1 through 255.
- **version**—Specify the BFD version. The options are BFD version 0 or BFD version 1. By default, the Junos OS software attempts to automatically determine the BFD version.

## Configuring ECMP-Aware BFD for LDP LSPs

When you configure BFD for a FEC, a BFD session is established for only one active local next-hop for the router. However, you can configure multiple BFD sessions, one for each FEC associated with a specific equal-cost multipath (ECMP) path. For this to function properly, you also need to configure LDP LSP periodic traceroute. (See [“Configuring LDP LSP Traceroute” on page 39](#).) LDP LSP traceroute is used to discover ECMP paths. A BFD session is initiated for each ECMP path discovered. Whenever a BFD session for one of the ECMP paths fails, an error is logged.

LDP LSP traceroute is run periodically to check the integrity of the ECMP paths. The following might occur when a problem is discovered:

- If the latest LDP LSP traceroute for a FEC differs from the previous traceroute, the BFD sessions associated with that FEC (the BFD sessions for address ranges that have changed from previous run) are brought down and new BFD sessions are initiated for the destination addresses in the altered ranges.
- If the LDP LSP traceroute returns an error (for example, a timeout), all the BFD sessions associated with that FEC are torn down.

To configure LDP to establish BFD sessions for all ECMP paths configured for the specified FEC, include the **ecmp** statement.

```
ecmp;
```

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

Along with the **ecmp** statement, you must also include the **periodic-traceroute** statement, either in the global LDP OAM configuration (at the **[edit protocols ldp oam]** or **[edit logical-systems logical-system-name protocols ldp oam]** hierarchy level) or in the configuration for the specified FEC (at the **[edit protocols ldp oam fec address]** or **[edit logical-systems logical-system-name protocols ldp oam fec address]** hierarchy level). Otherwise, the commit operation fails.

## Configuring a Failure Action for the BFD Session on an LDP LSP

You can configure route and next-hop properties in the event of a BFD session failure event on an LDP LSP. The failure event could be an existing BFD session that has gone down or could be a BFD session that never came up. LDP adds back the route or next hop when the relevant BFD session comes back up.

You can configure one of the following failure action options for the **failure-action** statement in the event of a BFD session failure on the LDP LSP:

- **remove-nexthop**—Removes the route corresponding to the next hop of the LSP's route at the ingress node when a BFD session failure event is detected.
- **remove-route**—Removes the route corresponding to the LSP from the appropriate routing tables when a BFD session failure event is detected. If the LSP is configured with ECMP and a BFD session corresponding to any path goes down, the route is removed.

To configure a failure action in the event of a BFD session failure on an LDP LSP, include either the **remove-nexthop** option or the **remove-route** option for the **failure-action** statement:

```
failure-action {  
    remove-nexthop;  
    remove-route;  
}
```

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

---

## Configuring the Holddown Interval for the BFD Session

You can specify the duration the BFD session should be up before adding a route or next hop by configuring the **holddown-interval** statement at either the **[edit protocols ldp oam bfd-liveness-detection]** hierarchy level or at the **[edit protocols ldp oam fec address bfd-liveness-detection]** hierarchy level. Specifying a time of 0 seconds causes the route or next hop to be added as soon as the BFD session comes back up.

```
holddown-interval seconds;
```

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

---

## Configuring OAM Ingress Policies for LDP

Using the **ingress-policy** statement, you can configure an Operation, Administration, and Management (OAM) policy to choose which forwarding equivalence classes (FECs) need to have OAM enabled. If the FEC passes through the policy or if the FEC is explicitly configured, OAM is enabled for a FEC. For FECs chosen using a policy, the BFD parameters configured under **[edit protocols ldp oam bfd-liveness-detection]** are applied.

You configure the OAM ingress policy at the **[edit policy-options]** hierarchy level. To configure an OAM ingress policy, include the **ingress-policy** statement:

```
ingress-policy ingress-policy-name;
```

You can configure this statement at the following hierarchy levels:

- **[edit protocols ldp oam]**
- **[edit logical-systems logical-system-name protocols ldp oam]**



## Configuring LDP LSP Traceroute

You can trace the route followed by an LDP-signaled LSP. LDP LSP traceroute is based on RFC 4379, *Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures*. This feature allows you to periodically trace all paths in a FEC. The FEC topology information is stored in a database accessible from the CLI.

A topology change does not automatically trigger a trace of an LDP LSP. However, you can manually initiate a traceroute. If the traceroute request is for an FEC that is currently in the database, the contents of the database are updated with the results.

The periodic traceroute feature applies to all FECs specified by the **oam** statement configured at the **[edit protocols ldp]** hierarchy level. To configure periodic LDP LSP traceroute, include the **periodic-traceroute** statement:

```
periodic-traceroute {
  disable;
  exp exp-value;
  fanout fanout-value;
  frequency minutes;
  paths number-of-paths;
  retries retry-attempts;
  source address;
  ttl ttl-value;
  wait seconds;
}
```

You can configure this statement at the following hierarchy levels:

- **[edit protocols ldp oam]**
- **[edit protocols ldp oam fec address]**

You can configure the **periodic-traceroute** statement by itself or with any of the following options:

- **exp**—Specify the class of service to use when sending probes.
- **fanout**—Specify the maximum number of next hops to search per node.
- **frequency**—Specify the interval between traceroute attempts.
- **paths**—Specify the maximum number of paths to search.
- **retries**—Specify the number of attempts to send a probe to a specific node before giving up.
- **source**—Specify the IPv4 source address to use when sending probes.
- **ttl**—Specify the maximum time-to-live value. Nodes that are beyond this value are not traced.
- **wait**—Specify the wait interval before resending a probe packet.

## Collecting LDP Statistics

LDP traffic statistics show the volume of traffic that has passed through a particular FEC on a router.

When you configure the **traffic-statistics** statement at the **[edit protocols ldp]** hierarchy level, the LDP traffic statistics are gathered periodically and written to a file. You can configure how often statistics are collected (in seconds) by using the **interval** option. The default collection interval is 5 minutes. You must configure an LDP statistics file; otherwise, LDP traffic statistics are not gathered. If the LSP goes down, the LDP statistics are reset.

To collect LDP traffic statistics, include the **traffic-statistics** statement:

```
traffic-statistics {
  file filename <files number> <size size> <world-readable | no-world-readable>;
  interval interval;
  no-penultimate-hop;
}
```

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

This section includes the following topics:

- [LDP Statistics Output on page 40](#)
- [Disabling LDP Statistics on the Penultimate-Hop Router on page 41](#)
- [LDP Statistics Limitations on page 41](#)

## LDP Statistics Output

The following sample output is from an LDP statistics file:

FEC	Type	Packets	Bytes	Shared
10.255.350.448/32	Transit	0	0	No
	Ingress	0	0	No
10.255.350.450/32	Transit	0	0	Yes
	Ingress	0	0	No
10.255.350.451/32	Transit	0	0	No
	Ingress	0	0	No
220.220.220.1/32	Transit	0	0	Yes
	Ingress	0	0	No
220.220.220.2/32	Transit	0	0	Yes
	Ingress	0	0	No
220.220.220.3/32	Transit	0	0	Yes
	Ingress	0	0	No

May 28 15:02:05, read 12 statistics in 00:00:00 seconds

The LDP statistics file includes the following columns of data:

- **read**—Number of bytes of data passed by the FEC since its LSP came up.
- **read**—FEC for which LDP traffic statistics are collected.
- **read**—Number of packets passed by the FEC since its LSP came up.

- **read**—This number (which appears next to the date and time) might differ from the actual number of the statistics displayed. Some of the statistics are summarized before being displayed.
- **Shared**—A **Yes** value indicates that several prefixes are bound to the same label (for example, when several prefixes are advertised with an egress policy). The LDP traffic statistics for this case apply to all the prefixes and should be treated as such.
- **Type**—Type of traffic originating from a router, either **Ingress** (originating from this router) or **Transit** (forwarded through this router).

## Disabling LDP Statistics on the Penultimate-Hop Router

Gathering LDP traffic statistics at the penultimate-hop router can consume excessive system resources, on next-hop routes in particular. This problem is exacerbated if you have configured the **deaggregate** statement in addition to the **traffic-statistics** statement. For routers reaching their limit of next-hop route usage, we recommend configuring the **no-penultimate-hop** option for the **traffic-statistics** statement:

```
traffic-statistics {
  no-penultimate-hop;
}
```

For a list of hierarchy levels at which you can configure the **traffic-statistics** statement, see the statement summary section for this statement.



**NOTE:** When you configure the **no-penultimate-hop** option, no statistics are available for the FECs that are the penultimate hop for this router.

Whenever you include or remove this option from the configuration, the LDP sessions are taken down and then restarted.

The following sample output is from an LDP statistics file showing routers on which the **no-penultimate-hop** option is configured:

FEC	Type	Packets	Bytes	Shared
10.255.245.218/32	Transit	0	0	No
	Ingress	4	246	No
10.255.245.221/32	Transit	statistics disabled		
	Ingress	statistics disabled		
13.1.1.0/24	Transit	statistics disabled		
	Ingress	statistics disabled		
13.1.3.0/24	Transit	statistics disabled		
	Ingress	statistics disabled		

## LDP Statistics Limitations

The following are issues related to collecting LDP statistics by configuring the **traffic-statistics** statement:

- You cannot clear the LDP statistics.

- If you shorten the specified interval, a new LDP statistics request is issued only if the statistics timer expires later than the new interval.
- A new LDP statistics collection operation cannot start until the previous one has finished. If the interval is short or if the number of LDP statistics is large, the time gap between the two statistics collections might be longer than the interval.

When an LSP goes down, the LDP statistics are reset.

---

## Tracing LDP Protocol Traffic

The following sections describe how to configure the trace options to examine LDP protocol traffic:

- [Tracing LDP Protocol Traffic at the Protocol and Routing Instance Levels on page 42](#)
- [Tracing LDP Protocol Traffic Within FECs on page 43](#)
- [Examples: Tracing LDP Protocol Traffic on page 43](#)

### Tracing LDP Protocol Traffic at the Protocol and Routing Instance Levels

To trace LDP protocol traffic, you can specify options in the global **traceoptions** statement at the **[edit routing-options]** hierarchy level, and you can specify LDP-specific options by including the **traceoptions** statement:

```
traceoptions {  
  file filename <files number> <size size> <world-readable | no-world-readable>;  
  flag flag <flag-modifier> <disable>;  
}
```

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

Use the **file** statement to specify the name of the file that receives the output of the tracing operation. All files are placed in the directory `/var/log`. We recommend that you place LDP-tracing output in the file **ldp-log**.

The following trace flags display the operations associated with the sending and receiving of various LDP messages. Each can carry one or more of the following modifiers:

- **address**—Trace the operation of address and address withdrawal messages.
- **binding**—Trace label-binding operations.
- **error**—Trace error conditions.
- **event**—Trace protocol events.
- **initialization**—Trace the operation of initialization messages.
- **label**—Trace the operation of label request, label map, label withdrawal, and label release messages.
- **notification**—Trace the operation of notification messages.

- **packets**—Trace the operation of address, address withdrawal, initialization, label request, label map, label withdrawal, label release, notification, and periodic messages. This modifier is equivalent to setting the **address**, **initialization**, **label**, **notification**, and **periodic** modifiers.

You can also configure the **filter** flag modifier with the **match-on address** sub-option for the **packets** flag. This allows you to trace based on the source and destination addresses of the packets.

- **path**—Trace label-switched path operations.
- **path**—Trace label-switched path operations.
- **periodic**—Trace the operation of hello and keepalive messages.
- **route**—Trace the operation of route messages.
- **state**—Trace protocol state transitions.

## Tracing LDP Protocol Traffic Within FECs

LDP associates a forwarding equivalence class (FEC) with each LSP it creates. The FEC associated with an LSP specifies which packets are mapped to that LSP. LSPs are extended through a network as each router chooses the label advertised by the next hop for the FEC and splices it to the label it advertises to all other routers.

You can trace LDP protocol traffic within a specific FEC and filter LDP trace statements based on an FEC. This is useful when you want to trace or troubleshoot LDP protocol traffic associated with an FEC. The following trace flags are available for this purpose: **route**, **path**, and **binding**.

The following example illustrates how you might configure the LDP **traceoptions** statement to filter LDP trace statements based on an FEC:

```
[edit protocols ldp traceoptions]
set flag route filter match-on fec policy "filter-policy-for-ldp-fec";
```

This feature has the following limitations:

- The filtering capability is only available for FECs composed of IP version 4 (IPv4) prefixes.
- Layer 2 circuit FECs cannot be filtered.
- When you configure both route tracing and filtering, MPLS routes are not displayed (they are blocked by the filter).
- Filtering is determined by the policy and the configured value for the **match-on** option. When configuring the policy, be sure that the default behavior is always **reject**.
- The only **match-on** option is **fec**. Consequently, the only type of policy you should include is a route-filter policy.

## Examples: Tracing LDP Protocol Traffic

Trace LDP path messages in detail:

```
[edit]
protocols {
  ldp {
    traceoptions {
      file ldp size 10m files 5;
      flag path;
    }
  }
}
```

Trace all LDP outgoing messages:

```
[edit]
protocols {
  ldp {
    traceoptions {
      file ldp size 10m files 5;
      flag packets;
    }
  }
}
```

Trace all LDP error conditions:

```
[edit]
protocols {
  ldp {
    traceoptions {
      file ldp size 10m files 5;
      flag error;
    }
  }
}
```

Trace all LDP incoming messages and all label-binding operations:

```
[edit]
protocols {
  ldp {
    traceoptions {
      file ldp size 10m files 5 world-readable;
      flag packets receive;
      flag binding;
    }
    interface all {
    }
  }
}
```

Trace LDP protocol traffic for an FEC associated with the LSP:

```
[edit]
protocols {
  ldp {
    traceoptions {
      flag route filter match-on fec policy filter-policy-for-ldp-fec;
    }
  }
}
```

}

## Configuring Miscellaneous LDP Properties

The following sections describe how to configure a number of miscellaneous LDP properties:

- [Configuring LDP to Use the IGP Route Metric on page 45](#)
- [Preventing Addition of Ingress Routes to the inet.0 Routing Table on page 45](#)
- [Multiple-Instance LDP and Carrier-of-Carriers VPNs on page 46](#)
- [Configuring MPLS and LDP to Pop the Label on the Ultimate-Hop Router on page 46](#)
- [Enabling LDP over RSVP-Established LSPs on page 46](#)
- [Enabling LDP over RSVP-Established LSPs in Heterogeneous Networks on page 47](#)
- [Configuring the TCP MD5 Signature for LDP Sessions on page 47](#)
- [Configuring LDP Session Protection on page 48](#)
- [Disabling SNMP Traps for LDP on page 49](#)
- [Configuring LDP Synchronization with the IGP on LDP Links on page 49](#)
- [Configuring LDP Synchronization with the IGP on the Router on page 50](#)
- [Configuring the Label Withdrawal Timer on page 50](#)
- [Ignoring the LDP Subnet Check on page 50](#)

### Configuring LDP to Use the IGP Route Metric

Use the **track-igp-metric** statement if you want the interior gateway protocol (IGP) route metric to be used for the LDP routes instead of the default LDP route metric (the default LDP route metric is 1).

To use the IGP route metric, include the **track-igp-metric** statement:

```
track-igp-metric;
```

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

### Preventing Addition of Ingress Routes to the inet.0 Routing Table

By configuring the **no-forwarding** statement, you can prevent ingress routes from being added to the inet.0 routing table instead of the inet.3 routing table even if you enabled the **traffic-engineering bgp-igp** statement at the **[edit protocols mpls]** or the **[edit logical-systems *logical-system-name* protocols mpls]** hierarchy level. By default, the **no-forwarding** statement is disabled.

To omit ingress routes from the inet.0 routing table, include the **no-forwarding** statement:

```
no-forwarding;
```

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

## Multiple-Instance LDP and Carrier-of-Carriers VPNs

By configuring multiple LDP routing instances, you can use LDP to advertise labels in a carrier-of-carriers VPN from a service provider provider edge (PE) router to a customer carrier customer edge (CE) router. This is especially useful when the carrier customer is a basic Internet service provider (ISP) and wants to restrict full Internet routes to its PE routers. By using LDP instead of BGP, the carrier customer shields its other internal routers from the Internet. Multiple-instance LDP is also useful when a carrier customer wants to provide Layer 2 or Layer 3 VPN services to its customers.

For an example of how to configure multiple LDP routing instances for carrier-of-carriers VPNs, see the *Multiple Instances for Label Distribution Protocol Feature Guide*.

## Configuring MPLS and LDP to Pop the Label on the Ultimate-Hop Router

The default advertised label is label 3 (Implicit Null label). If label 3 is advertised, the penultimate-hop router removes the label and sends the packet to the egress router. If ultimate-hop popping is enabled, label 0 (IPv4 Explicit Null label) is advertised. Ultimate-hop popping ensures that any packets traversing an MPLS network include a label.

To configure ultimate-hop popping, include the **explicit-null** statement:

```
explicit-null;
```

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



**NOTE:** Juniper Networks routers queue packets based on the incoming label. Routers from other vendors might queue packets differently. Keep this in mind when working with networks containing routers from multiple vendors.

For more information about labels, see *Label Description* and *Label Allocation*.

## Enabling LDP over RSVP-Established LSPs

You can run LDP over LSPs established by RSVP, effectively tunneling the LDP-established LSP through the one established by RSVP. To do so, enable LDP on the lo0.0 interface (see “[Enabling and Disabling LDP](#)” on page 20). You must also configure the LSPs over which you want LDP to operate by including the **ldp-tunneling** statement at the **[edit protocols mpls label-switched-path *lsp-name*]** hierarchy level:

```
[edit]
protocols {
  mpls {
    label-switched-path lsp-name {
      from source;
      to destination;
      ldp-tunneling;
    }
  }
}
```



```
}
```

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

**Related Documentation**

- [Tunneling LDP LSPs in RSVP LSPs Overview on page 5](#)

## Enabling LDP over RSVP-Established LSPs in Heterogeneous Networks

Some other vendors use an OSPF metric of 1 for the loopback address. Juniper Networks routers use an OSPF metric of 0 for the loopback address. This might require that you manually configure the RSVP metric when deploying LDP tunneling over RSVP LSPs in heterogeneous networks.

When a Juniper Networks router is linked to another vendor's router through an RSVP tunnel, and LDP tunneling is also enabled, by default the Juniper Networks router might not use the RSVP tunnel to route traffic to the LDP destinations downstream of the other vendor's egress router if the RSVP path has a metric of 1 larger than the physical OSPF path.

To ensure that LDP tunneling functions properly in heterogeneous networks, you can configure OSPF to ignore the RSVP LSP metric by including the **ignore-lsp-metrics** statement:

```
ignore-lsp-metrics;
```

You can configure this statement at the following hierarchy levels:

- [\[edit protocols ospf traffic-engineering shortcuts\]](#)
- [\[edit logical-systems \*logical-system-name\* protocols ospf traffic-engineering shortcuts\]](#)

To enable LDP over RSVP LSPs, you also still need to complete the procedure in Section [“Enabling LDP over RSVP-Established LSPs” on page 46](#).

## Configuring the TCP MD5 Signature for LDP Sessions

You can configure an MD5 signature for an LDP TCP connection to protect against the introduction of spoofed TCP segments into LDP session connection streams.

A router using the MD5 signature option is configured with a password for each peer for which authentication is required. The password is stored encrypted.

LDP hello adjacencies can still be created even when peering interfaces are configured with different security signatures. However, the TCP session cannot be authenticated and is never established.

To configure an MD5 signature for an LDP TCP connection, include the **session** and **authentication-key** statement:

```
session address {
  authentication-key md5-authentication-key;
}
```

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

Use the **session** statement to configure the address for the remote end of the LDP session.

The **md5-authentication-key** (password) can be up to 69 characters long. Characters can include any ASCII strings. If you include spaces, enclose all characters in quotation marks.

You can also configure an authentication key update mechanism for the LDP routing protocol. This mechanism allows you to update authentication keys without interrupting associated routing and signaling protocols such as Open Shortest Path First (OSPF) and Resource Reservation Setup Protocol (RSVP).

To configure the authentication key update mechanism, include the **key-chain** statement at the **[edit security authentication-key-chains]** hierarchy level, and specify the **key** option to create a keychain consisting of several authentication keys.

```
[edit security authentication-key-chains]
key-chain key-chain-name {
  key key {
    secret secret-data;
    start-time yyyy-mm-dd.hh:mm:ss;
  }
}
```

To configure the authentication key update mechanism for the LDP routing protocol, include the **authentication-key-chain** statement at the **[edit protocols ldp]** hierarchy level to associate the protocol with the **[edit security authentication-key-chains]** authentication keys.

```
[edit protocols ldp]
group group-name {
  neighbor address {
    authentication-key-chain key-chain-name;
  }
}
```

For more information about the authentication key update feature, see *Configuring the Authentication Key Update Mechanism for BGP and LDP Routing Protocols*.

## Configuring LDP Session Protection

An LDP session is normally created between a pair of routers that are connected by one or more links. The routers form one hello adjacency for every link that connects them and associate all the adjacencies with the corresponding LDP session. When the last hello adjacency for an LDP session goes away, the LDP session is terminated. You might want to modify this behavior to prevent an LDP session from being unnecessarily terminated and reestablished.

You can configure the Junos OS to leave the LDP session between two routers up even if there are no hello adjacencies on the links connecting the two routers by configuring the **session-protection** statement. You can optionally specify a time in seconds using the **timeout** option. The session remains up for the duration specified as long as the routers maintain IP network connectivity.

```
session-protection {
```

```

    timeout seconds;
}

```

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

## Disabling SNMP Traps for LDP

Whenever an LDP LSP makes a transition from up to down, or down to up, the router sends an SNMP trap. However, it is possible to disable the LDP SNMP traps on a router, logical system, or routing instance.

For information about the LDP SNMP traps and the proprietary LDP MIB, see the *SNMP MIBs and Traps Reference* and *Interpreting the Enterprise-Specific LDP MIB*.

To disable SNMP traps for LDP, specify the **trap disable** option for the **log-updown** statement:

```

log-updown {
    trap disable;
}

```

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

## Configuring LDP Synchronization with the IGP on LDP Links

LDP is a protocol for distributing labels in non-traffic-engineered applications. Labels are distributed along the best path determined by the IGP. If synchronization between LDP and the IGP is not maintained, the LSP goes down. When LDP is not fully operational on a given link (a session is not established and labels are not exchanged), the IGP advertises the link with the maximum cost metric. The link is not preferred but remains in the network topology.

LDP synchronization is supported only on active point-to-point interfaces and LAN interfaces configured as point-to-point under the IGP. LDP synchronization is not supported during graceful restart.

To advertise the maximum cost metric until LDP is operational for synchronization, include the **ldp-synchronization** statement:

```

ldp-synchronization {
    disable;
    hold-time seconds;
}

```

To disable synchronization, include the **disable** statement. To configure the time period to advertise the maximum cost metric for a link that is not fully operational, include the **hold-time** statement.

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

## Configuring LDP Synchronization with the IGP on the Router

You can configure the time the LDP waits before informing the IGP that the LDP neighbor and session for an interface are operational. For large networks with numerous FECs, you might need to configure a longer value to allow enough time for the LDP label databases to be exchanged.

To configure the time the LDP waits before informing the IGP that the LDP neighbor and session are operational, include the **igp-synchronization** statement and specify a time in seconds for the **holddown-interval** option:

```
igp-synchronization holddown-interval seconds;
```

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

## Configuring the Label Withdrawal Timer

The label withdrawal timer delays sending a label withdrawal message for a FEC to a neighbor. When an IGP link to a neighbor fails, the label associated with the FEC has to be withdrawn from all the upstream routers if the neighbor is the next hop for the FEC. After the IGP converges and a label is received from a new next hop, the label is readvertised to all the upstream routers. This is the typical network behavior. By delaying label withdrawal by a small amount of time (for example, until the IGP converges and the router receives a new label for the FEC from the downstream next hop), the label withdrawal and sending a label mapping soon could be avoided. The **label-withdrawal-delay** statement allows you to configure this delay time. By default, the delay is 60 seconds.

If the router receives the new label before the timer runs out, the label withdrawal timer is canceled. However, if the timer runs out, the label for the FEC is withdrawn from all of the upstream routers.

By default, LDP waits for 60 seconds before withdrawing labels to avoid resignaling LSPs multiple times while the IGP is reconverging. To configure the label withdrawal delay time in seconds, include the **label-withdrawal-delay** statement:

```
label-withdrawal-delay seconds;
```

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

## Ignoring the LDP Subnet Check

In Junos OS Release 8.4 and later releases, an LDP source address subnet check is performed during the neighbor establishment procedure. The source address in the LDP link hello packet is matched against the interface address. This causes an interoperability issue with some other vendors' equipment.

To disable the subnet check, include the **allow-subnet-mismatch** statement:

```
allow-subnet-mismatch;
```

This statement can be included at the following hierarchy levels:

- `[edit protocols ldp interface interface-name]`
- `[edit logical-systems logical-system-name protocols ldp interface interface-name]`

## Example: Configuring LDP Link Protection

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- [LDP Link Protection Overview on page 51](#)
- [Example: Configuring LDP Link Protection on page 68](#)

### LDP Link Protection Overview

- [Introduction to LDP on page 51](#)
- [Junos OS LDP Protocol Implementation on page 51](#)
- [Understanding Multipoint Extensions to LDP on page 52](#)
- [Using Multipoint Extensions to LDP on Targeted LDP Sessions on page 52](#)
- [Current Limitations of LDP Link Protection on page 53](#)
- [Using RSVP LSP as a Solution on page 54](#)
- [Understanding Multicast LDP Link Protection on page 56](#)
- [Different Modes for Providing LDP Link Protection on page 57](#)
- [Label Operation for LDP Link Protection on page 59](#)
- [Sample Multicast LDP Link Protection Configuration on page 65](#)
- [Make-Before-Break on page 66](#)
- [Caveats and Limitations on page 68](#)

### Introduction to LDP

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The Label Distribution Protocol (LDP) is a protocol for distributing labels in non-traffic-engineered applications. LDP allows routers to establish label-switched paths (LSPs) through a network by mapping network-layer routing information directly to the data link LSPs.

These LSPs might have an endpoint at a directly attached neighbor (comparable to IP hop-by-hop forwarding) or at a network egress node, enabling switching through all intermediary nodes. LSPs established by LDP can also traverse traffic-engineered LSPs created by RSVP.

LDP associates a forwarding equivalence class (FEC) with each LSP it creates. The FEC associated with an LSP specifies which packets are mapped to that LSP. LSPs are extended through a network as each router chooses the label advertised by the next hop for the FEC and splices it to the label it advertises to all other routers. This process forms a tree of LSPs that converge on the egress router.

### Junos OS LDP Protocol Implementation

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The Junos OS implementation of LDP supports LDP version 1. Junos OS supports a simple mechanism for tunneling between routers in an interior gateway protocol (IGP), to

eliminate the required distribution of external routes within the core. Junos OS allows an MPLS tunnel next hop to all egress routers in the network, with only an IGP running in the core to distribute routes to egress routers. Edge routers run BGP but do not distribute external routes to the core. Instead, the recursive route lookup at the edge resolves to an LSP switched to the egress router. No external routes are necessary on the transit LDP routers.

### Understanding Multipoint Extensions to LDP

An LDP defines mechanisms for setting up point-to-point, multipoint-to-point, point-to-multipoint, and multipoint-to-multipoint LSPs in the network. The point-to-multipoint and multipoint-to-multipoint LSPs are collectively referred to as multipoint LSPs, where traffic flows from a single source to multiple destinations, and from multiple sources to multiple destinations, respectively. The destination or egress routers are called leaf nodes, and traffic from the source traverses one or more transit nodes before reaching the leaf nodes.



**NOTE:** Junos OS does not provide support for multipoint-to-multipoint LSPs.

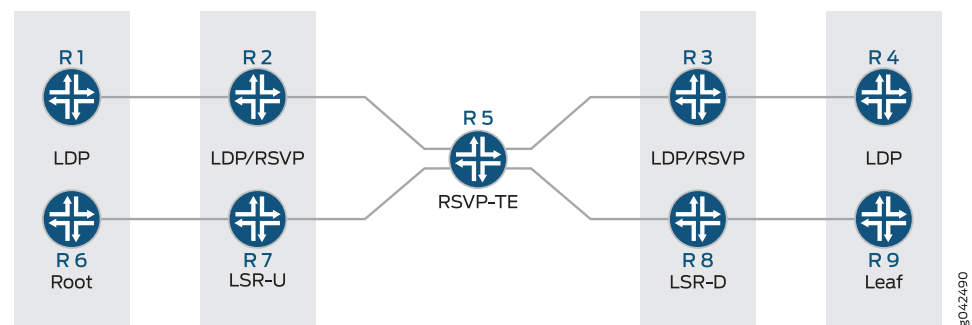
By taking advantage of the MPLS packet replication capability of the network, multipoint LSPs avoid unnecessary packet replication at the ingress router. Packet replication takes place only when packets are forwarded to two or more different destinations requiring different network paths.

### Using Multipoint Extensions to LDP on Targeted LDP Sessions

The specification for the multipoint extensions to LDP requires that the two endpoints of an LDP session are directly connected by a Layer 2 medium, or are considered to be neighbors by the network's IGP. This is referred to as an LDP link session. When the two endpoints of an LDP session are not directly connected, the session is referred to as a targeted LDP session.

Past Junos OS implementations support multicast LDP for link sessions only. With the introduction of the LDP link protection feature, the multicast LDP capabilities are extended to targeted LDP sessions. [Figure 6 on page 52](#) shows a sample topology.

**Figure 6: Multicast LDP Support for Targeted LDP Session**



Routers R7 and R8 are the upstream (LSR-U) and downstream (LSR-D) label-switched routers (LSRs), respectively, and deploy multicast LDP. The core router, Router R5, has RSVP-TE enabled.

When LSR-D is setting up the point-to-multipoint LSP with root and LSP ID attributes, it determines the upstream LSR-U as a next-hop on the best path to the root (currently, this next-hop is assumed to be an IGP next hop).

With the multicast LDP support on targeted LDP sessions, you can determine if there is an LSP next hop to LSR-U which is on LSR-D's path to root, where LSR-D and LSR-U are not directly connected neighbors, but targeted LDP peers. The point-to-multipoint label advertised on the targeted LDP session between LSR-D and LSR-U is not used unless there is an LSP between LSR-D and LSR-U. Therefore, a corresponding LSP in the reverse direction from LSR-U to LSR-D is required.

Data is transmitted on the point-to-multipoint LSP using unicast replication of packets, where LSR-U sends one copy to each downstream LSR of the point-to-multipoint LSP.

The data transmission is implemented in the following ways:

1. The point-to-multipoint capabilities on the targeted LDP session are negotiated.
2. The algorithm to select the upstream LSR is changed, where if IGP next hops are unavailable, or in other words, there is no LDP link session between LSR-D and LSR-U, an RSVP LSP is used as the next hop to reach LSR-U.
3. The incoming labels received over the targeted LDP sessions are installed as a branch next hop for this point-to-multipoint FEC route with the LDP label as the inner label and the RSVP label as the outer label.

### **Current Limitations of LDP Link Protection**

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When there is a link or node failure in an LDP network deployment, fast traffic recovery should be provided to recover impacted traffic flows for mission-critical services. In the case of multipoint LSPs, when one of the links of the point-to-multipoint tree fails, the subtrees might get detached until the IGP reconverges and the multipoint LSP is established using the best path from the downstream router to the new upstream router.

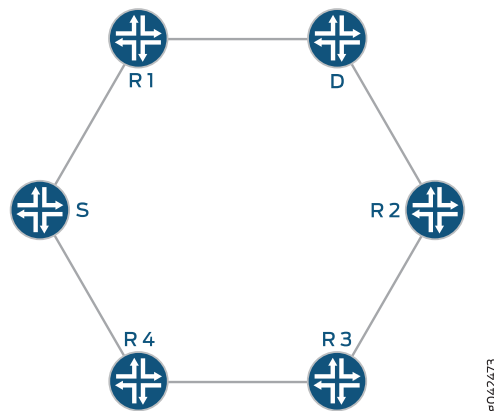
In fast reroute using local repair for LDP traffic, a backup path (repair path) is pre-installed in the Packet Forwarding Engine. When the primary path fails, traffic is rapidly moved to the backup path without having to wait for the routing protocols to converge. Loop-free alternate (LFA) is one of the methods used to provide IP fast reroute capability in the core and service provider networks.

Without LFA, when a link or a router fails or is returned to service, the distributed routing algorithms compute the new routes based on the changes in the network. The time during which the new routes are computed is referred to as routing transition. Until the routing transition is completed, the network connectivity is interrupted because the routers adjacent to a failure continue to forward the data packets through the failed component until an alternative path is identified.

However, LFA does not provide full coverage in all network deployments because of the IGP metrics. As a result, this is a limitation to the current LDP link protection schemes.

Figure 7 on page 54 illustrates a sample network with incomplete LFA coverage, where traffic flows from the source router (S) to the destination router (D) through Router R1. Assuming that each link in the network has the same metric, if the link between the Router S and Router R1 fails, Router R4 is not an LFA that protects the S-R1 link, so traffic resiliency is lost. Thus, full coverage is not achieved by using plain LFA. In typical networks, there is always some percentage of LFA coverage gap with plain LFA.

**Figure 7: Incomplete Coverage Problem with LFA**



### Using RSVP LSP as a Solution

The key to protect the traffic flowing through LDP LSPs is to have an explicit tunnel to re-route the traffic in the event of a link or node failure. The explicit path has to terminate on the next downstream router, and the traffic needs to be accepted on the explicit path, where the RPF check should pass.

RSVP LSPs help overcome the current limitations of loop-free alternate (LFA) for both point-to-point and point-to-multipoint LDP LSPs by extending the LFA coverage in the following methods:

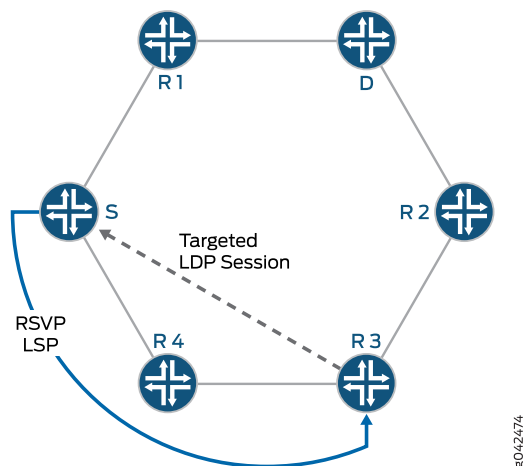
- [Manually Configured RSVP LSPs on page 54](#)
- [Dynamically Configured RSVP LSPs on page 55](#)

#### **Manually Configured RSVP LSPs**

Considering the example used in Figure 7 on page 54, when the S-R1 link fails, and Router R4 is not an LFA for that particular link, a manually created RSVP LSP is used as a patch to provide complete LFA coverage. The RSVP LSP is pre-sigaled and pre-installed in the Packet Forwarding Engine of Router S, so that it can be used as soon as Router S detects that the link has failed.



Figure 8: Manually Configured RSVP LSP Coverage



In this case, an RSVP LSP is created between Routers S, R4, and R3 as illustrated in [Figure 8 on page 55](#). A targeted LDP session is created between Router S and Router R3, as a result of which, when the S-R1 link fails, traffic reaches Router R3. Router R3 forwards the traffic to Router R2, as it is the shortest path to reach the destination, Router D.

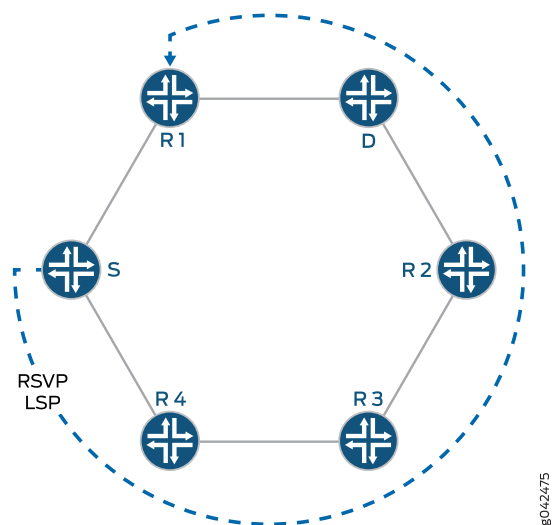
#### ***Dynamically Configured RSVP LSPs***

In this method, the RSVP LSPs are created automatically and pre-installed in the system so that they can be used immediately when there is a link failure. Here, the egress is the node on the other side of the link being protected, thereby improving the LFA coverage.

Considering the example used in [Figure 7 on page 54](#), in order to protect traffic against the potential failure of the S-R1 link, because Router R4 is not an LFA for that particular link, an RSVP bypass LSP is automatically created to Router R1, which is the node on the far side of the protected link as illustrated in [Figure 9 on page 56](#). From Router R1, traffic is forwarded to its original destination, Router D.

The RSVP LSP is pre-signaled and pre-installed in the Packet Forwarding Engine of Router S so that it can be used as soon as Router S detects that the link has failed.

Figure 9: Dynamically Configured RSVP LSP Coverage



An alternative mode of operation is not to use LFA at all, and to always have the RSVP LSP created to cover all link failures.

To enable dynamic RSVP LSPs, include the **dynamic-rsvp-lsp** statement at the **[edit protocols ldp interface *interface-name* link-protection]** hierarchy level, in addition to enabling the RSVP protocol on the appropriate interfaces.

Some of the benefits of enabling dynamic RSVP LSPs include:

- Ease of configuration.
- 100 percent coverage against link failure as long as there is an alternate path to the far end of the link being protected.
- Setting up and tearing down of the RSVP bypass LSP is automatic.
- RSVP LSP only used for link protection and not for forwarding traffic while the link being protected is up.
- Reduces the total number of RSVP LSPs required on the system.

### Understanding Multicast LDP Link Protection

A point-to-multipoint LDP label-switched path (LSP) is an LDP-signaled LSP that is point-to-multipoint, and is referred to as multicast LDP.

A multicast LDP LSP can be used to send traffic from a single root or ingress node to a number of leaf or egress nodes traversing one or more transit nodes. Multicast LDP link protection enables fast reroute of traffic carried over point-to-multipoint LDP LSPs in case of a link failure. When one of the links of the point-to-multipoint tree fails, the subtrees might get detached until the IGP reconverges and the multipoint LSP is established using the best path from the downstream router to the new upstream router.

To protect the traffic flowing through the multicast LDP LSP, you can configure an explicit tunnel to re-route the traffic in the event of link failure. The explicit path has to terminate on the next downstream router. The reverse path forwarding for the traffic should be successful.

Multicast LDP link protection introduces the following features and functionality:

- Use of dynamic RSVP LSP as bypass tunnels

The RSVP LSP's Explicit Route Object (ERO) is calculated using Constrained Shortest Path First (CSPF) with the constraint as the link to avoid. The LSP is signaled and torn down dynamically whenever link protection is necessary.

- Make-before-break

The make-before-break feature ensures that there is minimum packet loss when attempting to signal a new LSP path before tearing down the old LSP path for the multicast LDP LSP.

- Targeted LDP session

A targeted adjacency to the downstream label-switching router (LSR) is created for two reasons:

- To keep the session up after link failure.
- To use the point-to-multipoint label received from the session to send traffic to the downstream LSR on the RSVP LSP bypass tunnel.

When the downstream LSR sets up the multicast LDP LSP with the root node and LSP ID, it uses that upstream LSR, which is on the best path toward the root.



**NOTE:** Multicast LDP link protection is not required when there are multiple link adjacencies (parallel links) to the downstream LSR.

### Different Modes for Providing LDP Link Protection

Following are three different modes of operation available for unicast and multicast LDP link protection:

- **Case A: LFA only**

Under this mode of operation, multicast LDP link protection is provided using an existing viable loop-free alternate (LFA). In the absence of a viable LFA, link protection is not provided for the multicast LDP LSP.

- **Case B: LFA and Dynamic RSVP LSP**

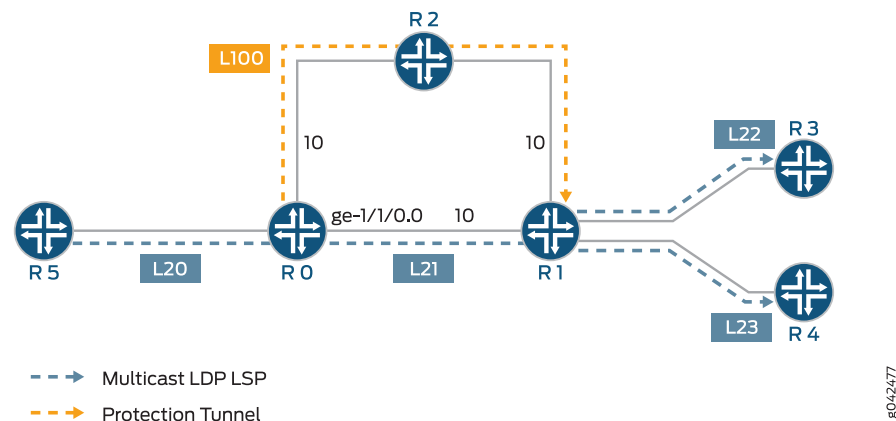
Under this mode of operation, multicast LDP link protection is provided using an existing viable LFA. In the absence of a viable LFA, an RSVP bypass LSP is created automatically to provide link protection for the multicast LDP LSP.

- **Case C: Dynamic RSVP LSP only**

Under this mode of operation, LFA is not used for link protection. Multicast LDP link protection is provided by using automatically created RSVP bypass LSP.

Figure 10 on page 58 is a sample topology illustrating the different modes of operation for multicast LDP link protection. Router R5 is the root connecting to two leaf nodes, Routers R3 and R4. Router R0 and Router R1 are the upstream and downstream label-switched routers (LSRs), respectively. A multicast LDP LSP runs among the root and leaf nodes.

Figure 10: Multicast LDP Link Protection Sample Topology



Considering that Router R0 needs to protect the multicast LDP LSP in the case that the R0-R1 link fails, the different modes of link protection operate in the following manner:

- **Case A: LFA only**

Router R0 checks if a viable LFA path exists that can avoid the R0-R1 link to reach Router R1. Based on the metrics, Router R2 is a valid LFA path for the R0-R1 link and is used to forward unicast LDP traffic. If multiple multicast LDP LSPs use the R0-R1 link, the same LFA (Router R2) is used for multicast LDP link protection.

When the R0-R1 link fails, the multicast LDP LSP traffic is moved onto the LFA path by Router R0, and the unicast LDP label to reach Router R1 (L100) is pushed on top of the multicast LDP label (L21).

- **Case B: LFA and Dynamic RSVP LSP**

Router R0 checks if a viable LFA path exists that can avoid the R0-R1 link to reach Router R1. Based on the metrics, Router R2 is a valid LFA path for the R0-R1 link and is used to forward unicast LDP traffic. If multiple multicast LDP LSPs use the R0-R1 link, the same LFA (Router R2) is used for multicast LDP link protection. When the R0-R1 link fails, the multicast LDP LSP traffic is moved onto the LFA path by Router R0.

However, if the metric on the R2-R1 link was 50 instead of 10, Router R2 is not a valid LFA for the R0-R1 link. In this case, an RSVP LSP is automatically created to protect the multicast LDP traffic traveling between Routers R0 and R1.

- **Case C: Dynamic RSVP LSP only**

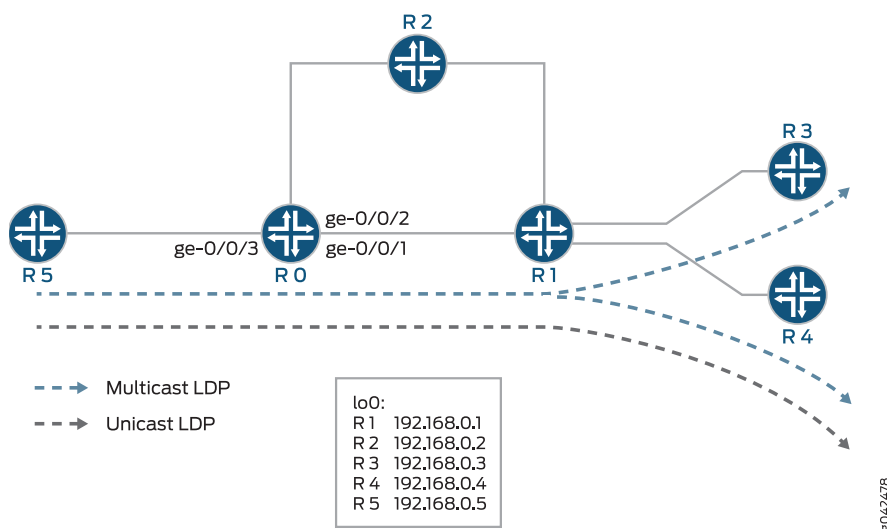
An RSVP LSP is signaled automatically from Router R0 to Router R1 through Router R2, avoiding interface ge-1/1/0. If multiple multicast LDP LSPs use the R0-R1 link, the same RSVP LSP is used for multicast LDP link protection.

When the R0-R1 link fails, the multicast LDP LSP traffic is moved onto the RSVP LSP by Router R0, and the RSVP label to reach Router R1 (L100) is pushed on top of the multicast LDP label (L21).

### Label Operation for LDP Link Protection

Using the same network topology as in Figure 5, [Figure 11 on page 59](#) illustrates the label operation for unicast and multicast LDP link protection.

Figure 11: LDP Label Operation Sample Topology



Router R5 is the root connecting to two leaf nodes, Routers R3 and R4. Router R0 and Router R1 are the upstream and downstream label-switched routers (LSRs), respectively. A multicast LDP LSP runs among the root and leaf nodes. An unicast LDP path connects Router R1 to Router R5.

The label operation is performed differently under the following modes of LDP link protection:

- [Case A: LFA Only on page 59](#)
- [Case B: LFA and Dynamic RSVP LSP on page 63](#)
- [Case C: Dynamic RSVP LSP Only on page 65](#)

#### Case A: LFA Only

Using the **show route detail** command output on Router R0, the unicast LDP traffic and multicast LDP traffic can be derived.

```
user@R0> show route detail
```

```

299840 (1 entry, 1 announced)
  *LDP   Preference: 9
         Next hop type: Router
         Address: 0x93bc22c
         Next-hop reference count: 1
         Next hop: 11.0.0.6 via ge-0/0/1.0 weight 0x1, selected
         Label operation: Swap 299824
         Session Id: 0x1
         Next hop: 11.0.0.10 via ge-0/0/2.0 weight 0xf000
         Label operation: Swap 299808
         Session Id: 0x3
         State: <Active Int>
         Age: 3:16      Metric:1
         Validation State: unverified
         Task: LDP
         Announcement bits (1): 0-KRT
         AS path: I
         Prefixes bound to route: 192.168.0.4/32

```

```

299856 (1 entry, 1 announced)
  *LDP   Preference: 9
         Next hop type: Flood
         Address: 0x9340e04
         Next-hop reference count: 3
         Next hop type: Router, Next hop index: 262143
         Address: 0x93bc3dc
         Next-hop reference count: 2
         Next hop: 11.0.0.6 via ge-0/0/1.0 weight 0x1
         Label operation: Swap 299888
         Next hop: 11.0.0.10 via ge-0/0/2.0 weight 0xf000
         Label operation: Swap 299888, Push 299776(top)
         Label TTL action: prop-ttl, prop-ttl(top)
         State: <Active Int AckRequest>
         Age: 3:16      Metric:1
         Validation State: unverified
         Task: LDP
         Announcement bits (1): 0-KRT
         AS path: I
         FECs bound to route: P2MP root-addr 192.168.0.5, lsp-id 99

```

Label 299840 is traffic arriving at Router R0 that corresponds to unicast LDP traffic to Router R1. Label 299856 is traffic arriving at Router 0 that corresponds to multicast LDP traffic from the root node R5 to the leaf egress nodes, R3 and R4.

The main path for both unicast and multicast LDP LSPs is through interface ge-0/0/1 (the link to Router R1), and the LFA path is through interface ge-0/0/2 (the link to Router R2). The LFA path is not used unless the ge-0/0/1 interface goes down.

In the label operation for Case A, the LFA-only mode of operation is different for unicast and multicast LDP traffic:

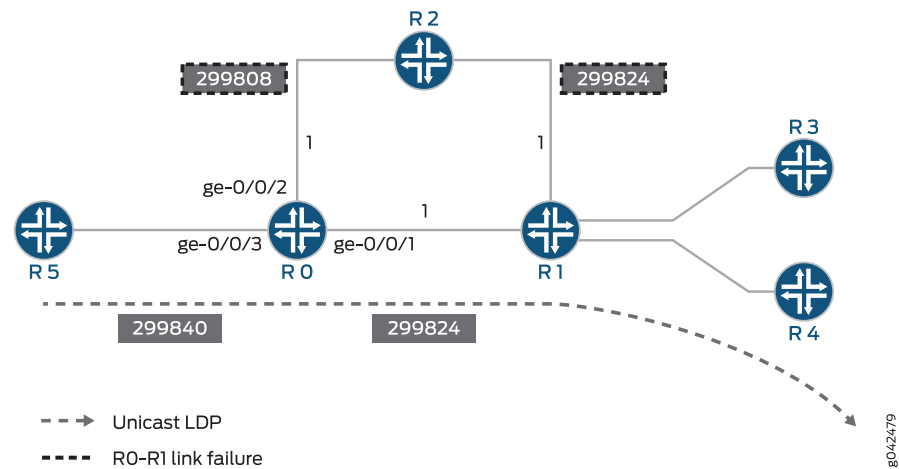
- Unicast label operation

For unicast LDP traffic, the FECs and associated labels are advertised on all the links in the network on which LDP is enabled. This means that in order to provide LFA action for the unicast LDP traffic to Router R4, instead of swapping the incoming label for label 299824 advertised by Router R1 for FEC R4, Router R0 simply swaps the incoming

label for label 299808 advertised by Router R2 for FEC R4. This is the standard Junos OS LFA operation for unicast LDP traffic.

Figure 12 on page 61 illustrates the label operation for unicast traffic when the R0-R1 link fails. The grey boxes show the label operation for unicast LDP traffic under normal condition, and the dotted boxes show the label operation for unicast LDP traffic when the R0-R1 link fails.

Figure 12: Unicast LDP Label Operation



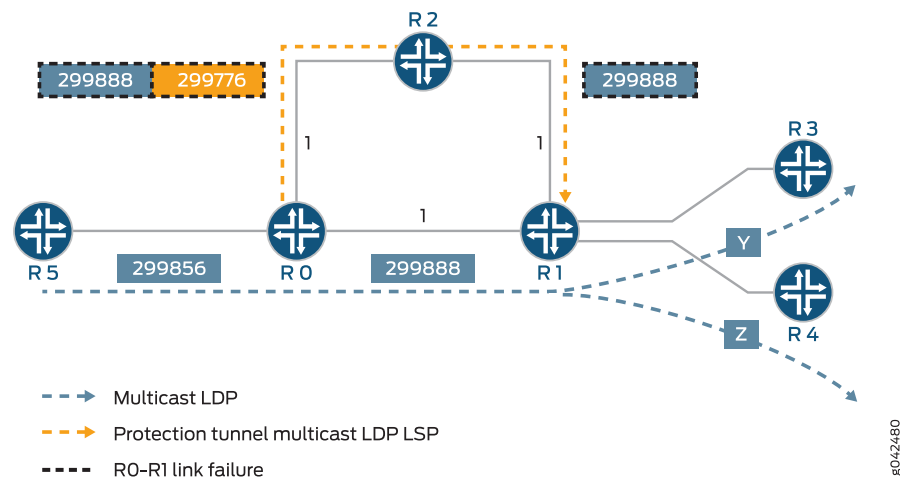
- Multicast label operation

The label operation for multicast LDP traffic differs from the unicast LDP label operation, because multipoint LSP labels are only advertised along the best path from the leaf node to the ingress node. As a result, Router R2 has no knowledge of the multicast LDP. To overcome this, the multicast LDP LSP traffic is simply tunneled inside the unicast LDP LSP path through Router R2 that terminates at Router R1.

In order to achieve this, Router R0 first swaps the incoming multicast LDP LSP label 299856 to label 299888 advertised by Router R1. Label 299776 is then pushed on top, which is the LDP label advertised by Router R2 for FEC R1. When the packet arrives at Router R2, the top label is popped out due to penultimate hop-popping. This means that the packet arrives at Router R1 with the multicast LDP label 299888 that Router R1 had originally advertised to Router R0.

Figure 13 on page 62 illustrates the label operation for multicast LDP traffic when the R0-R1 link fails. The blue boxes show the label operation for multicast LDP traffic under normal condition, and the dotted boxes show the label operation for multicast LDP traffic when the R0-R1 link fails.

Figure 13: Multicast LDP Label Operation



When the metric on the R2-R1 link is set to 1000 instead of 1, Router R2 is not a valid LFA for Router R0. In this case, if Router R2 receives a packet destined for Router R1, R3, or R4 before its IGP has converged, the packet is sent back to Router R0, resulting in looping packets.

Because Router R0 has no viable LFA, no backup paths are installed in the Packet Forwarding Engine. If the R0-R1 link fails, traffic flow is interrupted until the IGP and LDP converge and new entries are installed on the affected routers.

The **show route detail** command displays the state when no LFA is available for link protection.

```
user@host> show route detail
299840 (1 entry, 1 announced)
  *LDP    Preference: 9
          Next hop type: Router, Next hop index: 578
          Address: 0x9340d20
          Next-hop reference count: 2
          Next hop: 11.0.0.6 via ge-0/0/1.0, selected
          Label operation: Swap 299824
          Session Id: 0x1
          State: <Active Int>
          Age: 5:38      Metric: 1
          Validation State: unverified
          Task: LDP
          Announcement bits (1): 0-KRT
          AS path: I
          Prefixes bound to route: 192.168.0.4/32

299856 (1 entry, 1 announced)
  *LDP    Preference: 9
          Next hop type: Flood
          Address: 0x9340e04
          Next-hop reference count: 3
          Next hop type: Router, Next hop index: 579
          Address: 0x93407c8
```



```

Next-hop reference count: 2
Next hop: 11.0.0.6 via ge-0/0/1.0
Label operation: Swap 299888
State: <Active Int AckRequest>
Age: 5:38      Metric: 1
Validation State: unverified
Task: LDP
Announcement bits (1): 0-KRT
AS path: I
FECs bound to route: P2MP root-addr 192.168.0.5, lsp-id 99

```

### Case B: LFA and Dynamic RSVP LSP

In this mode of operation, if there is a viable LFA neighbor, the label operation behavior is similar to that of Case A, LFA only mode. However, if there is no viable LFA neighbor, an RSVP bypass tunnel is automatically created.

If the metric on the link R2-R1 is set to 1000 instead of 1, Router R2 is not an LFA for Router R0. On learning that there are no LFA paths to protect the R0-R1 link failure, an RSVP bypass tunnel is automatically created with Router R1 as the egress node and follows a path that avoids the R0-R1 link (for instance, R0-R2-R1).

If the R0-R1 link fails, the unicast LDP and multicast LDP traffic is tunneled through the RSVP bypass tunnel. The RSVP bypass tunnel is not used for normal forwarding and is used only to provide link protection to LDP traffic in the case of R0-R1 link failure.

Using the **show route detail** command, the unicast and multicast LDP traffic can be derived.

```

user@host> show route detail
299840 (1 entry, 1 announced)
  *LDP    Preference: 9
          Next hop type: Router
          Address: 0x940c3dc
          Next-hop reference count: 1
          Next hop: 11.0.0.6 via ge-0/0/1.0 weight 0x1, selected
          Label operation: Swap 299824
          Session Id: 0x1
          Next hop: 11.0.0.10 via ge-0/0/2.0 weight 0x8001
          Label-switched-path ge-0/0/1.0:BypassLSP->192.168.0.1
          Label operation: Swap 299824, Push 299872(top)
          Label TTL action: prop-ttl, prop-ttl(top)
          Session Id: 0x3
          State: <Active Int NhAckRequest>
          Age: 19      Metric: 1
          Validation State: unverified
          Task: LDP
          Announcement bits (1): 0-KRT
          AS path: I
          Prefixes bound to route: 192.168.0.4/32

299856 (1 entry, 1 announced)
  *LDP    Preference: 9
          Next hop type: Flood
          Address: 0x9340e04
          Next-hop reference count: 3
          Next hop type: Router, Next hop index: 262143
          Address: 0x940c154
          Next-hop reference count: 2

```

```
Next hop: 11.0.0.6 via ge-0/0/1.0 weight 0x1
Label operation: Swap 299888
Next hop: 11.0.0.10 via ge-0/0/2.0 weight 0x8001
Label-switched-path ge-0/0/1.0:BypassLSP->192.168.0.1
Label operation: Swap 299888, Push 299872(top)
Label TTL action: prop-ttl, prop-ttl(top)
State: < Active Int AckRequest>
Age: 20          Metric: 1
Validation State: unverified
Task: LDP
Announcement bits (1): 0-KRT
AS path: I
FECs bound to route: P2MP root-addr 192.168.0.5, lsp-id 99
```

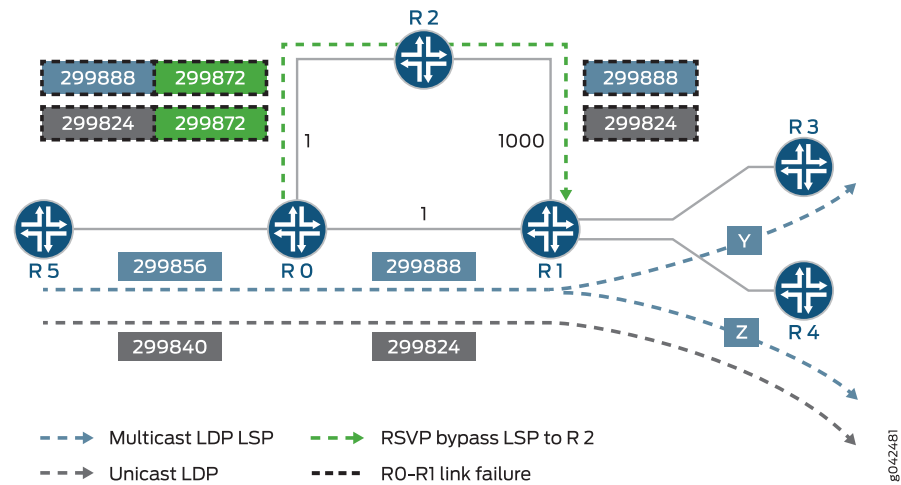
The main path for both unicast and multicast LDP LSP is through interface ge-0/0/1 (the link to Router R1), and the LFA path is through interface ge-0/0/2 (the link to Router R2). The LFA path is not used unless the ge-0/0/1 interface goes down.

Label 299840 is traffic arriving at Router R0 that corresponds to unicast LDP traffic to Router R4. Label 299856 is traffic arriving at Router 0 that corresponds to multicast LDP traffic from the root node R5 to the leaf egress nodes, R3 and R4.

As seen in the **show route detail** command output, the label operations for the protection path are the same for unicast LDP and multicast LDP traffic. The incoming LDP label at Router R0 is swapped to the LDP label advertised by Router R1 to Router R0. The RSVP label 299872 for the bypass tunnel is then pushed onto the packet. Penultimate hop-popping is used on the bypass tunnel, causing Router R2 to pop that label. Thus the packet arrives at Router R1 with the LDP label that it had originally advertised to Router R0.

[Figure 14 on page 65](#) illustrates the label operation for unicast LDP and multicast LDP traffic protected by the RSVP bypass tunnel. The grey and blue boxes represent label values used under normal conditions for unicast and multicast LDP traffic, respectively. The dotted boxes represent label values used when the R0-R1 link fails.

Figure 14: LDP Link Protection Label Operation

**Case C: Dynamic RSVP LSP Only**

In this mode of operation, LFA is not used at all. A dynamic RSVP bypass LSP is automatically created in order to provide link protection. The output from the **show route detail** command and the label operations are similar to Case B, LFA and dynamic RSVP LSP mode.

**Sample Multicast LDP Link Protection Configuration**

To enable multicast LDP link protection, the following configuration is required on Router R0:



**NOTE:** In this sample, multicast LDP link protection is enabled on the ge-1/0/0 interface of Router R0 that connects to Router R1, although typically all the interfaces need to be configured for link protection.

```
Router R0 protocols {
  rsvp {
    interface all;
    interface ge-0/0/0.0 {
      disable;
    }
  }
  mpls {
    interface all;
    interface ge-0/0/0.0 {
      disable;
    }
  }
  ospf {
    traffic-engineering;
  }
}
```

```

area 0.0.0.0 {
    interface lo0.0;
    interface ge-0/0/1.0 {
        link-protection;
    }
    interface ge-0/0/2.0;
    interface ge-0/0/3.0;
}
}
ldp {
    make-before-break {
        timeout seconds;
        switchover-delay seconds;
    }
    interface ge-1/1/0.0 {
        link-protection {
            disable;
            dynamic-rsvp-lsp;
        }
    }
}
}

```

The following configuration statements apply to the different modes of multicast LDP protection as follows:

- **link-protection** statement at **[edit protocols ospf interface ge-0/0/1.0]**

This configuration is applied only for Case A (LFA only) and Case B (LFA and dynamic RSVP LSP) modes of multicast LDP link protection. Configuring link protection under an IGP is not required for Case C (dynamic RSVP LSP only).

- **link-protection** statement at **[edit protocols ldp interface ge-0/0/1.0]**

This configuration is required for all modes of multicast LDP protection. However, if the only LDP traffic present is unicast, and dynamic RSVP bypasses are not required, then this configuration is not required, as the **link-protection** statement at the **[edit protocols ospf interface ge-0/0/1.0]** hierarchy level results in LFA action for the LDP unicast traffic.

- **dynamic-rsvp-lsp** statement at **[edit protocols ldp interface ge-0/0/1.0 link-protection]**

This configuration is applied only for Case B (LFA and dynamic RSVP LSP) and Case C (dynamic RSVP LSP only) modes of LDP link protection. Dynamic RSVP LSP configuration does not apply to Case A (LFA only).

### Make-Before-Break

The make-before-break feature is enabled by default on Junos OS and provides some benefits for point-to-multipoint LSPs.

For a point-to-multipoint LSP, a label-switched router (LSR) selects the LSR that is its next hop to the root of the LSP as its upstream LSR. When the best path to reach the root changes, the LSR chooses a new upstream LSR. During this period, the LSP might be temporarily broken, resulting in packet loss until the LSP reconverges to a new

upstream LSR. The goal of make-before-break in this case is to minimize the packet loss. In cases where the best path from the LSR to the root changes but the LSP continues to forward traffic to the previous next hop to the root, a new LSP should be established before the old LSP is withdrawn to minimize the duration of packet loss.

Taking for example, after a link failure, a downstream LSR (for instance, LSR-D) still receives and/or forwards packets to the other downstream LSRs, as it continues to receive packets from the one hop RSVP LSP. Once routing converges, LSR-D selects a new upstream LSR (LSR-U) for this point-to-multipoint LSP's FEC (FEC-A). The new LSR might already be forwarding packets for FEC-A to the downstream LSRs other than LSR-D. After LSR-U receives a label for FEC-A from LSR-D, it notifies LSR-D when it has learnt that LSP for FEC-A has been established from the root to itself. When LSR-D receives such a notification, it changes its next hop for the LSP root to LSR-U. This is a route delete and add operation on LSR-D. At this point, LSR-D does an LSP switchover, and traffic tunneled through RSVP LSP or LFA is dropped, and traffic from LSR-U is accepted. The new transit route for LSR-U is added. The RPF check is changed to accept traffic from LSR-U and to drop traffic from the old upstream LSR, or the old route is deleted and the new route is added.

The assumption is that LSR-U has received a make-before-break notification from its upstream router for the FEC-A point-to-multipoint LSP and has installed a forwarding state for the LSP. At that point it should signal LSR-D by means of make-before-break notification that it has become part of the tree identified by FEC-A and that LSR-D should initiate its switchover to the LSP. Otherwise, LSR-U should remember that it needs to send notification to LSR-D when it receives a make-before-break notification from the upstream LSR for FEC-A and installs a forwarding state for this LSP. LSR-D continues to receive traffic from the old next hop to the root node using one hop RSVP LSP or LFA path until it switches over to the new point-to-multipoint LSP to LSR-U.

The make-before-break functionality with multicast LDP link protection includes the following features:

- Make-before-break capability

An LSR advertises that it is capable of handling make-before-break LSPs using the capability advertisement. If the peer is not make-before-break capable, the make-before-break parameters are not sent to this peer. If an LSR receives a make-before-break parameter from a downstream LSR (LSR-D) but the upstream LSR (LSR-U) is not make-before-break capable, the LSR immediately sends a make-before-break notification to LSR-D, and the make-before-break capable LSP is not established. Instead, the normal LSP is established.

- Make-before-break status code

The make-before-break status code includes:

- 1—make-before-break request
- 2—make-before-break acknowledgment

When a downstream LSR sends a label-mapping message for point-to-multipoint LSP, it includes the make-before-break status code as 1 (request). When the upstream LSR updates the forwarding state for the point-to-multipoint LSP, it informs the

downstream LSR with a notification message containing the make-before-break status code as 2 (acknowledgment). At that point, the downstream LSR does an LSP switchover.

### Caveats and Limitations

---

The Junos OS implementation of the LDP link protection feature has the following caveats and limitations:

- Make-before-break is not supported for the following point-to-multipoint LSPs on an egress LSR:
  - Next-generation multicast virtual private network (MVPN) with virtual routing and forwarding (VRF) label
  - Static LSP
- The following features are not supported:
  - Nonstop active routing for point-to-multipoint LSP in Junos OS Releases 12.3, 13.1 and 13.2
  - Graceful restart switchover point-to-multipoint LSP
  - Link protection for routing instance

### Example: Configuring LDP Link Protection

This example shows how to configure Label Distribution Protocol (LDP) link protection for both unicast and multicast LDP label-switched paths (LSPs).

- [Requirements on page 68](#)
- [Overview on page 69](#)
- [Configuration on page 70](#)
- [Verification on page 75](#)

### Requirements

---

This example uses the following hardware and software components:

- Six routers that can be a combination of M Series, MX Series, or T Series routers with one root node and two leaf nodes running a point-to-multipoint LDP LSP.
- Junos OS Release 12.3 or later running on all the routers.

Before you begin:

1. Configure the device interfaces.
2. Configure the following protocols:
  - a. RSVP
  - b. MPLS

- c. OSPF or any other IGP
- d. LDP

## Overview

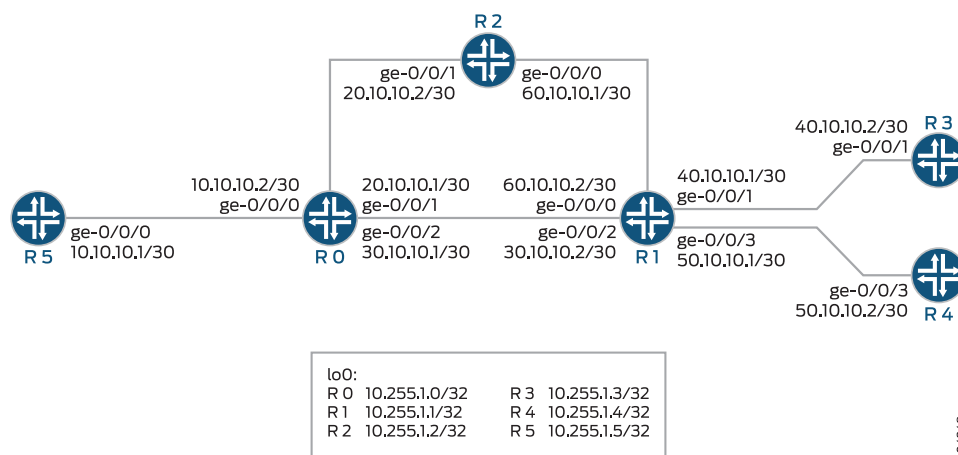
LDP link protection enables fast reroute of traffic carried over LDP LSPs in case of a link failure. LDP point-to-multipoint LSPs can be used to send traffic from a single root or ingress node to a number of leaf nodes or egress nodes traversing one or more transit nodes. When one of the links of the point-to-multipoint tree fails, the subtrees can get detached until the IGP reconverges and multicast LDP initiates label mapping using the best path from the downstream router to the new upstream router. To protect the traffic in the event of a link failure, you can configure an explicit tunnel so that traffic can be rerouted using the tunnel. Junos OS supports make-before-break capabilities to ensure minimum packet loss when attempting to signal a new LSP path before tearing down the old LSP path. This feature also adds targeted LDP support for multicast LDP link protection.

When configuring LDP link protection, be aware of the following considerations:

- Configure traffic engineering under IGP (if it is not supported by default), and include the interfaces configured for MPLS and RSVP so that constrained-based link protected dynamic RSVP LSP is signaled by RSVP using Constrained Shortest Path First (CSPF). When this condition is not satisfied, RSVP LSP might not come up and LDP cannot use it as a protected next hop.
- Configure a path between two label-switched routers (LSRs) to provide IP connectivity between the routers when there is a link failure. This enables CSPF to calculate an alternate path for link protection. When the connectivity between the routers is lost, the LDP targeted adjacency does not come up and dynamic RSVP LSP cannot be signaled, resulting in no protection for the LDP forwarding equivalence class (FEC) for which the peer is the downstream LSR.
- If link protection is active only on one LSR, then the other LSR should not be configured with the **strict-targeted-hellos** statement. This enables the LSR without link protection to allow asymmetric remote neighbor discovery and send periodic targeted hellos to the LSR that initiated the remote neighbor. When this condition is not satisfied, LDP targeted adjacency is not formed.
- LDP must be enabled on the loopback interface of the LSR to create remote neighbors based on LDP tunneling, LDP-based virtual private LAN service (VPLS), Layer 2 circuits, or LDP session protection. When this condition is not satisfied, LDP targeted adjacency is not formed.
- For unicast LDP LSP, loop-free alternate (LFA) should be configured in IGP.
- The ingress route to merge point should have at least one next hop avoiding the primary link between the merge point and the point of local repair for unicast LDP LSP.
- Point of local repair should have a unicast LDP label for the backup next hop to reach the merge point.

### Topology

Figure 15: LDP Link Protection



In this example, Router R5 is the root connecting to two leaf nodes, Routers R3 and R4. Router R0 is the point of local repair.

### 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, copy and paste the commands into the CLI at the **[edit]** hierarchy level, and then enter **commit** from configuration mode.

- ```

R5    set interfaces ge-0/0/0 unit 0 family inet address 10.10.10.1/30
      set interfaces ge-0/0/0 unit 0 family mpls
      set interfaces lo0 unit 0 family inet address 10.255.1.5/32
      set routing-options router-id 10.255.1.5
      set routing-options autonomous-system 100
      set protocols rsvp interface all
      set protocols rsvp interface fxp0.0 disable
      set protocols mpls traffic-engineering
      set protocols mpls interface all
      set protocols mpls interface fxp0.0 disable
      set protocols ospf traffic-engineering
      set protocols ospf area 0.0.0.0 interface all metric 1
      set protocols ospf area 0.0.0.0 interface fxp0.0 disable
      set protocols ldp interface all link-protection dynamic-rsvp-lsp
      set protocols ldp interface fxp0.0 disable
      set protocols ldp p2mp

R0    set interfaces ge-0/0/0 unit 0 family inet address 10.10.10.2/30
      set interfaces ge-0/0/0 unit 0 family mpls
      set interfaces ge-0/0/1 unit 0 family inet address 20.10.10.1/30
      set interfaces ge-0/0/1 unit 0 family mpls
      set interfaces ge-0/0/2 unit 0 family inet address 30.10.10.1/30
      set interfaces ge-0/0/2 unit 0 family mpls

```



```

set interfaces lo0 unit 0 family inet address 10.255.1.0/32
set routing-options router-id 10.255.1.0
set routing-options autonomous-system 100
set protocols rsvp interface all
set protocols rsvp interface fxp0.0 disable
set protocols mpls traffic-engineering
set protocols mpls interface all
set protocols mpls interface fxp0.0 disable
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface all metric 1
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ldp interface all link-protection dynamic-rsvp-lsp
set protocols ldp interface fxp0.0 disable
set protocols ldp p2mp

```

```

R1  set interfaces ge-0/0/0 unit 0 family inet address 60.10.10.2/30
    set interfaces ge-0/0/0 unit 0 family mpls
    set interfaces ge-0/0/1 unit 0 family inet address 40.10.10.1/30
    set interfaces ge-0/0/1 unit 0 family mpls
    set interfaces ge-0/0/2 unit 0 family inet address 30.10.10.2/30
    set interfaces ge-0/0/2 unit 0 family mpls
    set interfaces ge-0/0/3 unit 0 family inet address 50.10.10.1/30
    set interfaces ge-0/0/3 unit 0 family mpls
    set interfaces lo0 unit 0 family inet address 10.255.1.1/32
    set routing-options router-id 10.255.1.1
    set routing-options autonomous-system 100
    set protocols rsvp interface all
    set protocols rsvp interface fxp0.0 disable
    set protocols mpls traffic-engineering
    set protocols mpls interface all
    set protocols mpls interface fxp0.0 disable
    set protocols ospf traffic-engineering
    set protocols ospf area 0.0.0.0 interface all metric 1
    set protocols ospf area 0.0.0.0 interface fxp0.0 disable
    set protocols ldp interface all link-protection dynamic-rsvp-lsp
    set protocols ldp interface fxp0.0 disable
    set protocols ldp p2mp

```

```

R2  set interfaces ge-0/0/0 unit 0 family inet address 60.10.10.1/30
    set interfaces ge-0/0/0 unit 0 family mpls
    set interfaces ge-0/0/1 unit 0 family inet address 20.10.10.2/30
    set interfaces ge-0/0/1 unit 0 family mpls
    set interfaces lo0 unit 0 family inet address 10.255.1.2/32
    set routing-options router-id 10.255.1.2
    set routing-options autonomous-system 100
    set protocols rsvp interface all
    set protocols rsvp interface fxp0.0 disable
    set protocols mpls traffic-engineering
    set protocols mpls interface all
    set protocols mpls interface fxp0.0 disable
    set protocols ospf traffic-engineering
    set protocols ospf area 0.0.0.0 interface all
    set protocols ospf area 0.0.0.0 interface fxp0.0 disable
    set protocols ldp interface all link-protection dynamic-rsvp-lsp
    set protocols ldp interface fxp0.0 disable

```

```
set protocols ldp p2mp
```

```
R3  set interfaces ge-0/0/1 unit 0 family inet address 40.10.10.2/30
    set interfaces ge-0/0/1 unit 0 family mpls
    set interfaces lo0 unit 0 family inet address 10.255.1.3/32
    set routing-options router-id 10.255.1.3
    set routing-options autonomous-system 100
    set protocols rsvp interface all
    set protocols rsvp interface fxp0.0 disable
    set protocols mpls traffic-engineering
    set protocols mpls interface all
    set protocols mpls interface fxp0.0 disable
    set protocols ospf traffic-engineering
    set protocols ospf area 0.0.0.0 interface all metric 1
    set protocols ospf area 0.0.0.0 interface fxp0.0 disable
    set protocols ldp interface all link-protection dynamic-rsvp-lsp
    set protocols ldp interface fxp0.0 disable
    set protocols ldp p2mp root-address 10.255.1.5 lsp-id 1
```

```
R4  set interfaces ge-0/0/3 unit 0 family inet address 50.10.10.2/30
    set interfaces ge-0/0/3 unit 0 family mpls
    set interfaces lo0 unit 0 family inet address 10.255.1.4/32
    set protocols rsvp interface all
    set protocols rsvp interface fxp0.0 disable
    set protocols mpls traffic-engineering
    set protocols mpls interface all
    set protocols mpls interface fxp0.0 disable
    set protocols ospf traffic-engineering
    set protocols ospf area 0.0.0.0 interface all metric 1
    set protocols ospf area 0.0.0.0 interface fxp0.0 disable
    set protocols ldp interface all link-protection dynamic-rsvp-lsp
    set protocols ldp interface fxp0.0 disable
    set protocols ldp p2mp root-address 10.255.1.5 lsp-id 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*.

To configure Router R0:

1. Configure the Router R0 interfaces.

```
[edit interfaces]
```

```
user@R0# set ge-0/0/0 unit 0 family inet address 10.10.10.2/30
user@R0# set ge-0/0/0 unit 0 family mpls
```

```
user@R0# set ge-0/0/1 unit 0 family inet address 20.10.10.1/30
user@R0# set ge-0/0/1 unit 0 family mpls
```

```
user@R0# set ge-0/0/2 unit 0 family inet address 30.10.10.1/30
user@R0# set ge-0/0/2 unit 0 family mpls
```

```
user@R0# set lo0 unit 0 family inet address 10.255.1.0/32
```

2. Configure the router ID and autonomous system of Router R0.
 

```
[edit routing-options]
user@R0# set router-id 10.255.1.0
user@R0# set autonomous-system 100
```
3. Enable RSVP on all the interfaces of Router R0 (excluding the management interface).
 

```
[edit protocols]
user@R0# set rsvp interface all
user@R0# set rsvp interface fxp0.0 disable
```
4. Enable MPLS on all the interfaces of Router R0 (excluding the management interface) along with traffic engineering capabilities.
 

```
[edit protocols]
user@R0# set mpls traffic-engineering
user@R0# set mpls interface all
user@R0# set mpls interface fxp0.0 disable
```
5. Enable OSPF on all the interfaces of Router R0 (excluding the management interface), assign equal cost metric for the links, and enable traffic engineering capabilities.
 

```
[edit protocols]
user@R0# set ospf traffic-engineering
user@R0# set ospf area 0.0.0.0 interface all metric 1
user@R0# set ospf area 0.0.0.0 interface fxp0.0 disable
```



**NOTE:** For multicast LDP link protection with loop-free alternative (LFA), enable the following configuration under the [edit protocols] hierarchy level:

```
set ospf area 0 interface all link-protection
```

6. Enable LDP on all the interfaces of Router R0 (excluding the management interface) and configure link protection with dynamic RSVP bypass LSP.
 

```
[edit protocols]
user@R0# set ldp interface all link-protection dynamic-rsvp-lsp
user@R0# set ldp interface fxp0.0 disable
user@R0# set ldp p2mp
```

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

```
user@R0# show interfaces
ge-0/0/0 {
  unit 0 {
    family inet {
      address 10.10.10.2/30;
    }
    family mpls;
```

```
    }
  }
  ge-0/0/1 {
    unit 0 {
      family inet {
        address 20.10.10.1/30;
      }
      family mpls;
    }
  }
  ge-0/0/2 {
    unit 0 {
      family inet {
        address 30.10.10.1/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.1.0/32;
      }
    }
  }
}

user@R0# show routing-options
router-id 10.255.1.0;
autonomous-system 100;

user@R0# show protocols
rsvp {
  interface all;
  interface fxp0.0 {
    disable;
  }
}
mpls {
  traffic-engineering;
  interface all;
  interface fxp0.0 {
    disable;
  }
}
ospf {
  traffic-engineering;
  area 0.0.0.0 {
    interface all {
      metric 1;
    }
    interface fxp0.0 {
      disable;
    }
  }
}
ldp {
  interface all {
```

```
    link-protection {  
        dynamic-rsvp-lsp;  
    }  
}  
interface fxp0.0 {  
    disable;  
}  
p2mp;  
}
```

---

### Verification

Verify that the configuration is working properly.

- [Verifying the Bypass RSVP LSP Path on page 75](#)
- [Verifying Label Operation on page 76](#)

#### *Verifying the Bypass RSVP LSP Path*

**Purpose** Verify that the bypass RSVP LSP path has been created on the point of local repair (PLR).

**Action** From operational mode, run the **show route table mpls.0** command.

```

user@R0> show route table mpls.0
mpls.0: 17 destinations, 17 routes (17 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

0                *[MPLS/0] 05:28:13, metric 1
                  Receive
1                *[MPLS/0] 05:28:13, metric 1
                  Receive
2                *[MPLS/0] 05:28:13, metric 1
                  Receive
13               *[MPLS/0] 05:28:13, metric 1
                  Receive
299792           *[LDP/9] 00:41:41, metric 1
                  > to 30.10.10.2 via ge-0/0/2.0, Pop
299792(S=0)      *[LDP/9] 00:41:41, metric 1
                  > to 30.10.10.2 via ge-0/0/2.0, Pop
299808           *[LDP/9] 00:41:41, metric 1
                  > to 20.10.10.2 via ge-0/0/1.0, Pop
299808(S=0)      *[LDP/9] 00:41:41, metric 1
                  > to 20.10.10.2 via ge-0/0/1.0, Pop
299920           *[RSVP/7/1] 01:51:43, metric 1
                  > to 30.10.10.2 via ge-0/0/2.0, label-switched-path
ge-0/0/0.0:BypassLSP->10.255.1.1
299920(S=0)      *[RSVP/7/1] 01:51:43, metric 1
                  > to 30.10.10.2 via ge-0/0/2.0, label-switched-path
ge-0/0/0.0:BypassLSP->10.255.1.1
299936           *[RSVP/7/1] 01:51:25, metric 1
                  > to 20.10.10.2 via ge-0/0/1.0, label-switched-path
ge-0/0/0.0:BypassLSP->10.255.1.2
299936(S=0)      *[RSVP/7/1] 01:51:25, metric 1
                  > to 20.10.10.2 via ge-0/0/1.0, label-switched-path
ge-0/0/0.0:BypassLSP->10.255.1.2
299952           *[LDP/9] 00:06:11, metric 1
                  > to 10.10.10.1 via ge-0/0/0.0, Pop
299952(S=0)      *[LDP/9] 00:06:11, metric 1
                  > to 10.10.10.1 via ge-0/0/0.0, Pop
299968           *[LDP/9] 00:05:39, metric 1
                  > to 30.10.10.2 via ge-0/0/2.0, Swap 299984
299984           *[LDP/9] 00:05:38, metric 1
                  > to 30.10.10.2 via ge-0/0/2.0, Swap 300000
300000           *[LDP/9] 00:05:15, metric 1
                  > to 30.10.10.2 via ge-0/0/2.0, Swap 300016

```

**Meaning** When the R0-R1 link goes down, the RSVP bypass LSP is used to route traffic.

#### *Verifying Label Operation*

**Purpose** Verify the label swapping at the PLR.

**Action** From operational mode, run the **show route table mpls.0 label label extensive** command.

```
user@R0> show route table mpls.0 label 300000 extensive
mpls.0: 17 destinations, 17 routes (17 active, 0 holddown, 0 hidden)
300000 (1 entry, 1 announced)
TSI:
KRT in-kernel 300000 /52 -> {Swap 300016}
    *LDP      Preference: 9
              Next hop type: Router, Next hop index: 589
              Address: 0x9981610
              Next-hop reference count: 2
              Next hop: 30.10.10.2 via ge-0/0/2.0, selected
              Label operation: Swap 300016
              Load balance label: Label 300016: None;
              Session Id: 0x2
              State: <Active Int>
              Local AS: 100
              Age: 12:50      Metric: 1
              Validation State: unverified
              Task: LDP
              Announcement bits (1): 1-KRT
              AS path: I
              Prefixes bound to route: 10.255.1.4/32
```

**Meaning** The label is bound to reach Router R4, which is a leaf node.

## Configuring LDP Link Protection

You can configure Label Distribution Protocol (LDP) link protection for both unicast and multicast LDP label-switched paths (LSPs) to provide resiliency during link or node failure.

Before you begin:

1. Configure the device interfaces.
2. Configure the router ID and autonomous system number for the device.
3. Configure the following protocols:
  - a. RSVP
  - b. MPLS with traffic engineering capability.
  - c. OSPF with traffic engineering capability.



**NOTE:** For multicast LDP link protection with loop-free alternative (LFA), enable link protection.

[edit protocols]

user@R0# set ospf area 0 interface all link-protection

To configure LDP link protection:

1. Enable point-to-multipoint LDP LSPs.

```
[edit protocols]
user@R0# set ldp p2mp
```

2. Enable LDP on all the interfaces of Router R0 (excluding the management interface) and configure link protection with dynamic RSVP bypass LSP.

```
[edit protocols]
user@R0# set ldp interface all link-protection dynamic-rsvp-lsp
user@R0# set ldp interface fxp0.0 disable
```

3. Verify and commit the configuration.

For example:

```
[edit protocols]
user@R0# show protocols
rsvp {
  interface all;
  interface fxp0.0 {
    disable;
  }
}
mpls {
  traffic-engineering;
  interface all;
  interface fxp0.0 {
    disable;
  }
}
ospf {
  traffic-engineering;
  area 0.0.0.0 {
    interface all {
      metric 1;
    }
    interface fxp0.0 {
      disable;
    }
  }
}
ldp {
  interface all {
    link-protection {
      dynamic-rsvp-lsp;
    }
  }
  interface fxp0.0 {
    disable;
  }
  p2mp;
}

[edit]
user@R0# commit
commit complete
```



**Related Documentation** • [Example: Configuring LDP Link Protection on page 51](#)

## Configuring Multicast-Only Fast Reroute

You can configure multicast-only fast reroute (MoFRR) to minimize packet loss in a network when there is a link failure.

When fast reroute is applied to unicast streams, an upstream router preestablishes MPLS label-switched paths (LSPs) or precomputes an IP loop-free alternate (LFA) fast reroute backup path to handle failure of a segment in the downstream path.

In multicast routing, the traffic distribution graphs are usually originated by the receiver. This is unlike unicast routing, which usually establishes the path from the source to the receiver. Protocols that are capable of establishing multicast distribution graphs are PIM (for IP), multipoint LDP (for MPLS) and RSVP-TE (for MPLS). Of these, PIM and multipoint LDP receivers initiate the distribution graph setup, and therefore these are the two multicast protocols for which MoFRR is supported.

MoFRR is supported on MX Series routers with MPC line cards. As a prerequisite, all the line cards in the router must be MPCs.

Make sure that all of the

To configure MoFRR:

1. Set the router to enhanced IP mode.

```
[edit chassis]
user@host# set network-services enhanced-ip
```

2. Enable MoFRR.

```
[edit routing-options multicast]
user@host# set stream-protection
```

3. (Optional) Configure a routing policy that filters for a restricted set of multicast streams to be affected by your MoFRR configuration.

You can apply filters that are based on source or group addresses.

For example:

```
[edit policy-options]
policy-statement mofrr-select {
  term A {
    from {
      source-address-filter 225.1.1.1/32 exact;
    }
    then {
      accept;
    }
  }
  term B {
    from {
      source-address-filter 226.0.0.0/8 orlonger;
    }
  }
}
```

```

    }
    then {
        accept;
    }
}
term C {
    from {
        source-address-filter 227.1.1.0/24 orlonger;
        source-address-filter 227.4.1.0/24 orlonger;
        source-address-filter 227.16.1.0/24 orlonger;
    }
    then {
        accept;
    }
}
term D {
    from {
        source-address-filter 227.1.1.1/32 exact
    }
    then {
        reject; #MoFRR disabled
    }
}
...
}

```

4. (Optional) If you configured a routing policy to filter the set of to be affected by your MoFRR configuration, apply the policy.

```

[edit routing-options multicast stream-protection]
user@host# set policy policy-name

```

For example:

```

routing-options {
    multicast {
        stream-protection {
            policy mofrr-select
        }
    }
}

```

5. (Optional) In a PIM domain with MoFRR, allow MoFRR to be applied to any-source multicast (ASM) (\*,G) joins.

This is not supported for multipoint LDP MoFRR.

```

[edit routing-options multicast stream-protection]
user@host# set mofrr-asm-starg

```

6. (Optional) In a PIM domain with MoFRR, allow only a disjoint RPF (an RPF on a separate plane) to be selected as the backup RPF path.

This is not supported for multipoint LDP MoFRR. In a multipoint LDP MoFRR domain, the same label is shared between parallel links to the same upstream neighbor. This is not the case in a PIM domain, where each link forms a neighbor. The

**mofrr-disjoint-upstream-only** statement does not allow a backup RPF path to be selected if the path goes to the same upstream neighbor as that of the primary RPF

path. This ensures that MoFRR is triggered only on a topology that has multiple RPF upstream neighbors.

```
[edit routing-options multicast stream-protection]
user@host# set mofrr-disjoint-upstream-only
```

7. (Optional) In a PIM domain with MoFRR, prevent sending join messages on the backup path, but retain all other MoFRR functionality.

This is not supported for multipoint LDP MoFRR.

```
[edit routing-options multicast stream-protection]
user@host# set mofrr-no-backup-join
```

8. (Optional) In a PIM domain with MoFRR, allow new primary path selection to be based on the unicast gateway selection for the unicast route to the source and to change when there is a change in the unicast selection, rather than having the backup path be promoted as primary. This ensures that the primary RPF hop is always on the best path.

When you include the **mofrr-primary-selection-by-routing** statement, the backup path is not guaranteed to get promoted to be the new primary path when the primary path goes down.

This is not supported for multipoint LDP MoFRR.

```
[edit routing-options multicast stream-protection]
user@host# set mofrr-primary-selection-by-routing
```

#### Related Documentation

- [Understanding Multicast-Only Fast Reroute on page 9](#)
- [Example: Configuring Multicast-Only Fast Reroute in a PIM Domain](#)
- [Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119](#)



## CHAPTER 3

# LDP Examples

- [Example: Configuring LDP Downstream on Demand on page 83](#)
- [Example: Configuring Multipoint LDP In-Band Signaling for Point-to-Multipoint LSPs on page 88](#)
- [Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119](#)

### Example: Configuring LDP Downstream on Demand

---

This example shows how to configure LDP downstream on demand. LDP is commonly configured using downstream unsolicited advertisement mode, meaning label advertisements for all routes are received from all LDP peers. As service providers integrate the access and aggregation networks into a single MPLS domain, LDP downstream on demand is needed to distribute the bindings between the access and aggregation networks and to reduce the processing requirements for the control plane.

Downstream nodes could potentially receive tens of thousands of label bindings from upstream aggregation nodes. Instead of learning and storing all label bindings for all possible loopback addresses within the entire MPLS network, the downstream aggregation node can be configured using LDP downstream on demand to only request the label bindings for the FECs corresponding to the loopback addresses of those egress nodes on which it has services configured.

- [Requirements on page 83](#)
- [Overview on page 84](#)
- [Configuration on page 84](#)
- [Verification on page 87](#)

### Requirements

This example uses the following hardware and software components:

- M Series router
- Junos OS 12.2

## Overview

You can enable LDP downstream on demand label advertisement for an LDP session by including the **downstream-on-demand** statement at the **[edit protocols ldp session]** hierarchy level. If you have configured downstream on demand, the Juniper Networks router advertises the downstream on demand request to its peer routers. For a downstream on demand session to be established between two routers, both have to advertise downstream on demand mode during LDP session establishment. If one router advertises downstream unsolicited mode and the other advertises downstream on demand, downstream unsolicited mode is used.

## Configuration

### Configuring LDP Downstream on Demand

---

#### Step-by-Step Procedure

To configure a LDP downstream on demand policy and then configure that policy and enable LDP downstream on demand on the LDP session:

1. Configure the downstream on demand policy (DOD-Request-Loopbacks in this example).

This policy causes the router to forward label request messages only to the FECs that are matched by the DOD-Request-Loopbacks policy.

```
[edit policy-options]
user@host# set prefix-list Request-Loopbacks 10.1.1/32
user@host# set prefix-list Request-Loopbacks 10.1.1.2/32
user@host# set prefix-list Request-Loopbacks 10.1.1.3/32
user@host# set prefix-list Request-Loopbacks 10.1.1.4/32
user@host# set policy-statement DOD-Request-Loopbacks term 1 from prefix-list
Request-Loopbacks
user@host# set policy-statement DOD-Request-Loopbacks term 1 then accept
```

2. Specify the DOD-Request-Loopbacks policy using the **dod-request-policy** statement at the **[edit protocols ldp]** hierarchy level.

The policy specified with the **dod-request-policy** statement is used to identify the prefixes to send label request messages. This policy is similar to an egress policy or an import policy. When processing routes from the inet.0 routing table, the Junos OS software checks for routes matching the **DOD-Request-Loopbacks** policy (in this example). If the route matches the policy and the LDP session is negotiated with DOD advertisement mode, label request messages are sent to the corresponding downstream LDP session.

```
[edit protocols ldp]
user@host# set dod-request-policy DOD-Request-Loopbacks
```

3. Include the **downstream-on-demand** statement in the configuration for the LDP session to enable downstream on demand distribution mode.

```
[edit protocols ldp]
user@host# set session 1.1.1.1 downstream-on-demand
```

### Distributing LDP Downstream on Demand Routes into Labeled BGP

- Step-by-Step Procedure** To distribute LDP downstream on demand routes into labeled BGP, use a BGP export policy.
- Configure the LDP route policy (**redistribute\_ldp** in this example).
 

```
[edit policy-options]
user@host# set policy-statement redistribute_ldp term 1 from protocol ldp
user@host# set policy-statement redistribute_ldp term 1 from tag 1000
user@host# set policy-statement redistribute_ldp term 1 then accept
```
  - Include the LDP route policy, **redistribute\_ldp** in the BGP configuration (as a part of the BGP group configuration **ebgp-to-abr** in this example).
 

BGP forwards the LDP routes based on the **redistribute\_ldp** policy to the remote PE router

```
[edit protocols bgp]
user@host# set group ebgp-to-abr type external
user@host# set group ebgp-to-abr local-address 192.168.0.1
user@host# set group ebgp-to-abr peer-as 65319
user@host# set group ebgp-to-abr local-as 65320
user@host# set group ebgp-to-abr neighbor 192.168.6.1 family inet unicast
user@host# set group ebgp-to-abr neighbor 192.168.6.1 family inet labeled-unicast
user@host# set group ebgp-to-abr neighbor 192.168.6.1 export redistribute_ldp
```
- Step-by-Step Procedure** To restrict label propagation to other routers configured in downstream unsolicited mode (instead of downstream on demand), configure the following policies:
- Configure the **dod-routes** policy to accept routes from LDP.
 

```
user@host# set policy-options policy-statement dod-routes term 1 from protocol ldp
user@host# set policy-options policy-statement dod-routes term 1 from tag 1145307136
user@host# set policy-options policy-statement dod-routes term 1 then accept
```
  - Configure the **do-not-propagate-du-sessions** policy to not forward routes to neighbors 1.1.1.1, 2.2.2.2, and 3.3.3.3.
 

```
user@host# set policy-options policy-statement do-not-propagate-du-sessions term 1 to neighbor 1.1.1.1
user@host# set policy-options policy-statement do-not-propagate-du-sessions term 1 to neighbor 2.2.2.2
user@host# set policy-options policy-statement do-not-propagate-du-sessions term 1 to neighbor 3.3.3.3
user@host# set policy-options policy-statement do-not-propagate-du-sessions term 1 then reject
```
  - Configure the **filter-dod-on-du-sessions** policy to prevent the routes examined by the **dod-routes** policy from being forwarded to the neighboring routers defined in the **do-not-propagate-du-sessions** policy.
 

```
user@host# set policy-options policy-statement filter-dod-routes-on-du-sessions term 1 from policy dod-routes
```

```
user@host# set policy-options policy-statement filter-dod-routes-on-du-sessions
term 1 to policy do-not-propagate-du-sessions
```

4. Specify the **filter-dod-routes-on-du-sessions** policy as the export policy for BGP group **ebgp-to-abr**.

```
[edit protocols bgp]
user@host# set group ebgp-to-abr neighbor 192.168.6.2 export
filter-dod-routes-on-du-sessions
```

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

```
user@host#
show policy-options
prefix-list Request-Loopbacks {
  10.1.1.1/32;
  10.1.1.2/32;
  10.1.1.3/32;
  10.1.1.4/32;
}
policy-statement DOD-Request-Loopbacks {
  term 1 {
    from {
      prefix-list Request-Loopbacks;
    }
    then accept;
  }
}
policy-statement redistribute_ldp {
  term 1 {
    from {
      protocol ldp;
      tag 1000;
    }
    then accept;
  }
}

user@host#
show protocols ldp
dod-request-policy DOD-Request-Loopbacks;
session 1.1.1.1 {
  downstream-on-demand;
}

user@host#
show protocols bgp
group ebgp-to-abr {
  type external;
  local-address 192.168.0.1;
  peer-as 65319;
  local-as 65320;
  neighbor 192.168.6.1 {
    family inet {
      unicast;
      labeled-unicast {
```



```
        rib {  
            inet.3;  
        }  
    }  
    export redistribute_ldp;  
}
```

## Verification

### Verifying Label Advertisement Mode

**Purpose** Confirm that the configuration is working properly.

Use the **show ldp session** command to verify the status of the label advertisement mode for the LDP session.

**Action** Issue the **show ldp session** and **show ldp session detail** commands:

- The following command output for the **show ldp session** command indicates that the **Adv. Mode** (label advertisement mode) is **DOD** (meaning the LDP downstream on demand session is operational):

```
user@host> show ldp session
  Address          State      Connection  Hold time  Adv. Mode
  1.1.1.2          Operational Open         22         DOD
```

- The following command output for the **show ldp session detail** command indicates that the **Local Label Advertisement mode** is **Downstream unsolicited**, the default value (meaning downstream on demand is not configured on the local session). Conversely, the **Remote Label Advertisement mode** and the **Negotiated Label Advertisement mode** both indicate that **Downstream on demand** is configured on the remote session

```
user@host> show ldp session detail
Address: 1.1.1.2, State: Operational, Connection: Open, Hold time: 24
Session ID: 1.1.1.1:0--1.1.1.2:0
Next keepalive in 4 seconds
Passive, Maximum PDU: 4096, Hold time: 30, Neighbor count: 1
Neighbor types: configured-tunneled
Keepalive interval: 10, Connect retry interval: 1
Local address: 1.1.1.1, Remote address: 1.1.1.2
Up for 17:54:52
Capabilities advertised: none
Capabilities received: none
Protection: disabled
Local - Restart: disabled, Helper mode: enabled,
Remote - Restart: disabled, Helper mode: enabled
Local maximum neighbor reconnect time: 120000 msec
Local maximum neighbor recovery time: 240000 msec
Local Label Advertisement mode: Downstream unsolicited
Remote Label Advertisement mode: Downstream on demand
Negotiated Label Advertisement mode: Downstream on demand
Nonstop routing state: Not in sync
Next-hop addresses received:
  1.1.1.2
```

## Example: Configuring Multipoint LDP In-Band Signaling for Point-to-Multipoint LSPs

- [Understanding Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs on page 89](#)
- [Example: Configuring Multipoint LDP In-Band Signaling for Point-to-Multipoint LSPs on page 98](#)

## Understanding Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs

The Multipoint Label Distribution Protocol (M-LDP) for point-to-multipoint label-switched paths (LSPs) with in-band signaling is useful in a deployment with an existing IP/MPLS backbone, in which you need to carry multicast traffic, for IPTV for example.

For years, the most widely used solution for transporting multicast traffic has been to use native IP multicast in the service provider core with multipoint IP tunneling to isolate customer traffic. A multicast routing protocol, usually Protocol Independent Multicast (PIM), is deployed to set up the forwarding paths. IP multicast routing is used for forwarding, using PIM signaling in the core. For this model to work, the core network has to be multicast enabled. This allows for effective and stable deployments even in inter-autonomous system (AS) scenarios.

However, in an existing IP/MPLS network, deploying PIM might not be the first choice. Some service providers are interested in replacing IP tunneling with MPLS label encapsulation. The motivations for moving to MPLS label switching is to leverage MPLS traffic engineering and protection features and to reduce the amount of control traffic overhead in the provider core.

To do this, service providers are interested in leveraging the extension of the existing deployments to allow multicast traffic to pass through. The existing multicast extensions for IP/MPLS are point-to-multipoint extensions for RSVP-TE and point-to-multipoint and multipoint-to-multipoint extensions for LDP. These deployment scenarios are discussed in RFC 6826, *Multipoint LDP In-Band Signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths*. This feature overview is limited to point-to-multipoint extensions for LDP.

- [How M-LDP Works on page 90](#)
- [Terminology on page 94](#)
- [Ingress Join Translation and Pseudo Interface Handling on page 95](#)
- [Ingress Splicing on page 95](#)
- [Reverse Path Forwarding on page 95](#)
- [LSP Root Detection on page 95](#)
- [Egress Join Translation and Pseudo Interface Handling on page 95](#)
- [Egress Splicing on page 96](#)
- [Supported Functionality on page 96](#)
- [Unsupported Functionality on page 96](#)
- [LDP Functionality on page 97](#)
- [Egress LER Functionality on page 97](#)
- [Transit LSR Functionality on page 97](#)
- [Ingress LER Functionality on page 97](#)

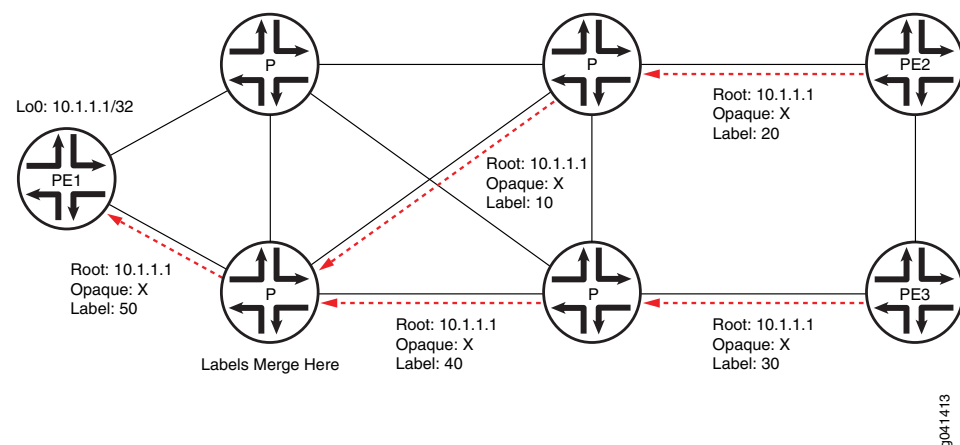
## How M-LDP Works

- [Label Bindings in M-LDP Signaling on page 90](#)
- [M-LDP in PIM-Free MPLS Core on page 90](#)
- [M-LDP in PIM-Enabled MPLS Core on page 92](#)

### Label Bindings in M-LDP Signaling

The multipoint extension to LDP uses point-to-multipoint and multipoint-to-multipoint forwarding equivalence class (FEC) elements (defined in RFC 5036, *LDP Specification*) along with capability advertisements, label mapping, and signaling procedures. The FEC elements include the idea of the LSP root, which is an IP address, and an “opaque” value, which is a selector that groups together the leaf nodes sharing the same opaque value. The opaque value is transparent to the intermediate nodes, but has meaning for the LSP root. Every LDP node advertises its local incoming label binding to the upstream LDP node on the shortest path to the root IP address found in the FEC. The upstream node receiving the label bindings creates its own local label and outgoing interfaces. This label allocation process might result in packet replication, if there are multiple outgoing branches. As shown in [Figure 16 on page 90](#), an LDP node merges the label bindings for the same opaque value if it finds downstream nodes sharing the same upstream node. This allows for effective building of point-to-multipoint LSPs and label conservation.

Figure 16: Label Bindings in M-LDP Signaling

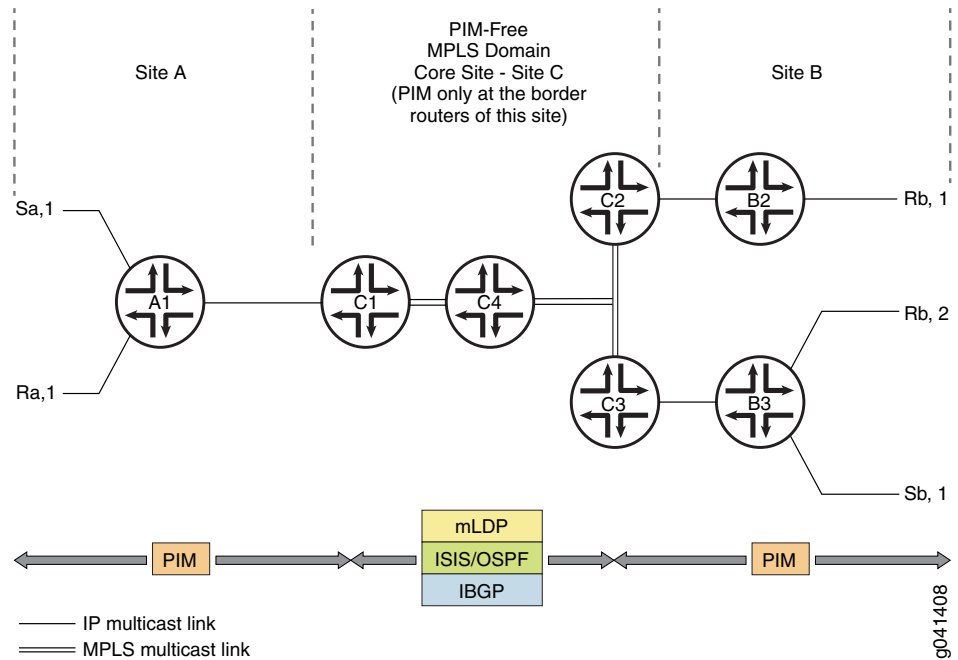


### M-LDP in PIM-Free MPLS Core

[Figure 17 on page 91](#) shows a scaled-down deployment scenario. Two separate PIM domains are interconnected by a PIM-free core site. The border routers in this core site support PIM on the border interfaces. Further, these border routers collect and distribute the routing information from the adjacent sites to the core network. The edge routers in Site C run BGP for root-node discovery. Interior gateway protocol (IGP) routes cannot be used for ingress discovery because in most cases the forwarding next hop provided by the IGP would not provide information about the ingress device toward the source. M-LDP inband signaling has a one-to-one mapping between the point-to-multipoint LSP and the (S,G) flow. With in-band signaling, PIM messages are directly translated into M-LDP FEC bindings. In contrast, out-of-band signaling is based on manual

configuration. One application for M-LDP inband signaling is to carry IPTV multicast traffic in an MPLS backbone.

Figure 17: Sample M-LDP Topology in PIM-Free MPLS Core



### Configuration

The configuration statement **mldp-inband-signalling** on the label-edge router (LER) enables PIM to use M-LDP in-band signaling for the upstream neighbors when the LER does not detect a PIM upstream neighbor. Static configuration of the MPLS LSP root is included in the PIM configuration, using policy. This is needed when IBGP is not available in the core site or to override IBGP-based LSP root detection.

For example:

```
protocols {
  pim {
    mldp-inband-signalling {
      policy lsp-mapping-policy-example;
    }
  }
}

policy-options {
  policy-statement lsp-mapping-policy-example {
    term channel1 {
      from {
        source-address-filter ip-prefix</prefix-length>; #policy filter for channel1
      }
      then {
        p2mp-lsp-root {
          # Statically configured ingress address of edge
          # used by channel1
        }
      }
    }
  }
}
```

```

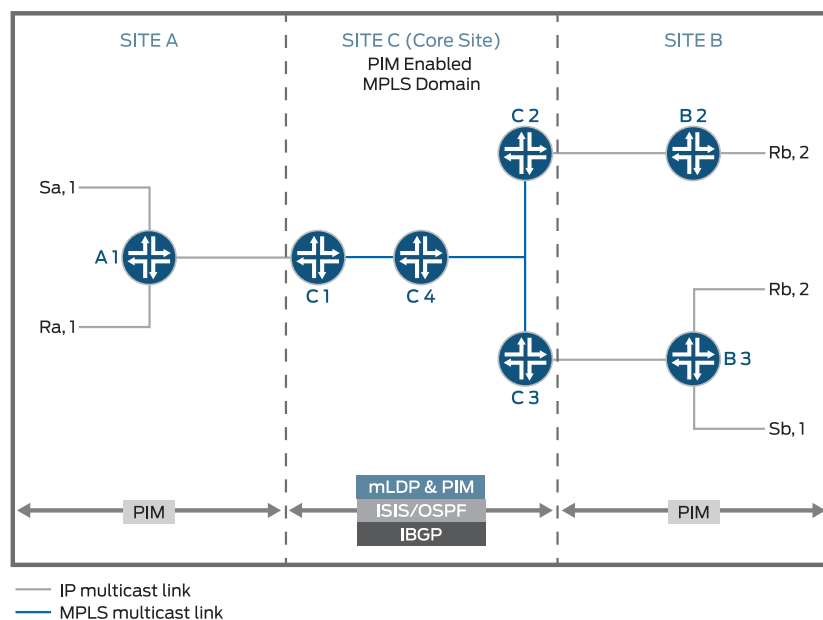
        address ip-address;
    }
    accept;
}
}
}
}

```

### M-LDP in PIM-Enabled MPLS Core

In order to migrate existing IPTV services from native IP multicast to MPLS multicast, customers need to smoothly transition from PIM to M-LDP point-to-multipoint LSPs with minimal outage. [Figure 18 on page 92](#) shows a similar M-LDP topology as [Figure 17 on page 91](#), but with a different scenario. The core is enabled with PIM, with one source streaming all the IPTV channels. The TV channels are sent as ASM streams with each channel identified by its group address. Previously, these channels were streamed on the core as IP streams and signaled using PIM.

Figure 18: Sample M-LDP Topology in PIM-Enabled MPLS Core



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By configuring the **mldp-inband-signaling** in this scenario, M-LDP signaling is initiated only when there is no PIM neighbor towards the source. However, because there is always a PIM neighbor towards the source unless PIM is deactivated on the upstream interfaces of the egress PE, PIM takes precedence over M-LDP and M-LDP does not take effect.

### Configuration

To progressively migrate channel by channel to M-LDP MPLS core with few streams using M-LDP upstream and other streams using existing PIM upstream, include the **selected-mldp-egress** configuration statement along with group based filters in the policy filter for M-LDP inband signaling.



**NOTE:** The M-LDP inband signaling policy filter can include either the `source-address-filter` statement or the `route-filter` statement, or a combination of both.

For example:

```
protocols {
  pim {
    mldp-inband-signalling {
      policy lsp-mapping-policy-example;
    }
  }
}

policy-options {
  policy-statement lsp-mapping-policy-example {
    term channel1 {
      from {
        source-address-filter ip-prefix</prefix-length>; #policy filter for channel1
      }
      then {
        selected-mldp-egress;
        accept;
      }
    }
    term channel2 {
      from {
        source-address-filter ip-prefix</prefix-length>; #policy filter for channel2
        route-filter ip-prefix</prefix-length>; #policy filter on multicast group address
      }
      then {
        selected-mldp-egress;
        p2mp-lsp-root {
          # Statically configured ingress address of edge
          # used by channel2
          address ip-address;
        }
        accept;
      }
    }
    term channel3 {
      from {
        route-filter ip-prefix</prefix-length>; #policy filter on multicast group address
      }
      then {
        selected-mldp-egress;
        accept;
      }
    }
  }
}
```



---

**NOTE:**

Some of the limitations of the above configuration are as follows:

- The `selected-mldp-egress` statement should be configured only on the LER. Configuring the `selected-mldp-egress` statement on non-egress PIM routers can cause path setup failures.
  - When policy changes are made to switch traffic from PIM upstream to M-LDP upstream and vice-versa, packet loss can be expected as break-and-make mechanism is performed at the control plane.
- 

### Terminology

---

The following terms are important for an understanding of M-LDP in-band signaling for multicast traffic.

**Point-to-point LSP**—An LSP that has one ingress label-switched router (LSR) and one egress LSR.

**Multipoint LSP**—Either a point-to-multipoint or a multipoint-to-multipoint LSP.

**Point-to-multipoint LSP**—An LSP that has one ingress LSR and one or more egress LSRs.

**Multipoint-to-point LSP**—An LSP that has one or more ingress LSRs and one unique egress LSR.

**Multipoint-to-multipoint LSP**—An LSP that connects a set of nodes, such that traffic sent by any node in the LSP is delivered to all others.

**Ingress LSR**—An ingress LSR for a particular LSP is an LSR that can send a data packet along the LSP. Multipoint-to-multipoint LSPs can have multiple ingress LSRs. Point-to-multipoint LSPs have only one, and that node is often referred to as the root node.

**Egress LSR**—An egress LSR for a particular LSP is an LSR that can remove a data packet from that LSP for further processing. Point-to-point and multipoint-to-point LSPs have only a single egress node. Point-to-multipoint and multipoint-to-multipoint LSPs can have multiple egress nodes.

**Transit LSR**—An LSR that has reachability to the root of the multipoint LSP through a directly connected upstream LSR and one or more directly connected downstream LSRs.

**Bud LSR**—An LSR that is an egress but also has one or more directly connected downstream LSRs.

**Leaf node**—Either an egress or bud LSR in the context of a point-to-multipoint LSP. In the context of a multipoint-to-multipoint LSP, an LSR is both ingress and egress for the same multipoint-to-multipoint LSP and can also be a bud LSR.



### Ingress Join Translation and Pseudo Interface Handling

---

At the ingress LER, LDP notifies PIM about the (S,G) messages that are received over the in-band signaling. PIM associates each (S,G) message with a pseudo interface. Subsequently, a shortest-path-tree (SPT) join message is initiated toward the source. PIM treats this as a new type of local receiver. When the LSP is torn down, PIM removes this local receiver based on notification from LDP.

### Ingress Splicing

---

LDP provides PIM with a next hop to be associated with each (S,G) entry. PIM installs a PIM (S,G) multicast route with the LDP next hop and other PIM receivers. The next hop is a composite next hop of local receivers + the list of PIM downstream neighbors + a sub-level next hop for the LDP tunnel.

### Reverse Path Forwarding

---

PIM's reverse-path-forwarding (RPF) calculation is performed at the egress node.

PIM performs M-LDP in-band signaling when all of the following conditions are true:

- There are no PIM neighbors toward the source.
- The M-LDP in-band signaling statement is configured.
- The next hop is learned through BGP, or is present in the static mapping (specified in an M-LDP in-band signaling policy).

Otherwise, if LSP root detection fails, PIM retains the (S,G) entry with an RPF state of unresolved.

PIM RPF registers this source address each time unicast routing information changes. Therefore, if the route toward the source changes, the RPF recalculation recurs. BGP protocol next hops toward the source too are monitored for changes in the LSP root. Such changes might cause traffic disruption for short durations.

### LSP Root Detection

---

If the RPF operation detects the need for M-LDP in-band signaling upstream, the LSP root (ingress) is detected. This root is a parameter for LDP LSP signaling.

The root node is detected as follows:

1. If the existing static configuration specifies the source address, the root is taken as given in configuration.
2. A lookup is performed in the unicast routing table. If the source address is found, the protocol next hop toward the source is used as the LSP root.

### Egress Join Translation and Pseudo Interface Handling

---

At the egress LER, PIM notifies LDP of the (S,G) message to be signaled along with the LSP root. PIM creates a pseudo interface as the upstream interface for this (S,G) message. When an (S,G) prune message is received, this association is removed.

### Egress Splicing

---

At the egress node of the core network, where the (S,G) join message from the downstream site is received, this join message is translated to M-LDP in-band signaling parameters and LDP is notified. Further, LSP teardown occurs when the (S,G) entry is lost, when the LSP root changes, or when the (S,G) entry is reachable over a PIM neighbor.

### Supported Functionality

---

For M-LDP in-band signaling, Junos OS supports the following functionality:

- Egress splicing of the PIM next hop with the LDP route
- Ingress splicing of the PIM route with the LDP next hop
- Translation of PIM join messages to LDP point-to-multipoint LSP setup parameters
- Translation of M-LDP in-band LSP parameters to set up PIM join messages
- Statically configured and BGP protocol next hop-based LSP root detection
- PIM (S,G) states in the PIM source-specific multicast (SSM) and anysource multicast (ASM) ranges
- Configuration statements on ingress and egress LERs to enable them to act as edge routers
- IGMP join messages on LERs
- Carrying IPv6 source and group address as opaque information toward an IPv4 root node
- Static configuration to map an IPv6 (S,G) to an IPv4 root address

### Unsupported Functionality

---

For M-LDP in-band signaling, Junos OS does *not* support the following functionality:

- Full support for PIM ASM
- The **mpls lsp point-to-multipoint ping** command with an (S,G) option
- Nonstop active routing (NSR)
- Make-before-break (MBB) for PIM
- IPv6 LSP root addresses (LDP does not support IPv6 LSPs.)
- Neighbor relationship between PIM speakers that are not directly connected
- Graceful restart
- PIM dense mode
- PIM bidirectional mode

### LDP Functionality

---

The PIM (S,G) information is carried as M-LDP opaque type-length-value (TLV) encodings. The point-to-multipoint FEC element consists of the root-node address. In the case of next-generation multicast VPNs (NGEN MVPNs), the point-to-multipoint LSP is identified by the root node address and the LSP ID.

### Egress LER Functionality

---

On the egress LER, PIM triggers LDP with the following information to create a point-to-multipoint LSP:

- Root node
- (S,G)
- Next hop

PIM finds the root node based on the source of the multicast tree. If the root address is configured for this (S,G) entry, the configured address is used as the point-to-multipoint LSP root. Otherwise, the routing table is used to look up the route to the source. If the route to the source of the multicast tree is a BGP-learned route, PIM retrieves the BGP next hop address and uses it as the root node for the point-to-multipoint LSP.

LDP finds the upstream node based on the root node, allocates a label, and sends the label mapping to the upstream node. LDP does not use penultimate hop popping (PHP) for in-band M-LDP signaling.

If the root addresses for the source of the multicast tree changes, PIM deletes the point-to-multipoint LSP and triggers LDP to create a new point-to-multipoint LSP. When this happens, the outgoing interface list becomes NULL, PIM triggers LDP to delete the point-to-multipoint LSP, and LDP sends a label withdraw message to the upstream node.

### Transit LSR Functionality

---

The transit LSR advertises a label to the upstream LSR toward the source of the point-to-multipoint FEC and installs the necessary forwarding state to forward the packets. The transit LSR can be any M-LDP capable router.

### Ingress LER Functionality

---

On the ingress LER, LDP provides the following information to PIM upon receiving the label mapping:

- (S,G)
- Flood next hop

Then PIM installs the forwarding state. If the new branches are added or deleted, the flood next hop is updated accordingly. If all branches are deleted due to a label being withdrawn, LDP sends updated information to PIM. If there are multiple links between

the upstream and downstream neighbors, the point-to-multipoint LSP is not load balanced.

## Example: Configuring Multipoint LDP In-Band Signaling for Point-to-Multipoint LSPs

This example shows how to configure multipoint LDP (M-LDP) in-band signaling for multicast traffic, as an extension to the Protocol Independent Multicast (PIM) protocol or as a substitute for PIM.

- [Requirements on page 98](#)
- [Overview on page 98](#)
- [Configuration on page 99](#)
- [Verification on page 108](#)

### Requirements

---

This example can be configured using the following hardware and software components:

- Junos OS Release 13.2 or later
- MX Series 3D Universal Edge Routers or M Series Multiservice Edge Routers for the Provider Edge (PE) Routers
- PTX Series Packet Transport Routers acting as transit label-switched routers
- T Series Core Routers for the Core Routers



**NOTE:** The PE routers could also be T Series Core Routers but that is not typical. Depending on your scaling requirements, the core routers could also be MX Series 3D Universal Edge Routers or M Series Multiservice Edge Routers. The Customer Edge (CE) devices could be other routers or switches from Juniper Networks or another vendor.

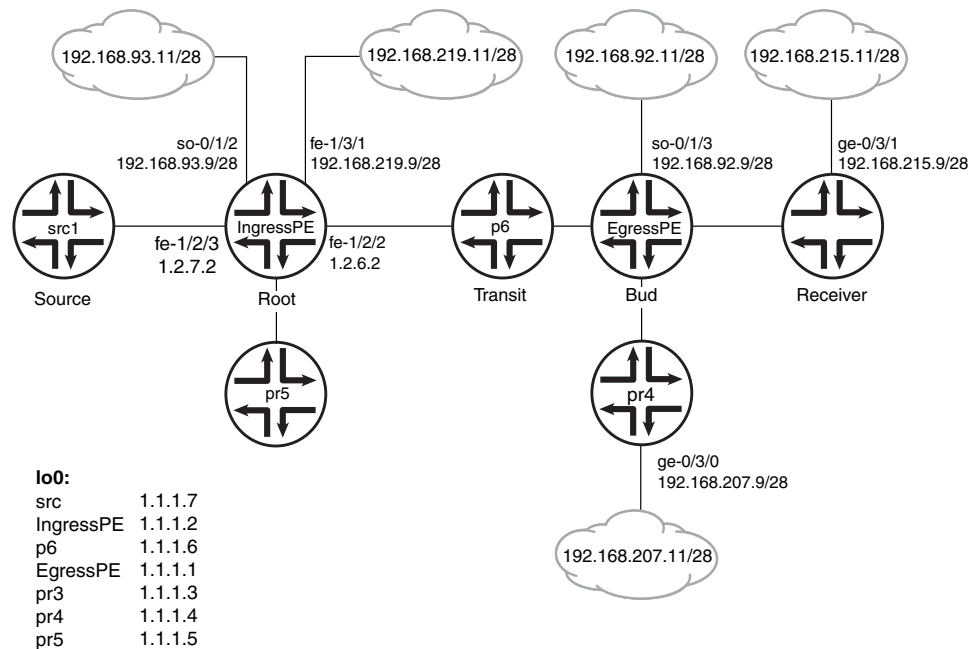
No special configuration beyond device initialization is required before configuring this example.

### Overview

---

"CLI Quick Configuration" on [page 99](#) shows the configuration for all of the devices in [Figure 19 on page 99](#). The section "Step-by-Step Procedure" on [page 102](#) describes the steps on Device EgressPE.

Figure 19: M-LDP In-Band Signaling for Point-to-Multipoint LSPs Example Topology



### 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 src1**

```
set logical-systems src1 interfaces fe-1/2/0 unit 0 family inet address 1.2.7.7/24
set logical-systems src1 interfaces lo0 unit 0 family inet address 1.1.1.7/32
set logical-systems src1 protocols ospf area 0.0.0.0 interface all
```

**Device IngressPE**

```
set interfaces so-0/1/2 unit 0 family inet address 192.168.93.9/28
set interfaces fe-1/2/0 unit 0 family inet address 1.2.3.2/24
set interfaces fe-1/2/0 unit 0 family mpls
set interfaces fe-1/2/1 unit 0 family inet address 1.2.5.2/24
set interfaces fe-1/2/2 unit 0 family inet address 1.2.6.2/24
set interfaces fe-1/2/2 unit 0 family mpls
set interfaces fe-1/2/3 unit 0 family inet address 1.2.7.2/24
set interfaces fe-1/3/1 unit 0 family inet address 192.168.219.9/28
set interfaces lo0 unit 0 family inet address 1.1.1.2/32
set protocols igmp interface fe-1/2/1.0 version 3
set protocols igmp interface fe-1/2/1.0 static group 232.1.1.1 source 192.168.219.11
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 1.1.1.2
set protocols bgp group ibgp family inet any
set protocols bgp group ibgp family inet-vpn any
set protocols bgp group ibgp neighbor 1.1.1.3
set protocols bgp group ibgp neighbor 1.1.1.4
set protocols bgp group ibgp neighbor 1.1.1.1
```

```

set protocols ospf area 0.0.0.0 interface all
set protocols ldp interface fe-1/2/0.0
set protocols ldp interface fe-1/2/2.0
set protocols ldp interface lo0.0
set protocols ldp p2mp
set protocols pim mldp-inband-signalling policy mldppim-ex
set protocols pim rp static address 1.1.1.5
set protocols pim interface fe-1/3/1.0
set protocols pim interface lo0.0
set protocols pim interface fe-1/2/0.21
set protocols pim interface fe-1/2/3.0
set protocols pim interface fe-1/2/1.0
set protocols pim interface so-0/1/2.0
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.0.0/24 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.219.11/32 orlonger
set policy-options policy-statement mldppim-ex term B then accept
set policy-options policy-statement mldppim-ex term A from source-address-filter
  1.1.1.7/32 orlonger
set policy-options policy-statement mldppim-ex term A from source-address-filter
  1.2.7.0/24 orlonger
set policy-options policy-statement mldppim-ex term A then accept
set routing-options autonomous-system 64510

```

#### Device EgressPE

```

set interfaces so-0/1/3 unit 0 point-to-point
set interfaces so-0/1/3 unit 0 family inet address 192.168.92.9/28
set interfaces fe-1/2/0 unit 0 family inet address 1.1.3.1/24
set interfaces fe-1/2/0 unit 0 family mpls
set interfaces fe-1/2/1 unit 0 family inet address 1.1.4.1/24
set interfaces fe-1/2/2 unit 0 family inet address 1.1.6.1/24
set interfaces fe-1/2/2 unit 0 family mpls
set interfaces fe-1/3/0 unit 0 family inet address 192.168.209.9/28
set interfaces lo0 unit 0 family inet address 1.1.1.1/32
set routing-options autonomous-system 64510
set protocols igmp interface fe-1/3/0.0 version 3
set protocols igmp interface fe-1/3/0.0 static group 232.1.1.1 group-count 3
set protocols igmp interface fe-1/3/0.0 static group 232.1.1.1 source 192.168.219.11
set protocols igmp interface fe-1/3/0.0 static group 227.1.1.1
set protocols igmp interface so-0/1/3.0 version 3
set protocols igmp interface so-0/1/3.0 static group 232.1.1.1 group-count 2
set protocols igmp interface so-0/1/3.0 static group 232.1.1.1 source 192.168.219.11
set protocols igmp interface so-0/1/3.0 static group 232.2.2.2 source 1.2.7.7
set protocols mpls interface fe-1/2/0.0
set protocols mpls interface fe-1/2/2.0
set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 1.1.1.1
set protocols bgp group ibgp family inet any
set protocols bgp group ibgp neighbor 1.1.1.2
set protocols msdp local-address 1.1.1.1
set protocols msdp peer 1.1.1.5
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ldp interface fe-1/2/0.0
set protocols ldp interface fe-1/2/2.0
set protocols ldp interface lo0.0

```

```

set protocols ldp p2mp
set protocols pim mldp-inband-signalling policy mldppim-ex
set protocols pim rp local address 1.1.1.1
set protocols pim rp local group-ranges 227.0.0.0/8
set protocols pim rp static address 1.1.1.4
set protocols pim rp static address 1.2.7.7 group-ranges 226.0.0.0/8
set protocols pim interface lo0.0
set protocols pim interface fe-1/3/0.0
set protocols pim interface fe-1/2/0.0
set protocols pim interface fe-1/2/1.0
set protocols pim interface so-0/1/3.0
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.0.0/24 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.219.11/32 orlonger
set policy-options policy-statement mldppim-ex term B then p2mp-lsp-root address
  1.1.1.2
set policy-options policy-statement mldppim-ex term B then accept
set policy-options policy-statement mldppim-ex term A from source-address-filter
  1.2.7.0/24 orlonger
set policy-options policy-statement mldppim-ex term A then accept

```

**Device p6**

```

set interfaces fe-1/2/0 unit 0 family inet address 1.1.6.6/24
set interfaces fe-1/2/0 unit 0 family mpls
set interfaces fe-1/2/1 unit 0 family inet address 1.2.6.6/24
set interfaces fe-1/2/1 unit 0 family mpls
set interfaces lo0 unit 0 family inet address 1.1.1.6/32
set interfaces lo0 unit 0 family mpls
set protocols ospf area 0.0.0.0 interface all
set protocols ldp interface fe-1/2/0.0
set protocols ldp interface fe-1/2/1.0
set protocols ldp interface lo0.0
set protocols ldp p2mp

```

**Device pr3**

```

set interfaces ge-0/3/1 unit 0 family inet address 192.168.215.9/28
set interfaces fe-1/2/0 unit 0 family inet address 1.1.3.3/24
set interfaces fe-1/2/0 unit 0 family mpls
set interfaces fe-1/2/1 unit 0 family inet address 1.2.3.3/24
set interfaces fe-1/2/1 unit 0 family mpls
set interfaces lo0 unit 0 family inet address 1.1.1.3/32
set protocols igmp interface ge-0/3/1.0 version 3
set protocols igmp interface ge-0/3/1.0 static group 232.1.1.2 source 192.168.219.11
set protocols igmp interface ge-0/3/1.0 static group 232.2.2.2 source 1.2.7.7
set protocols bgp group ibgp local-address 1.1.1.3
set protocols bgp group ibgp type internal
set protocols bgp group ibgp neighbor 1.1.1.2
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface fe-1/2/1.0 metric 2
set protocols ldp interface fe-1/2/0.0
set protocols ldp interface fe-1/2/1.0
set protocols ldp interface lo0.0
set protocols ldp p2mp
set protocols pim mldp-inband-signalling policy mldppim-ex
set protocols pim interface fe-0/3/1.0
set protocols pim interface lo0.0

```

```

set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.0.0/24 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.219.11/32 orlonger
set policy-options policy-statement mldppim-ex term B then p2mp-lsp-root address
  1.1.1.2
set policy-options policy-statement mldppim-ex term B then accept
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.0.0/24 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.219.11/32 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
  1.2.7.7/32 orlonger
set policy-options policy-statement mldppim-ex term B then p2mp-lsp-root address
  1.1.1.2
set policy-options policy-statement mldppim-ex term B then accept
set routing-options autonomous-system 64510

```

Device pr4

```

set interfaces ge-0/3/0 unit 0 family inet address 192.168.207.9/28
set interfaces fe-1/2/0 unit 0 family inet address 1.1.4.4/24
set interfaces fe-1/2/0 unit 0 family iso
set interfaces lo0 unit 0 family inet address 1.1.1.4/32
set protocols igmp interface ge-0/3/0.0 version 3
set protocols igmp interface ge-0/3/0.0 static group 232.1.1.2 source 192.168.219.11
set protocols igmp interface ge-0/3/0.0 static group 225.1.1.1
set protocols bgp group ibgp local-address 1.1.1.4
set protocols bgp group ibgp type internal
set protocols bgp group ibgp neighbor 1.1.1.2
set protocols msdp local-address 1.1.1.4
set protocols msdp peer 1.1.1.5
set protocols ospf area 0.0.0.0 interface all
set protocols pim rp local address 1.1.1.4
set protocols pim interface ge-0/3/0.0
set protocols pim interface lo0.0
set protocols pim interface fe-1/2/0.0
set routing-options autonomous-system 64510

```

Device pr5

```

set interfaces fe-1/2/0 unit 0 family inet address 1.2.5.5/24
set interfaces lo0 unit 0 family inet address 1.1.1.5/24
set protocols igmp interface lo0.0 version 3
set protocols igmp interface lo0.0 static group 232.1.1.1 source 192.168.219.11
set protocols msdp local-address 1.1.1.5
set protocols msdp peer 1.1.1.4
set protocols msdp peer 1.1.1.1
set protocols ospf area 0.0.0.0 interface all
set protocols pim rp local address 1.1.1.5
set protocols pim interface all

```

**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 EgressPE:

1. Configure the interfaces.



Enable MPLS on the core-facing interfaces. On the egress next hops, you do not need to enable MPLS.

```
[edit interfaces]
```

```
user@EgressPE# set fe-1/2/0 unit 0 family inet address 1.1.3.1/24
```

```
user@EgressPE# set fe-1/2/0 unit 0 family mpls
```

```
user@EgressPE# set fe-1/2/2 unit 0 family inet address 1.1.6.1/24
```

```
user@EgressPE# set fe-1/2/2 unit 0 family mpls
```

```
user@EgressPE# set so-0/1/3 unit 0 point-to-point
```

```
user@EgressPE# set so-0/1/3 unit 0 family inet address 192.168.92.9/28
```

```
user@EgressPE# set fe-1/2/1 unit 0 family inet address 1.1.4.1/24
```

```
user@EgressPE# set fe-1/3/0 unit 0 family inet address 192.168.209.9/28
```

```
user@EgressPE# set lo0 unit 0 family inet address 1.1.1.1/32
```

2. Configure IGMP on the egress interfaces.

For testing purposes, this example includes static group and source addresses.

```
[edit protocols igmp]
```

```
user@EgressPE# set interface fe-1/3/0.0 version 3
```

```
user@EgressPE# set interface fe-1/3/0.0 static group 232.1.1.1 group-count 3
```

```
user@EgressPE# set interface fe-1/3/0.0 static group 232.1.1.1 source 192.168.219.11
```

```
user@EgressPE# set interface fe-1/3/0.0 static group 227.1.1.1
```

```
user@EgressPE# set interface so-0/1/3.0 version 3
```

```
user@EgressPE# set interface so-0/1/3.0 static group 232.1.1.1 group-count 2
```

```
user@EgressPE# set interface so-0/1/3.0 static group 232.1.1.1 source 192.168.219.11
```

```
user@EgressPE# set interface so-0/1/3.0 static group 232.2.2.2 source 1.2.7.7
```

3. Configure MPLS on the core-facing interfaces.

```
[edit protocols mpls]
```

```
user@EgressPE# set interface fe-1/2/0.0
```

```
user@EgressPE# set interface fe-1/2/2.0
```

4. Configure BGP.

BGP is a policy-driven protocol, so also configure and apply any needed routing policies.

For example, you might want to export static routes into BGP.

```
[edit protocols bgp group ibgp]
```

```
user@EgressPE# set type internal
```

```
user@EgressPE# set local-address 1.1.1.1
```

```
user@EgressPE# set family inet any
```

```
user@EgressPE# set neighbor 1.1.1.2
```

5. (Optional) Configure an MSDP peer connection with Device pr5 in order to interconnect the disparate PIM domains, thus enabling redundant RPs.

```
[edit protocols msdp]
```

```
user@EgressPE# set local-address 1.1.1.1
```

```
user@EgressPE# set peer 1.1.1.5
```

6. Configure OSPF.  

```
[edit protocols ospf area 0.0.0.0]  
user@EgressPE# set interface all  
user@EgressPE# set interface fxp0.0 disable
```
7. Configure LDP on the core-facing interfaces and on the loopback interface.  

```
[edit protocols ldp]  
user@EgressPE# set interface fe-1/2/0.0  
user@EgressPE# set interface fe-1/2/2.0  
user@EgressPE# set interface lo0.0
```
8. Enable point-to-multipoint MPLS LSPs.  

```
[edit protocols ldp]  
user@EgressPE# set p2mp
```
9. Configure PIM on the downstream interfaces.  

```
[edit protocols pim]  
user@EgressPE# set interface lo0.0  
user@EgressPE# set interface fe-1/3/0.0  
user@EgressPE# set interface fe-1/2/1.0  
user@EgressPE# set interface so-0/1/3.0
```
10. Configure the RP settings because this device serves as the PIM rendezvous point (RP).  

```
[edit protocols pim]  
user@EgressPE# set rp local address 1.1.1.1  
user@EgressPE# set rp local group-ranges 227.0.0.0/8  
user@EgressPE# set rp static address 1.1.1.4  
user@EgressPE# set rp static address 1.2.7.7 group-ranges 226.0.0.0/8
```
11. Enable M-LDP in-band signaling and set the associated policy.  

```
[edit protocols pim]  
user@EgressPE# set mldp-inband-signalling policy mldppim-ex
```
12. Configure the routing policy that specifies the root address for the point-to-multipoint LSP and the associated source addresses.  

```
[edit policy-options policy-statement mldppim-ex]  
user@EgressPE# set term B from source-address-filter 192.168.0.0/24 orlonger  
user@EgressPE# set term B from source-address-filter 192.168.219.11/32 orlonger  
user@EgressPE# set term B then p2mp-lsp-root address 1.1.1.2  
user@EgressPE# set term B then accept  
  
user@EgressPE# set term A from source-address-filter 1.2.7.0/24 orlonger  
user@EgressPE# set term A then accept
```
13. Configure the autonomous system (AS) ID.  

```
[edit routing-options]  
user@EgressPE# set autonomous-system 64510
```

**Results** From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, **show policy-options**, and **show routing-options** commands. If the output

does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```

Device EgressPE user@EgressPE# show interfaces
so-0/1/3 {
  unit 0 {
    point-to-point;
    family inet {
      address 192.168.92.9/28;
    }
  }
}
fe-1/2/0 {
  unit 0 {
    family inet {
      address 1.1.3.1/24;
    }
    family mpls;
  }
}
fe-1/2/1 {
  unit 0 {
    family inet {
      address 1.1.4.1/24;
    }
  }
}
fe-1/2/2 {
  unit 0 {
    family inet {
      address 1.1.6.1/24;
    }
    family mpls;
  }
}
fe-1/3/0 {
  unit 0 {
    family inet {
      address 192.168.209.9/28;
    }
  }
}
lo0 {
  unit 0 {
    family inet {
      address 1.1.1.1/32;
    }
  }
}

user@EgressPE# show protocols
igmp {
  interface fe-1/3/0.0 {
    version 3;
    static {
      group 232.1.1.1 {

```

```
        group-count 3;
        source 192.168.219.11;
    }
    group 227.1.1.1;
}
}
interface so-0/1/3.0 {
    version 3;
    static {
        group 232.1.1.1 {
            group-count 2;
            source 192.168.219.11;
        }
        group 232.2.2.2 {
            source 1.2.7.7;
        }
    }
}
}
mpls {
    interface fe-1/2/0.0;
    interface fe-1/2/2.0;
}
bgp {
    group ibgp {
        type internal;
        local-address 1.1.1.1;
        family inet {
            any;
        }
        neighbor 1.1.1.2;
    }
}
msdp {
    local-address 1.1.1.1;
    peer 1.1.1.5;
}
ospf {
    area 0.0.0.0 {
        interface all;
        interface fxp0.0 {
            disable;
        }
    }
}
}
ldp {
    interface fe-1/2/0.0;
    interface fe-1/2/2.0;
    interface lo0.0;
    p2mp;
}
pim {
    mldp-inband-signalling {
        policy mldppim-ex;
    }
}
rp {
```

```

    local {
        address 1.1.1.1;
        group-ranges {
            227.0.0.0/8;
        }
    }
    static {
        address 1.1.1.4;
        address 1.2.7.7 {
            group-ranges {
                226.0.0.0/8;
            }
        }
    }
}
interface lo0.0;
interface fe-1/3/0.0;
interface fe-1/2/0.0;
interface fe-1/2/1.0;
interface so-0/1/3.0;
}

user@EgressPE# show policy-options
policy-statement mldppim-ex {
    term B {
        from {
            source-address-filter 192.168.0.0/24 orlonger;
            source-address-filter 192.168.219.11/32 orlonger;
        }
        then {
            p2mp-lsp-root {
                address 1.1.1.2;
            }
            accept;
        }
    }
    term A {
        from {
            source-address-filter 1.2.7.0/24 orlonger;
        }
        then accept;
    }
}

user@EgressPE# show routing-options
autonomous-system 64510;

```

Similarly, configure the other egress devices.

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

## Verification

---

Confirm that the configuration is working properly.

- [Checking the PIM Join States on page 108](#)
- [Checking the PIM Sources on page 111](#)
- [Checking the LDP Database on page 114](#)
- [Looking Up the Route Information for the MPLS Label on page 117](#)
- [Checking the LDP Traffic Statistics on page 118](#)

### *Checking the PIM Join States*

**Purpose** Display information about PIM join states to verify the M-LDP in-band upstream and downstream details. On the ingress device, the **show pim join extensive** command displays **Pseudo-MLDP** for the downstream interface. On the egress, the **show pim join extensive** command displays **Pseudo-MLDP** for the upstream interface.

**Action** From operational mode, enter the **show pim join extensive** command.

```
user@IngressPE> show pim join extensive
```

```
Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

Group: 232.1.1.1
  Source: 192.168.219.11
  Flags: sparse,spt
  Upstream interface: fe-1/3/1.0
  Upstream neighbor: Direct
  Upstream state: Local Source
  Keepalive timeout:
  Uptime: 1d 23:00:12
  Downstream neighbors:
    Interface: Pseudo-MLDP
    Interface: fe-1/2/1.0
      1.2.5.2 State: Join Flags: S   Timeout: Infinity
      Uptime: 1d 23:00:12 Time since last Join: 1d 23:00:12
```

```
Group: 232.1.1.2
  Source: 192.168.219.11
  Flags: sparse,spt
  Upstream interface: fe-1/3/1.0
  Upstream neighbor: Direct
  Upstream state: Local Source
  Keepalive timeout:
  Uptime: 1d 22:59:59
  Downstream neighbors:
    Interface: Pseudo-MLDP
```

```
Group: 232.1.1.3
  Source: 192.168.219.11
  Flags: sparse,spt
  Upstream interface: fe-1/3/1.0
  Upstream neighbor: Direct
  Upstream state: Local Source
  Keepalive timeout:
```

```

Uptime: 1d 22:07:31
Downstream neighbors:
  Interface: Pseudo-MLDP

Group: 232.2.2.2
Source: 1.2.7.7
Flags: sparse,spt
Upstream interface: fe-1/2/3.0
Upstream neighbor: Direct
Upstream state: Local Source
Keepalive timeout:
Uptime: 1d 22:59:59
Downstream neighbors:
  Interface: Pseudo-MLDP

user@EgressPE> show pim join extensive

Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

Group: 227.1.1.1
Source: *
RP: 1.1.1.1
Flags: sparse,rptree,wildcard
Upstream interface: Local
Upstream neighbor: Local
Upstream state: Local RP
Uptime: 1d 23:14:21
Downstream neighbors:
  Interface: fe-1/3/0.0
    192.168.209.9 State: Join Flags: SRW Timeout: Infinity
    Uptime: 1d 23:14:21 Time since last Join: 1d 20:12:35

Group: 232.1.1.1
Source: 192.168.219.11
Flags: sparse,spt
Upstream protocol: MLDP
Upstream interface: Pseudo MLDP
Upstream neighbor: MLDP LSP root <1.1.1.2>
Upstream state: Join to Source
Keepalive timeout:
Uptime: 1d 23:14:22
Downstream neighbors:
  Interface: so-0/1/3.0
    192.168.92.9 State: Join Flags: S Timeout: Infinity
    Uptime: 1d 20:12:35 Time since last Join: 1d 20:12:35
  Downstream neighbors:
    Interface: fe-1/3/0.0
      192.168.209.9 State: Join Flags: S Timeout: Infinity
      Uptime: 1d 20:12:35 Time since last Join: 1d 20:12:35

Group: 232.1.1.2
Source: 192.168.219.11
Flags: sparse,spt
Upstream protocol: MLDP
Upstream interface: Pseudo MLDP
Upstream neighbor: MLDP LSP root <1.1.1.2>
Upstream state: Join to Source
Keepalive timeout:
Uptime: 1d 23:14:22
Downstream neighbors:

```

```

    Interface: so-0/1/3.0
      192.168.92.9 State: Join Flags: S   Timeout: Infinity
      Uptime: 1d 20:12:35 Time since last Join: 1d 20:12:35
    Downstream neighbors:
      Interface: fe-1/2/1.0
        1.1.4.4 State: Join Flags: S Timeout: 198
        Uptime: 1d 22:59:59 Time since last Join: 00:00:12
    Downstream neighbors:
      Interface: fe-1/3/0.0
        192.168.209.9 State: Join Flags: S   Timeout: Infinity
        Uptime: 1d 20:12:35 Time since last Join: 1d 20:12:35

Group: 232.1.1.3
Source: 192.168.219.11
Flags: sparse,spt
Upstream protocol: MLDP
Upstream interface: Pseudo MLDP
Upstream neighbor: MLDP LSP root <1.1.1.2>
Upstream state: Join to Source
Keepalive timeout:
Uptime: 1d 20:12:35
Downstream neighbors:
  Interface: fe-1/3/0.0
    192.168.209.9 State: Join Flags: S   Timeout: Infinity
    Uptime: 1d 20:12:35 Time since last Join: 1d 20:12:35

Group: 232.2.2.2
Source: 1.2.7.7
Flags: sparse,spt
Upstream protocol: MLDP
Upstream interface: Pseudo MLDP
Upstream neighbor: MLDP LSP root <1.1.1.2>
Upstream state: Join to Source
Keepalive timeout:
Uptime: 1d 20:12:35
Downstream neighbors:
  Interface: so-0/1/3.0
    192.168.92.9 State: Join Flags: S   Timeout: Infinity
    Uptime: 1d 20:12:35 Time since last Join: 1d 20:12:35

```

user@pr3> show pim join extensive

Instance: PIM.master Family: INET  
 R = Rendezvous Point Tree, S = Sparse, W = Wildcard

```

Group: 232.1.1.2
Source: 192.168.219.11
Flags: sparse,spt
Upstream protocol: MLDP
Upstream interface: Pseudo MLDP
Upstream neighbor: MLDP LSP root <1.1.1.2>
Upstream state: Join to Source
Keepalive timeout:
Uptime: 1d 20:14:40
Downstream neighbors:
  Interface: Pseudo-GMP
    ge-0/3/1.0

Group: 232.2.2.2
Source: 1.2.7.7
Flags: sparse,spt
Upstream protocol: MLDP

```



```

Upstream interface: Pseudo MLDP
Upstream neighbor: MLDP LSP root <1.1.1.2>
Upstream state: Join to Source
Keepalive timeout:
Uptime: 1d 20:14:40
Downstream neighbors:
  Interface: Pseudo-GMP
    ge-0/3/1.0

```

```

user@pr4> show pim join extensive
Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

```

```

Group: 225.1.1.1
Source: *
RP: 1.1.1.4
Flags: sparse,rptree,wildcard
Upstream interface: Local
Upstream neighbor: Local
Upstream state: Local RP
Uptime: 1d 23:13:43
Downstream neighbors:
  Interface: ge-0/3/0.0
    192.168.207.9 State: Join Flags: SRW Timeout: Infinity
    Uptime: 1d 23:13:43 Time since last Join: 1d 23:13:43

```

```

Group: 232.1.1.2
Source: 192.168.219.11
Flags: sparse,spt
Upstream interface: fe-1/2/0.0
Upstream neighbor: 1.1.4.1
Upstream state: Local RP, Join to Source
Keepalive timeout: 0
Uptime: 1d 23:13:43
Downstream neighbors:
  Interface: ge-0/3/0.0
    192.168.207.9 State: Join Flags: S Timeout: Infinity
    Uptime: 1d 23:13:43 Time since last Join: 1d 23:13:43

```

```

user@pr5> show pim join extensive
ge-0/3/1.0

Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

Instance: PIM.master Family: INET6
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

```

### *Checking the PIM Sources*

**Purpose** Verify that the PIM sources have the expected M-LDP in-band upstream and downstream details.

**Action** From operational mode, enter the **show pim source** command.

```

user@IngressPE> show pim source

Instance: PIM.master Family: INET

```

```
Source 1.1.1.1
  Prefix 1.1.1.1/32
  Upstream interface Local
  Upstream neighbor Local

Source 1.2.7.7
  Prefix 1.2.7.0/24
  Upstream protocol MLDP
  Upstream interface Pseudo MLDP
  Upstream neighbor MLDP LSP root <1.1.1.2>

Source 192.168.219.11
  Prefix 192.168.219.0/28
  Upstream protocol MLDP
  Upstream interface Pseudo MLDP
  Upstream neighbor MLDP LSP root <1.1.1.2>

user@EgressPE> show pim source
Instance: PIM.master Family: INET

Source 1.2.7.7
  Prefix 1.2.7.0/24
  Upstream interface fe-1/2/3.0
  Upstream neighbor 1.2.7.2

Source 1.2.7.7
  Prefix 1.2.7.0/24
  Upstream interface fe-1/2/3.0
  Upstream neighbor Direct

Source 192.168.219.11
  Prefix 192.168.219.0/28
  Upstream interface fe-1/3/1.0
  Upstream neighbor 192.168.219.9

Source 192.168.219.11
  Prefix 192.168.219.0/28
  Upstream interface fe-1/3/1.0
  Upstream neighbor Direct

user@pr3> show pim source

Instance: PIM.master Family: INET

Source 1.2.7.7
  Prefix 1.2.7.0/24
  Upstream protocol MLDP
  Upstream interface Pseudo MLDP
  Upstream neighbor MLDP LSP root <1.1.1.2>

Source 192.168.219.11
  Prefix 192.168.219.0/28
  Upstream protocol MLDP
  Upstream interface Pseudo MLDP
  Upstream neighbor MLDP LSP root <1.1.1.2>

user@pr4> show pim source
Instance: PIM.master Family: INET

Source 1.1.1.4
```

```
Prefix 1.1.1.4/32
Upstream interface Local
Upstream neighbor Local

Source 192.168.219.11
Prefix 192.168.219.0/28
Upstream interface fe-1/2/0.0
Upstream neighbor 1.1.4.1
```

### *Checking the LDP Database*

**Purpose** Make sure that the `show ldp database` command displays the expected root-to-(S,G) bindings.

```

Action user@IngressPE> show ldp database
Input label database, 10.255.2.227:0--1.1.1.3:0
  Label Prefix
  300096 1.1.1.2/32
    3     1.1.1.3/32
  299856 1.1.1.6/32
  299776 10.255.2.227/32

Output label database, 10.255.2.227:0--1.1.1.3:0
  Label Prefix
  300144 1.1.1.2/32
  299776 1.1.1.3/32
  299856 1.1.1.6/32
    3     10.255.2.227/32

Input label database, 10.255.2.227:0--1.1.1.6:0
  Label Prefix
  299936 1.1.1.2/32
  299792 1.1.1.3/32
    3     1.1.1.6/32
  299776 10.255.2.227/32

Output label database, 10.255.2.227:0--1.1.1.6:0
  Label Prefix
  300144 1.1.1.2/32
  299776 1.1.1.3/32
  299856 1.1.1.6/32
    3     10.255.2.227/32
  300432 P2MP root-addr 1.1.1.2, grp: 232.2.2.2, src: 1.2.7.7
  300288 P2MP root-addr 1.1.1.2, grp: 232.1.1.1, src: 192.168.219.11
  300160 P2MP root-addr 1.1.1.2, grp: 232.1.1.2, src: 192.168.219.11
  300480 P2MP root-addr 1.1.1.2, grp: 232.1.1.3, src: 192.168.219.11

user@EgressPE> show ldp database

Input label database, 1.1.1.2:0--1.1.1.3:0
  Label Prefix
  300096 1.1.1.2/32
    3     1.1.1.3/32
  299856 1.1.1.6/32
  299776 10.255.2.227/32
  300144 P2MP root-addr 1.1.1.2, grp: 232.2.2.2, src: 1.2.7.7
  300128 P2MP root-addr 1.1.1.2, grp: 232.1.1.2, src: 192.168.219.11

Output label database, 1.1.1.2:0--1.1.1.3:0
  Label Prefix
    3     1.1.1.2/32
  299776 1.1.1.3/32
  299808 1.1.1.6/32
  299792 10.255.2.227/32

Input label database, 1.1.1.2:0--1.1.1.6:0
  Label Prefix
  299936 1.1.1.2/32
  299792 1.1.1.3/32
    3     1.1.1.6/32
  299776 10.255.2.227/32
  300128 P2MP root-addr 1.1.1.2, grp: 232.2.2.2, src: 1.2.7.7
  299984 P2MP root-addr 1.1.1.2, grp: 232.1.1.1, src: 192.168.219.11
  299952 P2MP root-addr 1.1.1.2, grp: 232.1.1.2, src: 192.168.219.11

```

```

300176      P2MP root-addr 1.1.1.2, grp: 232.1.1.3, src: 192.168.219.11
300192      P2MP root-addr 1.1.1.2, grp: ff3e::1:2, src: abcd::1:2:7:7

```

```
Output label database, 1.1.1.2:0--1.1.1.6:0
```

```

Label      Prefix
3          1.1.1.2/32
299776     1.1.1.3/32
299808     1.1.1.6/32
299792     10.255.2.227/32

```

```
-----
```

```
logical-system: default
```

```
Input label database, 10.255.2.227:0--1.1.1.3:0
```

```

Label      Prefix
300096     1.1.1.2/32
3          1.1.1.3/32
299856     1.1.1.6/32
299776     10.255.2.227/32

```

```
Output label database, 10.255.2.227:0--1.1.1.3:0
```

```

Label      Prefix
300144     1.1.1.2/32
299776     1.1.1.3/32
299856     1.1.1.6/32
3          10.255.2.227/32

```

```
Input label database, 10.255.2.227:0--1.1.1.6:0
```

```

Label      Prefix
299936     1.1.1.2/32
299792     1.1.1.3/32
3          1.1.1.6/32
299776     10.255.2.227/32

```

```
Output label database, 10.255.2.227:0--1.1.1.6:0
```

```

Label      Prefix
300144     1.1.1.2/32
299776     1.1.1.3/32
299856     1.1.1.6/32
3          10.255.2.227/32
300432     P2MP root-addr 1.1.1.2, grp: 232.2.2.2, src: 1.2.7.7
300288     P2MP root-addr 1.1.1.2, grp: 232.1.1.1, src: 192.168.219.11
300160     P2MP root-addr 1.1.1.2, grp: 232.1.1.2, src: 192.168.219.11
300480     P2MP root-addr 1.1.1.2, grp: 232.1.1.3, src: 192.168.219.11
300496     P2MP root-addr 1.1.1.2, grp: ff3e::1:2, src: abcd::1:2:7:7

```

```
user@p6> show ldp database
```

```
Input label database, 1.1.1.6:0--1.1.1.2:0
```

```

Label      Prefix
3          1.1.1.2/32
299776     1.1.1.3/32
299808     1.1.1.6/32

```

```
Output label database, 1.1.1.6:0--1.1.1.2:0
```

```

Label      Prefix
299776     1.1.1.2/32
299792     1.1.1.3/32
3          1.1.1.6/32

```

```
user@pr3> show ldp database
```

Input label database, 1.1.1.3:0--1.1.1.2:0

| Label  | Prefix          |
|--------|-----------------|
| 3      | 1.1.1.2/32      |
| 299776 | 1.1.1.3/32      |
| 299808 | 1.1.1.6/32      |
| 299792 | 10.255.2.227/32 |

Output label database, 1.1.1.3:0--1.1.1.2:0

| Label         | Prefix                                                             |
|---------------|--------------------------------------------------------------------|
| 300096        | 1.1.1.2/32                                                         |
| 3             | 1.1.1.3/32                                                         |
| 299856        | 1.1.1.6/32                                                         |
| 299776        | 10.255.2.227/32                                                    |
| <b>300144</b> | <b>P2MP root-addr 1.1.1.2, grp: 232.2.2.2, src: 1.2.7.7</b>        |
| <b>300128</b> | <b>P2MP root-addr 1.1.1.2, grp: 232.1.1.2, src: 192.168.219.11</b> |

Input label database, 1.1.1.3:0--10.255.2.227:0

| Label  | Prefix          |
|--------|-----------------|
| 300144 | 1.1.1.2/32      |
| 299776 | 1.1.1.3/32      |
| 299856 | 1.1.1.6/32      |
| 3      | 10.255.2.227/32 |

Output label database, 1.1.1.3:0--10.255.2.227:0

| Label  | Prefix          |
|--------|-----------------|
| 300096 | 1.1.1.2/32      |
| 3      | 1.1.1.3/32      |
| 299856 | 1.1.1.6/32      |
| 299776 | 10.255.2.227/32 |

### *Looking Up the Route Information for the MPLS Label*

**Purpose** Display the point-to-multipoint FEC information.

**Action** user@EgressPE> show route label 299808 detail

```
mpls.0: 14 destinations, 14 routes (14 active, 0 holddown, 0 hidden)
299808 (1 entry, 1 announced)
  *LDP    Preference: 9
           Next hop type: Flood
           Address: 0x931922c
           Next-hop reference count: 3
           Next hop type: Router, Next hop index: 1109
           Address: 0x9318b0c
           Next-hop reference count: 2
           Next hop: via so-0/1/3.0
           Label operation: Pop
           Next hop type: Router, Next hop index: 1110
           Address: 0x93191e0
           Next-hop reference count: 2
           Next hop: 192.168.209.11 via fe-1/3/0.0
           Label operation: Pop
           State: **Active Int AckRequest>
           Local AS: 10
           Age: 13:08:15 Metric: 1
           Validation State: unverified
           Task: LDP
           Announcement bits (1): 0-KRT
           AS path: I
           FECs bound to route: P2MP root-addr 1.1.1.2, grp: 232.1.1.1, src:
192.168.219.11
```

### Checking the LDP Traffic Statistics

**Purpose** Monitor the data traffic statistics for the point-to-multipoint LSP.

**Action** user@EgressPE> show ldp traffic-statistics p2mp  
P2MP FEC Statistics:

| FEC(root_addr:lsp_id/grp,src)    | Nexthop     | Packets | Bytes |
|----------------------------------|-------------|---------|-------|
| Shared                           |             |         |       |
| 1.1.1.2:232.2.2.2,1.2.7.7        | so-0/1/3.0  | 0       | 0     |
| No                               |             |         |       |
| 1.1.1.2:232.1.1.1,192.168.219.11 | so-0/1/3.0  | 0       | 0     |
| No                               |             |         |       |
|                                  | fe-1/3/0.0  | 0       | 0     |
| No                               |             |         |       |
| 1.1.1.2:232.1.1.2,192.168.219.11 | so-0/1/3.0  | 0       | 0     |
| No                               |             |         |       |
|                                  | fe-1/3/0.0  | 0       | 0     |
| No                               |             |         |       |
|                                  | 1t-1/2/0.14 | 0       | 0     |
| No                               |             |         |       |
| 1.1.1.2:232.1.1.3,192.168.219.11 | fe-1/3/0.0  | 0       | 0     |
| No                               |             |         |       |
| 1.1.1.2:ff3e::1:2,abcd::1:2:7:7  | fe-1/3/0.0  | 0       | 0     |
| No                               |             |         |       |

**Related Documentation**

- *Example: Configuring RSVP-Signaled Point-to-Multipoint LSPs on Logical Systems*
- *Example: Configuring Point-to-Multipoint LDPLSPs as the Data Plane for Intra-AS MBGP MVPNs*



## Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain

This example shows how to configure multicast-only fast reroute (MoFRR) to minimize packet loss in a network when there is a link failure.

Multipoint LDP MoFRR is used at the egress node of an MPLS network, where the packets are forwarded to an IP network. In the case of multipoint LDP MoFRR, the two paths toward the upstream provider edge (PE) router are established for receiving two streams of MPLS packets at the label-edge router (LER). One of the streams (the primary) is accepted, and the other one (the backup) is dropped at the LER. The backup stream is accepted if the primary path fails.

- [Requirements on page 119](#)
- [Overview on page 119](#)
- [CLI Quick Configuration on page 120](#)
- [Configuration on page 126](#)
- [Verification on page 131](#)

### Requirements

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

In a multipoint LDP domain, for MoFRR to work, only the egress PE router needs to have MoFRR enabled. The other routers do not need to support MoFRR.

MoFRR is supported on MX Series platforms with MPC line cards. As a prerequisite, the router must be set to **network-services enhanced-ip** mode, and all the line-cards in the platform must be MPCs.

This example requires Junos OS Release 14.1 or later on the egress PE router.

### Overview

In this example, Device R3 is the egress edge router. MoFRR is enabled on this device only.

OSPF is used for connectivity, though any interior gateway protocol (IGP) or static routes can be used.

For testing purposes, routers are used to simulate the source and the receiver. Device R4 and Device R8 are configured to statically join the desired group by using the **set protocols igmp interface interface-name static group group** command. In the case when a real multicast receiver host is not available, as in this example, this static IGMP configuration is useful. On the receivers, to make them listen to the multicast group address, this example uses **set protocols sap listen group**.

MoFRR configuration includes a policy option that is not shown in this example, but is explained separately. The option is configured as follows:

```
stream-protection {
```

```

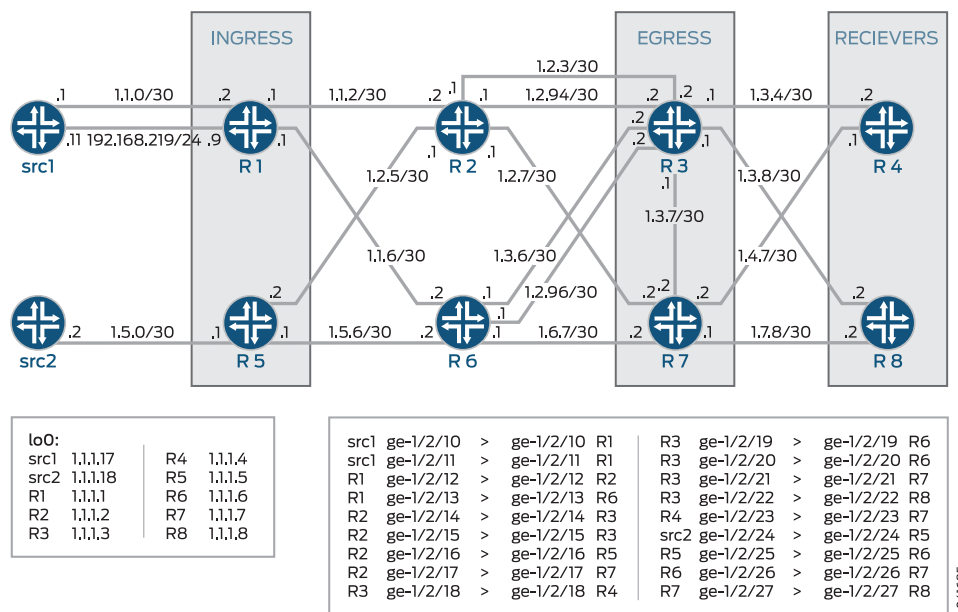
    policy policy-name;
}

```

## Topology

Figure 20 on page 120 shows the sample network.

Figure 20: MoFRR in an Multipoint LDP Domain



"CLI Quick Configuration" on page 120 shows the configuration for all of the devices in Figure 20 on page 120.

The section "Configuration" on page 126 describes the steps on Device R3.

## CLI Quick 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 src1**

```

set interfaces ge-1/2/10 unit 0 description src1-to-R1
set interfaces ge-1/2/10 unit 0 family inet address 1.1.0.1/30
set interfaces ge-1/2/11 unit 0 description src1-to-R1
set interfaces ge-1/2/11 unit 0 family inet address 192.168.219.11/24
set interfaces lo0 unit 0 family inet address 1.1.1.17/32
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface lo0.0 passive

```

**Device src2**

```

set interfaces ge-1/2/24 unit 0 description src2-to-R5
set interfaces ge-1/2/24 unit 0 family inet address 1.5.0.2/30
set interfaces lo0 unit 0 family inet address 1.1.1.18/32
set protocols rsvp interface all
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface lo0.0 passive

```

```

Device R1  set interfaces ge-1/2/12 unit 0 description R1-to-R2
            set interfaces ge-1/2/12 unit 0 family inet address 1.1.2.1/30
            set interfaces ge-1/2/12 unit 0 family mpls
            set interfaces ge-1/2/13 unit 0 description R1-to-R6
            set interfaces ge-1/2/13 unit 0 family inet address 1.1.6.1/30
            set interfaces ge-1/2/13 unit 0 family mpls
            set interfaces ge-1/2/10 unit 0 description R1-to-src1
            set interfaces ge-1/2/10 unit 0 family inet address 1.1.0.2/30
            set interfaces ge-1/2/11 unit 0 description R1-to-src1
            set interfaces ge-1/2/11 unit 0 family inet address 192.168.219.9/30
            set interfaces lo0 unit 0 family inet address 1.1.1.1/32
            set protocols rsvp interface all
            set protocols mpls interface all
            set protocols bgp group ibgp local-address 1.1.1.1
            set protocols bgp group ibgp export static-route-tobgp
            set protocols bgp group ibgp peer-as 10
            set protocols bgp group ibgp neighbor 1.1.1.3
            set protocols bgp group ibgp neighbor 1.1.1.7
            set protocols ospf traffic-engineering
            set protocols ospf area 0.0.0.0 interface all
            set protocols ospf area 0.0.0.0 interface lo0.0 passive
            set protocols ldp interface ge-1/2/12.0
            set protocols ldp interface ge-1/2/13.0
            set protocols ldp interface lo0.0
            set protocols ldp p2mp
            set protocols pim mldp-inband-signalling policy mldppim-ex
            set protocols pim rp static address 1.1.1.5
            set protocols pim interface lo0.0
            set protocols pim interface ge-1/2/10.0
            set protocols pim interface ge-1/2/11.0
            set policy-options policy-statement mldppim-ex term B from source-address-filter
              192.168.0.0/24 orlonger
            set policy-options policy-statement mldppim-ex term B from source-address-filter
              192.168.219.11/32 orlonger
            set policy-options policy-statement mldppim-ex term B then p2mp-lsp-root address
              1.1.1.2
            set policy-options policy-statement mldppim-ex term B then accept
            set policy-options policy-statement mldppim-ex term A from source-address-filter
              1.1.1.7/32 orlonger
            set policy-options policy-statement mldppim-ex term A from source-address-filter
              1.1.0.0/30 orlonger
            set policy-options policy-statement mldppim-ex term A then accept
            set policy-options policy-statement static-route-tobgp term static from protocol static
            set policy-options policy-statement static-route-tobgp term static from protocol direct
            set policy-options policy-statement static-route-tobgp term static then accept
            set routing-options autonomous-system 10

Device R2  set interfaces ge-1/2/12 unit 0 description R2-to-R1
            set interfaces ge-1/2/12 unit 0 family inet address 1.1.2.2/30
            set interfaces ge-1/2/12 unit 0 family mpls
            set interfaces ge-1/2/14 unit 0 description R2-to-R3
            set interfaces ge-1/2/14 unit 0 family inet address 1.2.3.1/30
            set interfaces ge-1/2/14 unit 0 family mpls
            set interfaces ge-1/2/16 unit 0 description R2-to-R5
            set interfaces ge-1/2/16 unit 0 family inet address 1.2.5.1/30

```

```
set interfaces ge-1/2/16 unit 0 family mpls
set interfaces ge-1/2/17 unit 0 description R2-to-R7
set interfaces ge-1/2/17 unit 0 family inet address 1.2.7.1/30
set interfaces ge-1/2/17 unit 0 family mpls
set interfaces ge-1/2/15 unit 0 description R2-to-R3
set interfaces ge-1/2/15 unit 0 family inet address 1.2.94.1/30
set interfaces ge-1/2/15 unit 0 family mpls
set interfaces lo0 unit 0 family inet address 1.1.1.2/32
set interfaces lo0 unit 0 family mpls
set protocols rsvp interface all
set protocols mpls interface all
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface all
set protocols ldp p2mp
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.0.0/24 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.219.11/32 orlonger
set policy-options policy-statement mldppim-ex term B then p2mp-lsp-root address
  1.1.1.2
set policy-options policy-statement mldppim-ex term B then accept
set routing-options autonomous-system 10
```

```
Device R3 set chassis network-services enhanced-ip
set interfaces ge-1/2/14 unit 0 description R3-to-R2
set interfaces ge-1/2/14 unit 0 family inet address 1.2.3.2/30
set interfaces ge-1/2/14 unit 0 family mpls
set interfaces ge-1/2/18 unit 0 description R3-to-R4
set interfaces ge-1/2/18 unit 0 family inet address 1.3.4.1/30
set interfaces ge-1/2/18 unit 0 family mpls
set interfaces ge-1/2/19 unit 0 description R3-to-R6
set interfaces ge-1/2/19 unit 0 family inet address 1.3.6.2/30
set interfaces ge-1/2/19 unit 0 family mpls
set interfaces ge-1/2/21 unit 0 description R3-to-R7
set interfaces ge-1/2/21 unit 0 family inet address 1.3.7.1/30
set interfaces ge-1/2/21 unit 0 family mpls
set interfaces ge-1/2/22 unit 0 description R3-to-R8
set interfaces ge-1/2/22 unit 0 family inet address 1.3.8.1/30
set interfaces ge-1/2/22 unit 0 family mpls
set interfaces ge-1/2/15 unit 0 description R3-to-R2
set interfaces ge-1/2/15 unit 0 family inet address 1.2.94.2/30
set interfaces ge-1/2/15 unit 0 family mpls
set interfaces ge-1/2/20 unit 0 description R3-to-R6
set interfaces ge-1/2/20 unit 0 family inet address 1.2.96.2/30
set interfaces ge-1/2/20 unit 0 family mpls
set interfaces lo0 unit 0 family inet address 1.1.1.3/32 primary
set routing-options autonomous-system 10
set routing-options multicast stream-protection
set protocols rsvp interface all
set protocols mpls interface all
set protocols bgp group ibgp local-address 1.1.1.3
set protocols bgp group ibgp peer-as 10
set protocols bgp group ibgp neighbor 1.1.1.1
set protocols bgp group ibgp neighbor 1.1.1.5
```

```

set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface all
set protocols ldp p2mp
set protocols pim mldp-inband-signalling policy mldppim-ex
set protocols pim interface lo0.0
set protocols pim interface ge-1/2/18.0
set protocols pim interface ge-1/2/22.0
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.0.0/24 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.219.11/32 orlonger
set policy-options policy-statement mldppim-ex term B then accept
set policy-options policy-statement mldppim-ex term A from source-address-filter
  1.1.0.1/30 orlonger
set policy-options policy-statement mldppim-ex term A then accept
set policy-options policy-statement static-route-tobgp term static from protocol static
set policy-options policy-statement static-route-tobgp term static from protocol direct
set policy-options policy-statement static-route-tobgp term static then accept

```

**Device R4**

```

set interfaces ge-1/2/18 unit 0 description R4-to-R3
set interfaces ge-1/2/18 unit 0 family inet address 1.3.4.2/30
set interfaces ge-1/2/18 unit 0 family mpls
set interfaces ge-1/2/23 unit 0 description R4-to-R7
set interfaces ge-1/2/23 unit 0 family inet address 1.4.7.1/30
set interfaces lo0 unit 0 family inet address 1.1.1.4/32
set protocols igmp interface ge-1/2/18.0 version 3
set protocols igmp interface ge-1/2/18.0 static group 232.1.1.1 group-count 2
set protocols igmp interface ge-1/2/18.0 static group 232.1.1.1 source 192.168.219.11
set protocols igmp interface ge-1/2/18.0 static group 232.2.2.2 source 1.2.7.7
set protocols sap listen 232.1.1.1
set protocols sap listen 232.2.2.2
set protocols rsvp interface all
set protocols mpls interface all
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols pim mldp-inband-signalling policy mldppim-ex
set protocols pim interface ge-1/2/23.0
set protocols pim interface ge-1/2/18.0
set protocols pim interface lo0.0
set policy-options policy-statement static-route-tobgp term static from protocol static
set policy-options policy-statement static-route-tobgp term static from protocol direct
set policy-options policy-statement static-route-tobgp term static then accept
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.0.0/24 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.219.11/32 orlonger
set policy-options policy-statement mldppim-ex term B then p2mp-lsp-root address
  1.1.1.2
set policy-options policy-statement mldppim-ex term B then accept
set routing-options autonomous-system 10

```

**Device R5**

```
set interfaces ge-1/2/24 unit 0 description R5-to-src2
set interfaces ge-1/2/24 unit 0 family inet address 1.5.0.1/30
set interfaces ge-1/2/16 unit 0 description R5-to-R2
set interfaces ge-1/2/16 unit 0 family inet address 1.2.5.2/30
set interfaces ge-1/2/16 unit 0 family mpls
set interfaces ge-1/2/25 unit 0 description R5-to-R6
set interfaces ge-1/2/25 unit 0 family inet address 1.5.6.1/30
set interfaces ge-1/2/25 unit 0 family mpls
set interfaces lo0 unit 0 family inet address 1.1.1.5/32
set protocols rsvp interface all
set protocols mpls interface all
set protocols bgp group ibgp local-address 1.1.1.5
set protocols bgp group ibgp export static-route-tobgp
set protocols bgp group ibgp peer-as 10
set protocols bgp group ibgp neighbor 1.1.1.7
set protocols bgp group ibgp neighbor 1.1.1.3
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface ge-1/2/16.0
set protocols ldp interface ge-1/2/25.0
set protocols ldp p2mp
set protocols pim interface lo0.0
set protocols pim interface ge-1/2/24.0
set policy-options policy-statement static-route-tobgp term static from protocol static
set policy-options policy-statement static-route-tobgp term static from protocol direct
set policy-options policy-statement static-route-tobgp term static then accept
set routing-options autonomous-system 10
```

**Device R6**

```
set interfaces ge-1/2/13 unit 0 description R6-to-R1
set interfaces ge-1/2/13 unit 0 family inet address 1.1.6.2/30
set interfaces ge-1/2/13 unit 0 family mpls
set interfaces ge-1/2/19 unit 0 description R6-to-R3
set interfaces ge-1/2/19 unit 0 family inet address 1.3.6.1/30
set interfaces ge-1/2/19 unit 0 family mpls
set interfaces ge-1/2/25 unit 0 description R6-to-R5
set interfaces ge-1/2/25 unit 0 family inet address 1.5.6.2/30
set interfaces ge-1/2/25 unit 0 family mpls
set interfaces ge-1/2/26 unit 0 description R6-to-R7
set interfaces ge-1/2/26 unit 0 family inet address 1.6.7.1/30
set interfaces ge-1/2/26 unit 0 family mpls
set interfaces ge-1/2/20 unit 0 description R6-to-R3
set interfaces ge-1/2/20 unit 0 family inet address 1.2.96.1/30
set interfaces ge-1/2/20 unit 0 family mpls
set interfaces lo0 unit 0 family inet address 1.1.1.6/30
set protocols rsvp interface all
set protocols mpls interface all
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface all
set protocols ldp p2mp
```

**Device R7**

```
set interfaces ge-1/2/17 unit 0 description R7-to-R2
set interfaces ge-1/2/17 unit 0 family inet address 1.2.7.2/30
```

```

set interfaces ge-1/2/17 unit 0 family mpls
set interfaces ge-1/2/21 unit 0 description R7-to-R3
set interfaces ge-1/2/21 unit 0 family inet address 1.3.7.2/30
set interfaces ge-1/2/21 unit 0 family mpls
set interfaces ge-1/2/23 unit 0 description R7-to-R4
set interfaces ge-1/2/23 unit 0 family inet address 1.4.7.2/30
set interfaces ge-1/2/23 unit 0 family mpls
set interfaces ge-1/2/26 unit 0 description R7-to-R6
set interfaces ge-1/2/26 unit 0 family inet address 1.6.7.2/30
set interfaces ge-1/2/26 unit 0 family mpls
set interfaces ge-1/2/27 unit 0 description R7-to-R8
set interfaces ge-1/2/27 unit 0 family inet address 1.7.8.1/30
set interfaces ge-1/2/27 unit 0 family mpls
set interfaces lo0 unit 0 family inet address 1.1.1.7/32
set protocols rsvp interface all
set protocols mpls interface all
set protocols bgp group ibgp local-address 1.1.1.7
set protocols bgp group ibgp export static-route-tobgp
set protocols bgp group ibgp peer-as 10
set protocols bgp group ibgp neighbor 1.1.1.5
set protocols bgp group ibgp neighbor 1.1.1.1
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface ge-1/2/17.0
set protocols ldp interface ge-1/2/21.0
set protocols ldp interface ge-1/2/26.0
set protocols ldp p2mp
set protocols pim mldp-inband-signalling policy mldppim-ex
set protocols pim interface lo0.0
set protocols pim interface ge-1/2/27.0
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.0.0/24 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
  192.168.219.11/32 orlonger
set policy-options policy-statement mldppim-ex term B then accept
set policy-options policy-statement mldppim-ex term A from source-address-filter
  1.1.0.1/30 orlonger
set policy-options policy-statement mldppim-ex term A then accept
set policy-options policy-statement static-route-tobgp term static from protocol static
set policy-options policy-statement static-route-tobgp term static from protocol direct
set policy-options policy-statement static-route-tobgp term static then accept
set routing-options autonomous-system 10
set routing-options multicast stream-protection policy mldppim-ex

```

**Device R8**

```

set interfaces ge-1/2/22 unit 0 description R8-to-R3
set interfaces ge-1/2/22 unit 0 family inet address 1.3.8.2/30
set interfaces ge-1/2/22 unit 0 family mpls
set interfaces ge-1/2/27 unit 0 description R8-to-R7
set interfaces ge-1/2/27 unit 0 family inet address 1.7.8.2/30
set interfaces ge-1/2/27 unit 0 family mpls
set interfaces lo0 unit 0 family inet address 1.1.1.8/32
set protocols igmp interface ge-1/2/22.0 version 3
set protocols igmp interface ge-1/2/22.0 static group 232.1.1.1 group-count 2
set protocols igmp interface ge-1/2/22.0 static group 232.1.1.1 source 192.168.219.11
set protocols igmp interface ge-1/2/22.0 static group 232.2.2.2 source 1.2.7.7

```

```

set protocols sap listen 232.1.1.1
set protocols sap listen 232.2.2.2
set protocols rsvp interface all
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface all
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols pim mldp-inband-signalling policy mldppim-ex
set protocols pim interface ge-1/2/27.0
set protocols pim interface ge-1/2/22.0
set protocols pim interface lo0.0
set policy-options policy-statement static-route-tobgp term static from protocol static
set policy-options policy-statement static-route-tobgp term static from protocol direct
set policy-options policy-statement static-route-tobgp term static then accept
set policy-options policy-statement mldppim-ex term B from source-address-filter
    192.168.0.0/24 orlonger
set policy-options policy-statement mldppim-ex term B from source-address-filter
    192.168.219.11/32 orlonger
set policy-options policy-statement mldppim-ex term B then p2mp-lsp-root address
    1.1.1.2
set policy-options policy-statement mldppim-ex term B then accept
set routing-options autonomous-system 10

```

## Configuration

**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 Device R3:

1. Enable enhanced IP mode.

```

[edit chassis]
user@R3# set network-services enhanced-ip

```

2. Configure the device interfaces.

```

[edit interfaces]
user@R3# set ge-1/2/14 unit 0 description R3-to-R2
user@R3# set ge-1/2/14 unit 0 family inet address 1.2.3.2/30
user@R3# set ge-1/2/14 unit 0 family mpls

```

```

user@R3# set ge-1/2/18 unit 0 description R3-to-R4
user@R3# set ge-1/2/18 unit 0 family inet address 1.3.4.1/30
user@R3# set ge-1/2/18 unit 0 family mpls

```

```

user@R3# set ge-1/2/19 unit 0 description R3-to-R6
user@R3# set ge-1/2/19 unit 0 family inet address 1.3.6.2/30
user@R3# set ge-1/2/19 unit 0 family mpls

```

```

user@R3# set ge-1/2/21 unit 0 description R3-to-R7
user@R3# set ge-1/2/21 unit 0 family inet address 1.3.7.1/30
user@R3# set ge-1/2/21 unit 0 family mpls

```

```

user@R3# set ge-1/2/22 unit 0 description R3-to-R8

```



```
user@R3# set ge-1/2/22 unit 0 family inet address 1.3.8.1/30
user@R3# set ge-1/2/22 unit 0 family mpls
```

```
user@R3# set ge-1/2/15 unit 0 description R3-to-R2
user@R3# set ge-1/2/15 unit 0 family inet address 1.2.94.2/30
user@R3# set ge-1/2/15 unit 0 family mpls
```

```
user@R3# set ge-1/2/20 unit 0 description R3-to-R6
user@R3# set ge-1/2/20 unit 0 family inet address 1.2.96.2/30
user@R3# set ge-1/2/20 unit 0 family mpls
```

```
user@R3# set lo0 unit 0 family inet address 1.1.1.3/32 primary
```

3. Configure the autonomous system (AS) number.

```
user@R3# set routing-options autonomous-system 10
```

4. Configure the routing policies.

```
[edit policy-options policy-statement mldppim-ex]
user@R3# set term B from source-address-filter 192.168.0.0/24 orlonger
user@R3# set term B from source-address-filter 192.168.219.11/32 orlonger
user@R3# set term B then accept
user@R3# set term A from source-address-filter 1.1.0.1/30 orlonger
user@R3# set term A then accept
```

```
[edit policy-options policy-statement static-route-tobgp]
user@R3# set term static from protocol static
user@R3# set term static from protocol direct
user@R3# set term static then accept
```

5. Configure PIM.

```
[edit protocols pim]
user@R3# set mldp-inband-signalling policy mldppim-ex
user@R3# set interface lo0.0
user@R3# set interface ge-1/2/18.0
user@R3# set interface ge-1/2/22.0
```

6. Configure LDP.

```
[edit protocols ldp]
user@R3# set interface all
user@R3# set p2mp
```

7. Configure an IGP or static routes.

```
[edit protocols ospf]
user@R3# set traffic-engineering
user@R3# set area 0.0.0.0 interface all
user@R3# set area 0.0.0.0 interface fxp0.0 disable
user@R3# set area 0.0.0.0 interface lo0.0 passive
```

8. Configure internal BGP.

```
[edit protocols bgp group ibgp]
user@R3# set local-address 1.1.1.3
user@R3# set peer-as 10
user@R3# set neighbor 1.1.1.1
```

```
user@R3# set neighbor 1.1.1.5
```

9. Configure MPLS and, optionally, RSVP.

```
[edit protocols mpls]  
user@R3# set interface all
```

```
[edit protocols rsvp]  
user@R3# set interface all
```

10. Enable MoFRR.

```
[edit routing-options multicast]  
user@R3# set stream-protection
```

**Results** From configuration mode, confirm your configuration by entering the **show chassis**, **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 chassis  
network-services enhanced-ip;
```

```
user@R3# show interfaces
```

```
ge-1/2/14 {  
  unit 0 {  
    description R3-to-R2;  
    family inet {  
      address 1.2.3.2/30;  
    }  
    family mpls;  
  }  
}
```

```
ge-1/2/18 {  
  unit 0 {  
    description R3-to-R4;  
    family inet {  
      address 1.3.4.1/30;  
    }  
    family mpls;  
  }  
}
```

```
ge-1/2/19 {  
  unit 0 {  
    description R3-to-R6;  
    family inet {  
      address 1.3.6.2/30;  
    }  
    family mpls;  
  }  
}
```

```
ge-1/2/21 {  
  unit 0 {  
    description R3-to-R7;  
    family inet {  
      address 1.3.7.1/30;  
    }  
  }  
}
```

```

    }
    family mpls;
  }
}
ge-1/2/22 {
  unit 0 {
    description R3-to-R8;
    family inet {
      address 1.3.8.1/30;
    }
    family mpls;
  }
}
ge-1/2/15 {
  unit 0 {
    description R3-to-R2;
    family inet {
      address 1.2.94.2/30;
    }
    family mpls;
  }
}
ge-1/2/20 {
  unit 0 {
    description R3-to-R6;
    family inet {
      address 1.2.96.2/30;
    }
    family mpls;
  }
}
lo0 {
  unit 0 {
    family inet {
      address 192.168.15.1/32;
      address 1.1.1.3/32 {
        primary;
      }
    }
  }
}

user@R3# show protocols
rsvp {
  interface all;
}
mpls {
  interface all;
}
bgp {
  group ibgp {
    local-address 1.1.1.3;
    peer-as 10;
    neighbor 1.1.1.1;
    neighbor 1.1.1.5;
  }
}

```

```

}
ospf {
  traffic-engineering;
  area 0.0.0.0 {
    interface all;
    interface fxp0.0 {
      disable;
    }
    interface lo0.0 {
      passive;
    }
  }
}
ldp {
  interface all;
  p2mp;
}
pim {
  mldp-inband-signalling {
    policy mldppim-ex;
  }
  interface lo0.0;
  interface ge-1/2/18.0;
  interface ge-1/2/22.0;
}

user@R3# show policy-options
policy-statement mldppim-ex {
  term B {
    from {
      source-address-filter 192.168.0.0/24 orlonger;
      source-address-filter 192.168.219.11/32 orlonger;
    }
    then accept;
  }
  term A {
    from {
      source-address-filter 1.1.0.1/30 orlonger;
    }
    then accept;
  }
}
policy-statement static-route-tobgp {
  term static {
    from protocol [ static direct ];
    then accept;
  }
}

user@R3# show routing-options
autonomous-system 10;
multicast {
  stream-protection;
}

```

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

## Verification

Confirm that the configuration is working properly.

- [Checking the LDP Point-to-Multipoint Forwarding Equivalency Classes on page 131](#)
- [Examining the Label Information on page 131](#)
- [Checking the Multicast Routes on page 133](#)
- [Checking the LDP Point-to-Multipoint Traffic Statistics on page 134](#)

---

### Checking the LDP Point-to-Multipoint Forwarding Equivalency Classes

**Purpose** Make sure the MoFRR is enabled, and determine what labels are being used.

**Action** user@R3> show ldp p2mp fec

```
LDP P2MP FECs:
P2MP root-addr 1.1.1.1, grp: 232.1.1.1, src: 192.168.219.11
  MoFRR enabled
  Fec type: Egress (Active)
  Label: 301568
P2MP root-addr 1.1.1.1, grp: 232.1.1.2, src: 192.168.219.11
  MoFRR enabled
  Fec type: Egress (Active)
  Label: 301600
```

**Meaning** The output shows that MoFRR is enabled, and it shows that the labels 301568 and 301600 are being used for the two multipoint LDP point-to-multipoint LSPs.

---

### Examining the Label Information

**Purpose** Make sure that the egress device has two upstream interfaces for the multicast group join.

**Action** user@R3> 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: 0xffff
               ge-1/2/19.0, 1.3.6.1, Label: 301584, weight: 0xffff

```

user@R3> show route label 301600 detail

```

mpls.0: 18 destinations, 18 routes (18 active, 0 holddown, 0 hidden)
301600 (1 entry, 1 announced)
  *LDP    Preference: 9
           Next hop type: Flood
           Address: 0x27356b4
           Next-hop reference count: 3
           Next hop type: Router, Next hop index: 1520
           Address: 0x27350f4
           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: 1481
           Address: 0x273645c
           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: 54:25 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: 232.1.1.2, src:
192.168.219.11
Primary Upstream : 1.1.1.3:0--1.1.1.6:0
RPF Nexthops :
    ge-1/2/20.0, 1.2.96.1, Label: 301600, weight: 0x1
    ge-1/2/19.0, 1.3.6.1, Label: 301600, weight: 0x1
Backup Upstream : 1.1.1.3:0--1.1.1.2:0
RPF Nexthops :
    ge-1/2/15.0, 1.2.94.1, Label: 301616, weight: 0xfffe
    ge-1/2/14.0, 1.2.3.1, Label: 301616, weight: 0xfffe

```

**Meaning** The output shows the primary upstream paths and the backup upstream paths. It also shows the RPF next hops.

### Checking the Multicast Routes

**Purpose** Examine the IP multicast forwarding table to make sure that there is an upstream RPF interface list, with a primary and a backup interface.

**Action** user@R3> show ldp p2mp path

```

P2MP path type: Transit/Egress
  Output Session (label): 1.1.1.2:0 (301568) (Primary)
  Egress Nexthops: Interface ge-1/2/18.0
                   Interface ge-1/2/22.0
  RPF Nexthops:   Interface ge-1/2/15.0, 1.2.94.1, 301568, 1
                   Interface ge-1/2/20.0, 1.2.96.1, 301584, 65534
                   Interface ge-1/2/14.0, 1.2.3.1, 301568, 1
                   Interface ge-1/2/19.0, 1.3.6.1, 301584, 65534
  Attached FECs:  P2MP root-addr 1.1.1.1, grp: 232.1.1.1, src: 192.168.219.11
(Active)
P2MP path type: Transit/Egress
  Output Session (label): 1.1.1.6:0 (301584) (Backup)
  Egress Nexthops: Interface ge-1/2/18.0
                   Interface ge-1/2/22.0
  RPF Nexthops:   Interface ge-1/2/15.0, 1.2.94.1, 301568, 1
                   Interface ge-1/2/20.0, 1.2.96.1, 301584, 65534
                   Interface ge-1/2/14.0, 1.2.3.1, 301568, 1
                   Interface ge-1/2/19.0, 1.3.6.1, 301584, 65534
  Attached FECs:  P2MP root-addr 1.1.1.1, grp: 232.1.1.1, src: 192.168.219.11
(Active)
P2MP path type: Transit/Egress
  Output Session (label): 1.1.1.6:0 (301600) (Primary)
  Egress Nexthops: Interface ge-1/2/18.0
                   Interface ge-1/2/22.0
  RPF Nexthops:   Interface ge-1/2/15.0, 1.2.94.1, 301616, 65534
                   Interface ge-1/2/20.0, 1.2.96.1, 301600, 1
                   Interface ge-1/2/14.0, 1.2.3.1, 301616, 65534
                   Interface ge-1/2/19.0, 1.3.6.1, 301600, 1
  Attached FECs:  P2MP root-addr 1.1.1.1, grp: 232.1.1.2, src: 192.168.219.11
(Active)
P2MP path type: Transit/Egress
  Output Session (label): 1.1.1.2:0 (301616) (Backup)
  Egress Nexthops: Interface ge-1/2/18.0
                   Interface ge-1/2/22.0
  RPF Nexthops:   Interface ge-1/2/15.0, 1.2.94.1, 301616, 65534
                   Interface ge-1/2/20.0, 1.2.96.1, 301600, 1
                   Interface ge-1/2/14.0, 1.2.3.1, 301616, 65534
                   Interface ge-1/2/19.0, 1.3.6.1, 301600, 1
  Attached FECs:  P2MP root-addr 1.1.1.1, grp: 232.1.1.2, src: 192.168.219.11
(Active)

```

**Meaning** The output shows primary and backup sessions, and RPF next hops.

### Checking the LDP Point-to-Multipoint Traffic Statistics

**Purpose** Make sure that both primary and backup statistics are listed.



**Action** user@R3> `show ldp traffic-statistics p2mp`

P2MP FEC Statistics:

| FEC(root_addr:lsp_id/grp,src)                                 | Nexthop | Packets | Bytes |
|---------------------------------------------------------------|---------|---------|-------|
| Shared                                                        |         |         |       |
| 1.1.1.1:232.1.1.1,192.168.219.11, Label: 301568               | 1.3.8.2 | 0       | 0     |
| No                                                            | 1.3.4.2 | 0       | 0     |
| No                                                            |         |         |       |
| 1.1.1.1:232.1.1.1,192.168.219.11, Label: 301584, Backup route | 1.3.4.2 | 0       | 0     |
| No                                                            | 1.3.8.2 | 0       | 0     |
| No                                                            |         |         |       |
| 1.1.1.1:232.1.1.2,192.168.219.11, Label: 301600               | 1.3.8.2 | 0       | 0     |
| No                                                            | 1.3.4.2 | 0       | 0     |
| No                                                            |         |         |       |
| 1.1.1.1:232.1.1.2,192.168.219.11, Label: 301616, Backup route | 1.3.4.2 | 0       | 0     |
| No                                                            | 1.3.8.2 | 0       | 0     |
| No                                                            |         |         |       |

**Meaning** The output shows both primary and backup routes with the labels.

- Related Documentation**
- [Understanding Multicast-Only Fast Reroute on page 9](#)
  - [Configuring Multicast-Only Fast Reroute on page 79](#)
  - *Example: Configuring Multicast-Only Fast Reroute in a PIM Domain*



## CHAPTER 4

# LDP Configuration Statements

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## allow-subnet-mismatch

---

|                                 |                                                                                                                                                                                                                                                            |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | allow-subnet-mismatch;                                                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp interface <i>interface-name</i> ],<br>[edit protocols ldp interface <i>interface-name</i> ]                                                                                                 |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.3.                                                                                                                                                                                                              |
| <b>Description</b>              | Ignore the LDP subnet check. For Junos OS Release 8.4 and later releases, an LDP source address subnet check was added for the neighbor establishment procedure. The source address in the LDP link hello packet is matched against the interface address. |
| <b>Default</b>                  | The source address in the LDP link hello packet is matched against the interface address.                                                                                                                                                                  |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                        |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Ignoring the LDP Subnet Check on page 50</a></li></ul>                                                                                                                                                 |

## authentication-algorithm

**Syntax** authentication-algorithm *algorithm*;

**Hierarchy Level** [edit logical-systems *logical-system-name* protocols bgp],  
 [edit logical-systems *logical-system-name* protocols bgp group *group-name*],  
 [edit logical-systems *logical-system-name* protocols bgp group *group-name* neighbor *address*],  
 [edit logical-systems *logical-system-name* protocols ldp session *session-address*],  
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols bgp],  
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols bgp group *group-name*],  
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols bgp group *group-name* neighbor *address*],  
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols ldp session *session-address*],  
 [edit logical-systems *logical-system-name* routing-options bmp],  
 [edit logical-systems *logical-system-name* routing-options bmp station *station-name*],  
 [edit protocols bgp],  
 [edit protocols bgp group *group-name*],  
 [edit protocols bgp group *group-name* neighbor *address*],  
 [edit protocols ldp session *session-address*],  
 [edit routing-instances *routing-instance-name* protocols bgp],  
 [edit routing-instances *routing-instance-name* protocols bgp group *group-name*],  
 [edit routing-instances *routing-instance-name* protocols bgp group *group-name* neighbor *address*],  
 [edit routing-instances *routing-instance-name* protocols ldp session *session-address*],  
 [edit routing-options bmp],  
 [edit routing-options bmp station *station-name*]

**Release Information** Statement introduced in Junos OS Release 7.6.  
 Statement introduced for BGP 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.  
 Statement introduced for BMP in Junos OS Release 13.2X51-D15 for the QFX Series.  
 Statement introduced for BMP in Junos OS Release 13.3.

**Description** Configure an authentication algorithm type.

**Options** *algorithm*—Specify one of the following types of authentication algorithms:

- **aes-128-cmac-96**—Cipher-based message authentication code (AES128, 96 bits).
- **hmac-sha-1-96**—Hash-based message authentication code (SHA1, 96 bits).
- **md5**—Message digest 5.

**Default:** hmac-sha-1-96



**NOTE:** The default is not displayed in the output of the `show bgp bmp` command unless a key or key-chain is also configured.

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

**Related Documentation**

- *Example: Configuring Route Authentication for BGP*
- *Configuring BGP Monitoring Protocol Version 3*

## authentication-key (Protocols LDP)

---

**Syntax** authentication-key *md5-authentication-key*;

**Hierarchy Level** [edit logical-systems *logical-system-name* protocols ldp session *address*],  
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols  
ldp session *address*],  
[edit protocols ldp session *address*],  
[edit routing-instances *routing-instance-name* protocols ldp session *address*]

**Release Information** Statement introduced before Junos OS Release 7.4.

**Description** Configure the MD5 authentication signature. The maximum length of the authentication signature is 69 characters.

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

**Related Documentation**

- [Configuring the TCP MD5 Signature for LDP Sessions on page 47](#)

## authentication-key-chain (Protocols LDP)

---

|                                 |                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | authentication-key-chain <i>key-chain</i> ;                                                                                                                                                                                                                                                                                                             |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>name</i> protocols ldp session <i>address</i> ],<br>[edit logical-systems <i>name</i> routing-instances <i>instance-name</i> protocols ldp session <i>address</i> ],<br>[edit protocols ldp session <i>address</i> ],<br>[edit routing-instances <i>instance-name</i> protocols ldp session <i>address</i> ]                   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 8.0.<br>Statement introduced in Junos OS Release 9.0 for EX Series switches.<br>Statement introduced in Junos OS Release 11.3 for the QFX Series.                                                                                                                                                              |
| <b>Description</b>              | Apply and enable an authentication keychain to the routing device. Note that the referenced key chain must be defined. When configuring the authentication key update mechanism for LDP, you cannot commit the <b>0.0.0.0/allow</b> statement with authentication keys or key chains. The CLI issues a warning and fails to commit such configurations. |
| <b>Options</b>                  | <b>key-chain</b> —Authentication keychain name. It can be up to 126 characters. Characters can include any ASCII strings. If you include spaces, enclose all characters in quotation marks (" ").                                                                                                                                                       |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Configuring the Authentication Key Update Mechanism for BGP and LDP Routing Protocols</i></li><li>• <a href="#">Configuring Miscellaneous LDP Properties on page 45</a></li></ul>                                                                                                                            |



## bfd-liveness-detection (Protocols LDP)

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <pre> bfd-liveness-detection {   detection-time threshold <i>milliseconds</i>;   ecmp;   failure-action {     remove-nexthop;     remove-route;   }   holddown-interval <i>seconds</i>;   minimum-interval <i>milliseconds</i>;   minimum-receive-interval <i>milliseconds</i>;   minimum-transmit-interval <i>milliseconds</i>;   multiplier <i>detection-time-multiplier</i>;   no-adaptation;   transmit-interval {     minimum-interval <i>milliseconds</i>;     threshold <i>milliseconds</i>;   }   version (0   1   automatic); } </pre> |
| <b>Hierarchy Level</b>     | <p>[edit logical-systems <i>logical-system-name</i> protocols ldp <b>oam</b>],<br/> [edit logical-systems <i>logical-system-name</i> protocols ldp oam <b>fec address</b>],<br/> [edit protocols ldp <b>oam</b>],<br/> [edit protocols ldp oam <b>fec address</b>]</p>                                                                                                                                                                                                                                                                          |
| <b>Release Information</b> | <p>Statement introduced in Junos OS Release 7.6.</p> <p>Support for the <b>bfd-liveness-detection</b> statement at the [edit protocols ldp oam <b>fec address</b>] hierarchy level and the <b>ecmp</b> option added in Junos OS Release 9.0.</p> <p>Support for the <b>failure-action</b> statement with the <b>remove-nexthop</b> and <b>remove-route</b> options and the <b>holddown-interval</b> statement added in Junos OS Release 9.4.</p>                                                                                                |
| <b>Description</b>         | <p>Enable Bidirectional Forwarding Detection (BFD) for all MPLS LSPs or for just a specific LSP.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Options</b>             | <p><b>minimum-interval</b>—Minimum transmit and receive interval.<br/> <b>Range:</b> 50 through 255,000 milliseconds<br/> <b>Default:</b> 50</p> <p><b>minimum-receive-interval</b>—Minimum receive interval.<br/> <b>Range:</b> 50 through 255,000 milliseconds<br/> <b>Default:</b> 50</p> <p><b>minimum-transmit-interval</b>—Minimum transmit interval.<br/> <b>Range:</b> 50 through 255,000 milliseconds<br/> <b>Default:</b> 50</p> <p><b>multiplier</b>—Detection time multiplier.<br/> <b>Range:</b> 50 through 255</p>                |

**Default:** 3

The other options 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**

- [Configuring BFD for LDP LSPs on page 34](#)

---

## deaggregate

---

**Syntax** deaggregate | no-deaggregate;

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

**Release Information** Statement introduced before Junos OS Release 7.4.

**Description** Control forwarding equivalence class (FEC) deaggregation on the router. The use of the **deaggregate** statement in LDP is a standard practice that we recommend for LDP deployments.

**Default** Deaggregation is disabled on the router.

**Options** **deaggregate**—Deaggregate FECs.  
**no-deaggregate**—Aggregate FECs.

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

**Related Documentation**

- [Configuring FEC Deaggregation on page 32](#)

## disable (Protocols LDP)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | disable;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp graceful-restart],<br>[edit logical-systems <i>logical-system-name</i> protocols ldp interface <i>interface-name</i> ],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp interface <i>interface-name</i> ],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options graceful-restart],<br>[edit protocols ldp graceful-restart],<br>[edit protocols ldp interface <i>interface-name</i> ],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp interface <i>interface-name</i> ],<br>[edit routing-instances <i>routing-instance-name</i> routing-options graceful-restart] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>              | Explicitly disable LDP on an interface, or explicitly disable LDP graceful restart.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Default</b>                  | LDP is enabled on interfaces configured with the LDP <b>interface</b> statement. LDP graceful restart is automatically enabled when graceful restart is enabled under the <b>[edit routing-options]</b> hierarchy level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Enabling and Disabling LDP on page 20</a></li> <li>• <a href="#">Configuring LDP Graceful Restart on page 24</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## dod-request-policy

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|                                 |                                                                                                                                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>dod-request-policy <i>dod-request-policy-name</i>;</code>                                                                                                            |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit protocols ldp]                                                                                   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 12.2.                                                                                                                             |
| <b>Description</b>              | Specify the name of the LDP downstream on demand request policy. LDP sends label request messages only for those FECs matching in the downstream on demand request policy. |
| <b>Options</b>                  | <i>dod-request-policy-name</i> —Specify the name of the downstream on demand request policy.                                                                               |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                        |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring LDP Downstream on Demand on page 83</a></li></ul>                                                 |

## downstream-on-demand

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>downstream-on-demand;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | [edit logical systems <i>logical-system-name</i> protocols ldp session <i>session-address</i> ],<br>[edit protocols ldp session <i>session-address</i> ]                                                                                                                                                                                                                                                                                                                                      |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 12.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b>              | Enable LDP downstream on demand on the LDP session. LDP is widely deployed in downstream unsolicited advertisement mode. As service providers integrate the access and aggregation networks into a single MPLS domain, LDP downstream on demand is needed to distribute the bindings between access and aggregation networks to minimize the workload for the access node (AN) control plane and to avoid the storage of tens of thousands of label bindings from upstream aggregation nodes. |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring LDP Downstream on Demand on page 83</a></li></ul>                                                                                                                                                                                                                                                                                                                                                                    |

## ecmp

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>ecmp;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp oam bfd-liveness-detection],<br>[edit logical-systems <i>logical-system-name</i> protocols ldp oam fec address<br>bfd-liveness-detection],<br>[edit protocols ldp oam bfd-liveness-detection],<br>[edit protocols ldp oam fec address bfd-liveness-detection]                                                                                                                                                                                                          |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 8.5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>              | Allows LDP to establish BFD sessions for all ECMP paths configured for the specified FEC. If you configure the <b>ecmp</b> statement, you must also configure the <b>periodic-traceroute</b> statement for the specified FEC. If you do not do so, the commit operation fails. You can configure the <b>periodic-traceroute</b> statement at the global hierarchy level ([edit protocols ldp oam]) while only configuring the <b>ecmp</b> statement for a specific FEC ([edit protocols ldp oam fec address bfd-liveness-detection]). |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring ECMP-Aware BFD for LDP LSPs on page 37</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                |

## egress-policy

|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>egress-policy [ <i>policy-names</i> ];</code>                                                                                                                                                                                                                                 |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Control the prefixes advertised into LDP.                                                                                                                                                                                                                                           |
| <b>Default</b>                  | Only the loopback address is advertised.                                                                                                                                                                                                                                            |
| <b>Options</b>                  | <i>policy-names</i> —Name of one or more routing policies.                                                                                                                                                                                                                          |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring the Prefixes Advertised into LDP from the Routing Table on page 31</a></li> </ul>                                                                                                                                  |

## explicit-null (Protocols LDP)

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|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | explicit-null;                                                                                                                                                                                                                                                                      |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Advertise label 0 to the egress router of a label-switched path (LSP).                                                                                                                                                                                                              |
| <b>Default</b>                  | If you do not include the <b>explicit-null</b> statement in the MPLS configuration, label 3 (implicit null) is advertised.                                                                                                                                                          |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring MPLS and LDP to Pop the Label on the Ultimate-Hop Router on page 46</a></li></ul>                                                                                                                                   |

## export (Protocols LDP)

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|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | export [ <i>policy-names</i> ];                                                                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Apply policy filters to outbound LDP label bindings. Filters are applied to all label bindings from all neighbors.                                                                                                                                                                  |
| <b>Options</b>                  | <i>policy-names</i> —Name of one or more routing policies.                                                                                                                                                                                                                          |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Filtering Outbound LDP Label Bindings on page 28</a></li></ul>                                                                                                                                                                  |

## failure-action (Protocols LDP)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>failure-action {     remove-nexthop;     remove-route; }</pre>                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>          | <p>[edit logical-systems <i>logical-system-name</i> protocols ldp oam bfd-liveness-detection],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols ldp oam fec <i>address</i> bfd-liveness-detection],</p> <p>[edit protocols ldp oam bfd-liveness-detection],</p> <p>[edit protocols ldp oam fec <i>address</i> bfd-liveness-detection]</p>                                                                         |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.4.                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b>              | Configure route and next-hop properties in the event of a BFD session failure event on an LDP LSP. The failure event could be an existing BFD session that has gone down or could be a BFD session that never came up. LDP adds back the route or next hop when the relevant BFD session comes back up.                                                                                                                            |
| <b>Options</b>                  | <p><b>remove-nexthop</b>—Remove a route corresponding to a next hop of the LSP's route at the ingress node when a BFD session failure event is detected.</p> <p><b>remove-route</b>—Remove the route corresponding to an LSP from the appropriate routing tables when a BFD session failure event is detected. If the LSP is configured with ECMP and a BFD session corresponding to any path goes down, the route is removed.</p> |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring a Failure Action for the BFD Session on an LDP LSP on page 37</a></li> </ul>                                                                                                                                                                                                                                                                                      |

## fec

```

Syntax  fec fec-address {
        bfd-liveness-detection {
            detection-time threshold milliseconds;
            ecmp;
            failure-action {
                remove-nexthop;
                remove-route;
            }
            holddown-interval milliseconds;
            ingress-policy ingress-policy-name;
            minimum-interval milliseconds;
            minimum-receive-interval milliseconds;
            minimum-transmit-interval milliseconds;
            multiplier detection-time-multiplier;
            no-adaptation;
            transmit-interval {
                minimum-interval milliseconds;
                threshold milliseconds;
            }
            version (0 | 1 | automatic);
        }
        no-bfd-liveness-detection;
        periodic-traceroute {
            disable;
            exp exp-value;
            fanout fanout-value;
            frequency minutes;
            paths number-of-paths;
            retries retry-attempts;
            source address;
            ttl ttl-value;
            wait seconds;
        }
    }

```

**Hierarchy Level** [edit logical-systems *logical-systems-name* protocols ldp oam],  
[edit protocols ldp oam]

**Release Information** Statement introduced in Junos OS Release 8.5.  
Statement introduced in Junos OS Release 12.2 for EX Series switches.

**Description** Allows you to configure BFD for a specific LDP forwarding equivalence class (FEC).


**Options** *fec-address*—Specify the FEC address.  
  
The other 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** • [Configuring BFD for LDP LSPs on page 34](#)

## graceful-restart (Protocols LDP)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <pre>graceful-restart {   disable;   helper-disable;   maximum-neighbor-recovery-time <i>value</i>;   reconnect-time <i>seconds</i>;   recovery-time <i>value</i>; }</pre>                                                                                                                       |
| <b>Hierarchy Level</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>[edit logical-systems <i>logical-system-name</i> protocols ldp],<br/> [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br/> [edit protocols ldp],<br/> [edit routing-instances <i>routing-instance-name</i> protocols ldp]</p> |
| <b>Release Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                |
| <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Configure LDP graceful restart on the LDP master protocol instance or for a specific routing instance.                                                                                                                                                                                           |
| <div style="display: flex; align-items: center;">  <div> <p><b>NOTE:</b> When you alter the graceful restart configuration at either the [edit routing-options graceful-restart] or [edit protocols ldp graceful-restart] hierarchy levels, any running LDP session is automatically restarted to apply the graceful restart configuration. This behavior mirrors the behavior of BGP when you alter its graceful restart configuration.</p> </div> </div> |                                                                                                                                                                                                                                                                                                  |
| <b>Required Privilege Level</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>routing—To view this statement in the configuration.<br/> routing-control—To add this statement to the configuration.</p>                                                                                                                                                                     |
| <b>Related Documentation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | • <a href="#">Configuring LDP Graceful Restart on page 24</a>                                                                                                                                                                                                                                    |

## hello-interval (Protocols LDP)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>hello-interval seconds;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>          | <code>[edit logical-systems <i>logical-system-name</i> protocols ldp interface <i>interface-name</i>],</code><br><code>[edit logical-systems <i>logical-system-name</i> protocols ldp targeted-hello],</code><br><code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols</code><br><code>  ldp interface <i>interface-name</i>],</code><br><code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols</code><br><code>  ldp targeted-hello],</code><br><code>[edit protocols ldp interface <i>interface-name</i>],</code><br><code>[edit protocols ldp targeted-hello],</code><br><code>[edit routing-instances <i>routing-instance-name</i> protocols ldp interface <i>interface-name</i>],</code><br><code>[edit routing-instances <i>routing-instance-name</i> protocols ldp targeted-hello]</code> |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.<br>Support for LDP targeted hellos added in Junos OS Release 9.5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b>              | Control the LDP timer that regulates how often hello messages are sent. You can control the rate both link hello messages and targeted hello messages are sent depending on the hierarchy level at which you configure the <b>hello-interval</b> statement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Options</b>                  | <b>seconds</b> —Length of time between transmission of hello packets.<br><b>Range:</b> 1 through 65,535 seconds<br><b>Default:</b> 5 seconds for link hello messages, 15 seconds for targeted hello messages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Required Privilege Level</b> | <b>routing</b> —To view this statement in the configuration.<br><b>routing-control</b> —To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring the LDP Timer for Hello Messages on page 20</a></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## helper-disable (LDP)

|                                 |                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | helper-disable;                                                                                                                                                                                                                                                                                                                                         |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp graceful-restart],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp graceful-restart],<br>[edit protocols ldp graceful-restart],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp graceful-restart] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>              | Disable helper mode for LDP graceful restart. When helper mode is disabled, a router cannot help a neighboring router that is attempting to restart LDP.                                                                                                                                                                                                |
| <b>Default</b>                  | Helper mode is enabled by default on all routing protocols (including LDP) that support graceful restart.                                                                                                                                                                                                                                               |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring LDP Graceful Restart on page 24</a></li> </ul>                                                                                                                                                                                                                                         |

## holddown-interval

|                                 |                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | holddown-interval <i>holddown-interval</i> ;                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp oam bfd-liveness-detection],<br>[edit logical-systems <i>logical-system-name</i> protocols ldp oam fec <i>address</i> bfd-liveness-detection],<br>[edit protocols ldp oam bfd-liveness-detection],<br>[edit protocols ldp oam fec <i>address</i> bfd-liveness-detection] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.4.                                                                                                                                                                                                                                                                                           |
| <b>Description</b>              | Specify how long the BFD session should be up before adding the route or next hop. Specifying a time of 0 seconds causes the route or next hop to be added as soon as the BFD session comes back up.                                                                                                                                    |
| <b>Options</b>                  | <p><b><i>holddown-interval</i></b>—Number of seconds the BFD session should remain up before adding the route or next hop.</p> <p><b>Default:</b> 0 seconds</p> <p><b>Range:</b> 0 through 65,535 seconds</p>                                                                                                                           |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring the Holddown Interval for the BFD Session on page 38</a></li> </ul>                                                                                                                                                                                                    |

## hold-time (Protocols LDP)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>hold-time seconds;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>          | <code>[edit logical-systems <i>logical-system-name</i> protocols ldp interface <i>interface-name</i>],</code><br><code>[edit logical-systems <i>logical-system-name</i> protocols ldp targeted-hello],</code><br><code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols</code><br><code>  ldp interface <i>interface-name</i>],</code><br><code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols</code><br><code>  ldp targeted-hello],</code><br><code>[edit protocols ldp interface <i>interface-name</i>],</code><br><code>[edit protocols ldp targeted-hello],</code><br><code>[edit routing-instances <i>routing-instance-name</i> protocols ldp interface <i>interface-name</i>],</code><br><code>[edit routing-instances <i>routing-instance-name</i> protocols ldp targeted-hello]</code> |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.<br>Support for LDP targeted hellos added in Junos OS Release 9.5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b>              | Specify how long an LDP node should wait for a hello message before declaring a neighbor to be down. This value is sent as part of a hello message so that each LDP node tells its neighbors how long to wait. You can specify times for both link hello messages and targeted hello messages depending on the hierarchy level at which you configure the <b>hold-time</b> statement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Options</b>                  | <b>seconds</b> —Hold-time value.<br><b>Range:</b> 1 through 65,535 seconds<br><b>Default:</b> 15 seconds for link hello messages, 45 seconds for targeted hello messages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring the Delay Before LDP Neighbors Are Considered Down on page 21</a></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## ignore-lsp-metrics

|                                 |                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | ignore-lsp-metrics;                                                                                                                                                                                                                                                                                                  |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ospf traffic-engineering shortcuts],<br>[edit protocols ospf traffic-engineering shortcuts]                                                                                                                                                               |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 7.5.                                                                                                                                                                                                                                                                        |
| <b>Description</b>              | Cause OSPF to ignore the RSVP LSP metric.<br><br>Some other vendors use an OSPF metric of 1 for the loopback address. Juniper Networks routers use an OSPF metric of 0 for the loopback address. This can cause interoperability problems when you configure LDP tunneling over RSVP LSPs in heterogeneous networks. |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                  |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Enabling LDP over RSVP-Established LSPs in Heterogeneous Networks on page 47</a></li> </ul>                                                                                                                                                                     |

## igp-synchronization

|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | igp-synchronization holddown-interval <i>seconds</i> ;                                                                                                                                                                                                                              |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.5.                                                                                                                                                                                                                                       |
| <b>Description</b>              | Configure the time the LDP waits before informing the IGP that the LDP neighbor and session for an interface are operational. For large networks with numerous FECs, you might need to configure a longer value to allow enough time for the LDP label databases to be exchanged.   |
| <b>Options</b>                  | <b>holddown-interval <i>seconds</i></b> —Time the LDP waits before informing the IGP that the LDP neighbor and session for an interface are operational.<br><b>Default:</b> 10 seconds<br><b>Range:</b> 10 through 60 seconds                                                       |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring LDP Synchronization with the IGP on the Router on page 50</a></li> </ul>                                                                                                                                           |

## import (Protocols LDP)

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|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>import [ <i>policy-names</i> ];</code>                                                                                                                                                                                                                                        |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Apply policy filters to received LDP label bindings. Filters are applied to all label bindings from all neighbors.                                                                                                                                                                  |
| <b>Options</b>                  | <i>policy-names</i> —Name of one or more routing policies.                                                                                                                                                                                                                          |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Filtering Inbound LDP Label Bindings on page 26</a></li></ul>                                                                                                                                                                   |

## ingress-policy

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>ingress-policy [ <i>ingress-policy-names</i> ];</code>                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Hierarchy Level</b>          | [edit logical-system <i>logical-system-name</i> protocols ldp entropy-label],<br>[edit logical-system <i>logical-system-name</i> protocols ldp <a href="#">oam</a> ],<br>[edit protocols ldp entropy-label],<br>[edit protocols ldp <a href="#">oam</a> ]                                                                                                                                                                                                                                           |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.4.<br>Statement introduced at the <b>[edit protocols ldp entropy-label]</b> hierarchy level in Junos OS Release 14.1.                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>              | <p>Configure an LDP ingress policy for either the entropy label or Operation, Administration, and Management (OAM).</p> <p>For OAM, configure the ingress policy to choose which forwarding equivalence classes (FECs) need to have OAM enabled. If the FEC passes through the policy or if the FEC is explicitly configured, OAM is enabled for a FEC. For FECs chosen using a policy, the BFD parameters configured under <b>[edit protocols ldp oam bfd-liveness-detection]</b> are applied.</p> |
| <b>Options</b>                  | <i>ingress-policy-names</i> —Specify the names of the ingress policies.                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring OAM Ingress Policies for LDP on page 38</a></li> <li>• <a href="#">Configuring the Entropy Label for LSPs</a></li> </ul>                                                                                                                                                                                                                                                                                                           |

## interface (Protocols LDP)

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|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>interface <i>interface-name</i> {<br/>    disable;<br/>    hello-interval <i>seconds</i>;<br/>    hold-time <i>seconds</i>;<br/>    transport-address (interface   loopback);<br/>}</pre>                                                                                      |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Enable LDP on one or more router interfaces.                                                                                                                                                                                                                                        |
| <b>Default</b>                  | LDP is disabled on all interfaces.                                                                                                                                                                                                                                                  |
| <b>Options</b>                  | <i>interface-name</i> —Name of an interface. To configure all interfaces, specify <b>all</b> .<br><br>The remaining statements are explained separately.                                                                                                                            |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Enabling and Disabling LDP on page 20</a></li></ul>                                                                                                                                                                             |



## keepalive-interval

|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>keepalive-interval <i>seconds</i>;</code>                                                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Set the keepalive interval value.                                                                                                                                                                                                                                                   |
| <b>Options</b>                  | <b><i>seconds</i></b> —Keepalive value.<br><b>Range:</b> 1 through 65,535<br><b>Default:</b> 10 seconds                                                                                                                                                                             |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring the Interval for LDP Keepalive Messages on page 23</a></li> </ul>                                                                                                                                                  |

## keepalive-timeout

|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>keepalive-timeout <i>seconds</i>;</code>                                                                                                                                                                                                                                      |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Set the keepalive timeout value. The keepalive timeout defines the amount of time that the neighbor LDP node waits before determining that the session has failed.                                                                                                                  |
| <b>Options</b>                  | <b><i>seconds</i></b> —Keepalive timeout value.<br><b>Range:</b> 1 through 65,535<br><b>Default:</b> 30 seconds                                                                                                                                                                     |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring the LDP Keepalive Timeout on page 23</a></li> </ul>                                                                                                                                                                |

## l2-smart-policy

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|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | l2-smart-policy;                                                                                                                                                                                                                                                                    |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 8.4.                                                                                                                                                                                                                                       |
| <b>Description</b>              | Prevent LDP from exporting IPv4 FECs over sessions with Layer 2 neighbors only. IPv4 FECs received over such sessions are filtered out.                                                                                                                                             |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring LDP IPv4 FEC Filtering on page 33</a></li></ul>                                                                                                                                                                     |

## label-withdrawal-delay

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|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | label-withdrawal-delay <i>seconds</i> ;                                                                                                                                                                                                                                             |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.1.                                                                                                                                                                                                                                       |
| <b>Description</b>              | Delay the withdrawal of labels to reduce router workload during IGP convergence.                                                                                                                                                                                                    |
| <b>Options</b>                  | <b>seconds</b> —Configure the number of seconds to wait before withdrawing labels for the LDP LSPs.<br><b>Default:</b> 60 seconds<br><b>Range:</b> 0 through 300 seconds                                                                                                            |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring the Label Withdrawal Timer on page 50</a></li></ul>                                                                                                                                                                 |

## ldp

```
Syntax  ldp {
    (deaggregate | no-deaggregate);
    egress-policy [ policy-names ];
    explicit-null;
    export [ policy-names ];
    graceful-restart {
        disable;
        helper-disable;
        maximum-neighbor-recovery-time seconds;
        reconnect-time seconds;
        recovery-time seconds;
    }
    import [ policy-names ];
    interface (interface-name | all) {
        disable;
        hello-interval seconds;
        hold-time seconds;
        transport-address (interface | router-id);
    }
    keepalive-interval seconds;
    keepalive-timeout seconds;
    log-updown {
        trap disable;
    }
    no-forwarding;
    oam {
        bfd-liveness-detection {
            detection-time threshold milliseconds;
            ecmp;
            failure-action {
                remove-nexthop;
                remove-route;
            }
            holddown-interval milliseconds;
            minimum-interval milliseconds;
            minimum-receive-interval milliseconds;
            minimum-transmit-interval milliseconds;
            multiplier detection-time-multiplier;
            no-adaptation;
            transmit-interval {
                minimum-interval milliseconds;
                threshold milliseconds;
            }
        }
    }
    fec fec-address {
        bfd-liveness-detection {
            detection-time threshold milliseconds;
            ecmp;
            failure-action {
                remove-nexthop;
                remove-route;
            }
        }
    }
}
```

```

    holddown-interval milliseconds;
    ingress-policy ingress-policy-name;
    minimum-interval milliseconds;
    minimum-receive-interval milliseconds;
    minimum-transmit-interval milliseconds;
    multiplier detection-time-multiplier;
    no-adaptation;
    transmit-interval {
        minimum-interval milliseconds;
        threshold milliseconds;
    }
    version (0 | 1 | automatic);
}
no-bfd-liveness-detection;
periodic-traceroute {
    disable;
    exp exp-value;
    fanout fanout-value;
    frequency minutes;
    paths number-of-paths;
    retries retry-attempts;
    source address;
    ttl ttl-value;
    wait seconds;
}
}
ingress-policy ingress-policy-name;
periodic-traceroute {
    disable;
    exp exp-value;
    fanout fanout-value;
    frequency minutes;
    paths number-of-paths;
    retries retry-attempts;
    source address;
    ttl ttl-value;
    wait seconds;
}
}
p2mp;
policing {
    fec fec-address {
        ingress-traffic filter-name;
        transit-traffic filter-name;
    }
}
}
preference preference;
session address {
    authentication-algorithm algorithm;
    authentication-key authentication-key;
    authentication-key-chain key-chain-name;
}
strict-targeted-hellos;
traceoptions {
    file filename <files number <size size> <world-readable | no-world-readable>;
    flag flag <flag-modifier> <disable>;
}

```

```

}
track-igp-metric;
traffic-statistics {
  file filename <files number> <size size> <world-readable | no-world-readable>;
  interval interval;
  no-penultimate-hop;
}
transport-address (address | interface | router-id);
}

```

|                                 |                                                                                                                                                                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols],<br>[edit protocols],<br>[edit routing-instances <i>routing-instance-name</i> protocols] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.<br>Statement introduced in Junos OS Release 11.1 for EX Series switches.                                                                                                                                          |
| <b>Description</b>              | Enable LDP routing on the router or switch.<br><br>You must include the <b>ldp</b> statement in the configuration to enable LDP on the router or switch.                                                                                                            |
| <b>Default</b>                  | LDP is disabled on the router.                                                                                                                                                                                                                                      |
| <b>Options</b>                  | The other statements are explained separately.                                                                                                                                                                                                                      |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Minimum LDP Configuration on page 20</a></li> <li>• <a href="#">Enabling and Disabling LDP on page 20</a></li> </ul>                                                                                           |

## ldp-synchronization

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>ldp-synchronization {<br/>    disable;<br/>    hold-time seconds;<br/>}</pre>                                                                                                                                                                                                                                                                                                                                          |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ospf interface <i>interface-name</i> ],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ospf interface <i>interface-name</i> ],<br>[edit protocols ospf interface <i>interface-name</i> ],<br>[edit routing-instances <i>routing-instance-name</i> protocols ospf interface <i>interface-name</i> ] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 7.5.                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b>              | Enable synchronization by advertising the maximum cost metric until LDP is operational on the link.                                                                                                                                                                                                                                                                                                                         |
| <b>Options</b>                  | The other statements are explained separately.                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                         |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring LDP Synchronization with the IGP on LDP Links on page 49</a></li></ul>                                                                                                                                                                                                                                                                                      |

## log-updown (Protocols LDP)

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|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>log-updown {<br/>    trap disable;<br/>}</pre>                                                                                                                                                                                                                                 |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Disable LDP traps on the router, logical system, or routing instance.                                                                                                                                                                                                               |
| <b>Options</b>                  | <b>trap disable</b> —Disable LDP traps.<br><b>Default:</b> LDP traps are enabled on the router.                                                                                                                                                                                     |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Disabling SNMP Traps for LDP on page 49</a></li></ul>                                                                                                                                                                           |

## make-before-break (LDP)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>make-before-break {     timeout <i>seconds</i>;     switchover-delay <i>seconds</i>; }</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>          | [edit protocols ldp]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 12.3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>              | Configures make before break (MBB) for multicast LDP (MLDP) link protection to ensure minimum packet loss when attempting to signal a new label-switched path (LSP) before tearing down the old LSP path.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Options</b>                  | <p><b>timeout <i>seconds</i></b>—Specify a value to change a make -before-break timeout for point-to-multipoint LSPs. Even if an MBB acknowledgment is not received for a point-to-multipoint LSP before the specified timeout period expires, the label-switching router (LSR) performs an MBB switchover from the old LSR to the new upstream LSR.</p> <p><b>Range:</b> 1 through 300 seconds</p> <p><b>Default:</b> 30 seconds</p> <p><b>switchover-delay <i>seconds</i></b>—Specify a value to change switchover delay for a point-to-multipoint LSP from the old LSR to the new upstream LSR. If an MBB acknowledgment is received on a point of local repair (PLR) router, the PLR waits for the specified seconds to switch its upstream LSR from the old LSR to the new LSR.</p> <p><b>Range:</b> 1 through 300 seconds</p> <p><b>Default:</b> 30 seconds</p> |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring LDP Link Protection on page 51</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## maximum-neighbor-recovery-time

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|                                 |                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>maximum-neighbor-recovery-time seconds;</code>                                                                                                                                                                                                                                                                                                    |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp graceful-restart],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp graceful-restart],<br>[edit protocols ldp graceful-restart],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp graceful-restart] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4. Statement changed from <b>maximum-recovery-time</b> to <b>maximum-neighbor-recovery-time</b> in Junos OS Release 9.1.                                                                                                                                                                                 |
| <b>Description</b>              | Specify the maximum amount of time to wait before giving up an attempt to gracefully restart.                                                                                                                                                                                                                                                           |
| <b>Options</b>                  | <b>seconds</b> —Configure the maximum recovery time, in seconds.<br><b>Range:</b> 120 through 1800 seconds<br><b>Default:</b> 140 seconds                                                                                                                                                                                                               |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring Recovery Time and Maximum Recovery Time on page 26</a></li><li>• <i>Configuring Graceful Restart Options for LDP</i></li><li>• <i>no-strict-lsa-checking</i></li><li>• <i>recovery-time</i></li></ul>                                                                                   |



## mldp-inband-signalling (Protocols Multipoint LDP)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | mldp-inband-signalling {<br><a href="#">policy</a> <i>policy-name</i> ;<br>}                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols pim],<br>[edit protocols pim],                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 13.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>              | <p>Multipoint LDP (M-LDP) in-band signaling enables you to carry multicast traffic across an existing IP/MPLS backbone, while avoiding the use of PIM in the provider core.</p> <p>On the label-edge router (LER), enable PIM to use M-LDP in-band signaling for the upstream neighbors when the LER does not detect a PIM upstream neighbor. On the egress nodes, configure the MPLS LSP root in the PIM configuration, using the <b>policy</b> statement.</p> <p>The remaining statement is explained separately.</p> |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Multipoint LDP In-Band Signaling for Point-to-Multipoint LSPs on page 88</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                       |

## mofrr-asm-starg (Multicast-Only Fast Reroute in a PIM Domain)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | mofrr-asm-starg;                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit logical-systems <i>logical-system-name</i> routing-options multicast stream-protection],<br>[edit routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit routing-options multicast stream-protection] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 14.1.                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>              | When you configure multicast-only fast reroute (MoFRR) in a PIM domain, allow MoFRR to be applied to any-source multicast (ASM) (*,G) joins.                                                                                                                                                                                                                                                                |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                         |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Understanding Multicast-Only Fast Reroute on page 9</a></li> <li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a PIM Domain</a></li> <li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119</a></li> </ul>                                                                      |

## **mofrr-disjoint-upstream-only (Multicast-Only Fast Reroute in a PIM Domain)**

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>mofrr-disjoint-upstream-only;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit logical-systems <i>logical-system-name</i> routing-options multicast stream-protection],<br>[edit routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit routing-options multicast stream-protection]                                                                                                                                                                                                                                                      |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 14.1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b>              | <p>When you configure multicast-only fast reroute (MoFRR) in a PIM domain, allow only a disjoint RPF (an RPF on a separate plane) to be selected as the backup RPF path.</p> <p>In a multipoint LDP MoFRR domain, the same label is shared between parallel links to the same upstream neighbor. This is not the case in a PIM domain, where each link forms a neighbor. The <b>mofrr-disjoint-upstream-only</b> statement does not allow a backup RPF path to be selected if the path goes to the same upstream neighbor as that of the primary RPF path. This ensures that MoFRR is triggered only on a topology that has multiple RPF upstream neighbors.</p> |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Understanding Multicast-Only Fast Reroute on page 9</a></li><li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a PIM Domain</a></li><li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119</a></li></ul>                                                                                                                                                                                                                                                                                                                               |

## mofrr-no-backup-join (Multicast-Only Fast Reroute in a PIM Domain)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | mofrr-no-backup-join;                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit logical-systems <i>logical-system-name</i> routing-options multicast stream-protection],<br>[edit routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit routing-options multicast stream-protection] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 14.1.                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>              | When you configure multicast-only fast reroute (MoFRR) in a PIM domain, prevent sending join messages on the backup path, but retain all other MoFRR functionality.                                                                                                                                                                                                                                         |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                         |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Understanding Multicast-Only Fast Reroute on page 9</a></li> <li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a PIM Domain</a></li> <li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119</a></li> </ul>                                                                      |

## **mofrr-primary-selection-by-routing (Multicast-Only Fast Reroute)**

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>mofrr-primary-selection-by-routing;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit logical-systems <i>logical-system-name</i> routing-options multicast stream-protection],<br>[edit routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit routing-options multicast stream-protection]                                                                                                                                                                                 |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 14.1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>              | <p>When you configure multicast-only fast reroute (MoFRR) in a PIM domain, allow new primary path selection to be based on the unicast gateway selection for the unicast route to the source and to change when there is a change in the unicast selection, rather than having the backup path be promoted as primary. This ensures that the primary RPF hop is always on the best path.</p> <p>When you include the <b>mofrr-primary-selection-by-routing</b> statement, the backup path is not guaranteed to get promoted to be the new primary path when the primary path goes down.</p> |
| <b>Default</b>                  | By default, the backup path gets promoted to be the primary path when MoFRR is configured in a PIM domain.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Understanding Multicast-Only Fast Reroute on page 9</a></li><li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a PIM Domain</a></li><li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119</a></li></ul>                                                                                                                                                                                                                                                          |

## no-forwarding

---

|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | no-forwarding;                                                                                                                                                                                                                                                                      |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Do not add ingress routes to the inet.0 routing table even if <b>traffic-engineering bgp-igp</b> (configured at the [edit protocols mpls] hierarchy level) is enabled.                                                                                                              |
| <b>Default</b>                  | The <b>no-forwarding</b> statement is disabled. Ingress routes are added to the inet.0 routing table instead of the inet.3 routing table when <b>traffic-engineering bgp-igp</b> is enabled.                                                                                        |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Preventing Addition of Ingress Routes to the inet.0 Routing Table on page 45</a></li> <li>• <a href="#">Configuring Virtual-Router Routing Instances in VPNs</a></li> </ul>                                                    |

## oam (Protocols LDP)

```
Syntax  oam {
        bfd-liveness-detection {
            detection-time threshold milliseconds;
            ecmp;
            failure-action {
                remove-nexthop;
                remove-route;
            }
            holddown-interval milliseconds;
            ingress-policy ingress-policy-name;
            minimum-interval milliseconds;
            minimum-receive-interval milliseconds;
            minimum-transmit-interval milliseconds;
            multiplier detection-time-multiplier;
            no-adaptation;
            transmit-interval {
                minimum-interval milliseconds;
                threshold milliseconds;
            }
            version (0 | 1 | automatic);
        }
        fec fec-address;
        ingress-policy ingress-policy-name;
        lsp-ping-interval seconds;
        periodic-traceroute {
            disable;
            exp exp-value;
            fanout fanout-value;
            frequency minutes;
            paths number-of-paths;
            retries retry-attempts;
            source address;
            ttl ttl-value;
            wait seconds;
        }
    }
```

**Hierarchy Level** [edit logical-systems *logical-system-name* protocols ldp]  
[edit protocols ldp]

**Release Information** Statement introduced in Junos OS Release 7.6.  
**lsp-ping-interval** option introduced in Junos OS Release 9.4.

**Description** Configure Operation, Administration, and Maintenance (OAM) and Bidirectional Forwarding Detection (BFD) protocol for LDP.

**Options** **fec *fec-address***—Specify the forwarding equivalence class (FEC) address. You must either specify a FEC address or configure an OAM ingress policy to ensure that the BFD session comes up.

**lsp-ping-interval *seconds***—Specify the duration of the LSP ping interval in seconds. To issue a ping on an LDP-signaled LSP, use the **ping mpls ldp** command.

**Default:** 60 seconds

**Range:** 30 through 3,600 seconds

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**

- [Configuring BFD for LDP LSPs on page 34](#)

## p2mp (Protocols LDP)

**Syntax** p2mp{  
    root-address *root-address*{  
        lsp-id *id*;  
    }

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

**Release Information** Statement introduced in Junos OS Release 11.2.

**Description** Enable point-to-multipoint MPLS LSPs in an LDP-signaled LSP.

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

**Related Documentation**

- *Example: Configuring Point-to-Multipoint LDP LSPs as the Data Plane for Intra-AS MBGP MVPNs*
- *Point-to-Multipoint LSPs Overview*

## p2mp-ldp-next-hop

---

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>p2mp-ldp-next-hop {<br/>  root-address <i>root-address</i>{<br/>    lsp-id <i>id</i>;<br/>  }<br/>}</pre>                                                                                                                                                                                                                                                                                                                                              |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options static route <i>destination-prefix</i> ],<br>[edit logical-systems <i>logical-system-name</i> routing-options static route <i>destination-prefix</i> ],<br>[edit routing-instances <i>routing-instance-name</i> routing-options static route <i>destination-prefix</i> ],<br>[edit routing-options static route <i>destination-prefix</i> ] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 13.3.                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>              | 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.                                                                                                                                                                                                                                                                       |
| <b>Options</b>                  | <b>root-address <i>root address</i></b> — Specify the root address of the point-to-multipoint LSP.<br><br><b>lsp-id <i>id</i></b> — Specify the generic LSP identifier. The range is 1 through 65535.                                                                                                                                                                                                                                                       |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                         |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• [edit routing-options] <i>Hierarchy Level</i></li></ul>                                                                                                                                                                                                                                                                                                                                                             |



## periodic-traceroute

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <pre> periodic-traceroute {   disable;   exp <i>exp-value</i>;   fanout <i>fanout-value</i>;   frequency <i>minutes</i>;   paths <i>number-of-paths</i>;   retries <i>retry-attempts</i>;   source <i>address</i>;   ttl <i>ttl-value</i>;   wait <i>seconds</i>; } </pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Hierarchy Level</b>     | [edit logical-systems <i>logical-system-name</i> protocols ldp oam],<br>[edit logical-systems <i>logical-system-name</i> protocols ldp oam fec <i>fec-address</i> ],<br>[edit protocols ldp oam],<br>[edit protocols ldp oam fec <i>fec-address</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Release Information</b> | Statement introduced in Junos OS Release 8.4.<br>Support added at the [edit protocols ldp oam] and [edit logical-systems <i>logical-system-name</i> protocols ldp oam] hierarchy levels in Junos OS Release 9.0.<br>Statement introduced in Junos OS Release 12.2 for EX Series switches.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>         | Enable tracing of forwarding equivalence classes (FECs) for LDP LSPs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Options</b>             | <p><b>disable</b>—(Optional) Disable tracing for a specific FEC. This option is available at the [edit protocols ldp oam fec <i>fec-address</i> periodic-traceroute] and [edit logical-systems <i>logical-system-name</i> protocols ldp oam fec <i>fec-address</i> periodic-traceroute] hierarchy levels only.</p> <p><b>exp <i>exp-value</i></b>—(Optional) Specify the class of service to use when sending probes.<br/> <b>Default:</b> 7<br/> <b>Range:</b> 0 through 7</p> <p><b>fanout <i>fanout-value</i></b>—(Optional) Specify the maximum number of next hops to search per node.<br/> <b>Default:</b> 16<br/> <b>Range:</b> 1 through 16</p> <p><b>frequency <i>minutes</i></b>—(Optional) Specify the interval between traceroute attempts.<br/> <b>Default:</b> 60 minutes<br/> <b>Range:</b> 15 through 120 minutes</p> <p><b>paths <i>number-of-paths</i></b>—(Optional) Specify the maximum number of paths to search.<br/> <b>Default:</b> 3<br/> <b>Range:</b> 1 through 255</p> |

**retries** *retry-attempts*—(Optional) Specify the number of attempts to send a probe to a specific node before giving up.

**Default:** 3

**Range:** 1 through 9

**source address**—(Optional) Specify the IPv4 source address to use when sending probes.

**ttl value**—(Optional) Specify the maximum time-to-live value. Nodes that are beyond this value are not traced.

**Default:** 64

**Range:** 1 through 255

**wait seconds**—(Optional) Specify the wait interval before resending a probe packet.

**Default:** 10 seconds

**Range:** 5 though 15 seconds

|                                 |                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration. |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------|

|                              |                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------|
| <b>Related Documentation</b> | <ul style="list-style-type: none"><li>• <a href="#">Configuring LDP LSP Traceroute on page 39</a></li></ul> |
|------------------------------|-------------------------------------------------------------------------------------------------------------|

## policing (Protocols LDP)

|                                 |                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre> policing {     fec <i>fec-address</i> {         ingress-traffic <i>filter-name</i>;         transit-traffic <i>filter-name</i>;     } } </pre>                                                                                                                                                      |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp]                       |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                         |
| <b>Description</b>              | Enable policing of forwarding equivalence classes (FECs) for LDP.                                                                                                                                                                                                                                         |
| <b>Options</b>                  | <p><b>fec <i>fec-address</i></b>—Specify the address for the FEC.</p> <p><b>ingress-traffic <i>filter-name</i></b>—Specify the name of the filter for policing ingress FEC traffic.</p> <p><b>transit-traffic <i>filter-name</i></b>—Specify the name of the filter for policing transit FEC traffic.</p> |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                       |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring Policers for LDP FECs on page 32</a></li> </ul>                                                                                                                                                                                          |

## policy (Multicast-Only Fast Reroute)

|                            |                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <code>policy <i>policy-name</i>;</code>                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>     | [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit logical-systems <i>logical-system-name</i> routing-options multicast stream-protection],<br>[edit routing-instances <i>routing-instance-name</i> routing-options multicast stream-protection],<br>[edit routing-options multicast stream-protection] |
| <b>Release Information</b> | Statement introduced in Junos OS Release 14.1.                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>         | When you configure multicast-only fast reroute (MoFRR), apply a routing policy that filters for a restricted set of multicast streams to be affected by your MoFRR configuration. You can apply filters that are based on source or group addresses.                                                                                                                                                        |

For example:

```

routing-options {
  multicast {
    stream-protection {
      policy mofrr-select;
    }
  }
}
policy-statement mofrr-select {
  term A {
    from {
      source-address-filter 225.1.1.1/32 exact;;
    }
    then {
      accept;
    }
  }
  term B {
    from {
      source-address-filter 226.0.0.0/8 orlonger;
    }
    then {
      accept;
    }
  }
  term C {
    from {
      source-address-filter 227.1.1.0/24 orlonger;
      source-address-filter 227.4.1.0/24 orlonger;
      source-address-filter 227.16.1.0/24 orlonger;
    }
    then {
      accept;
    }
  }
  term D {
    from {

```

```

        source-address-filter 227.1.1.1/32 exact
    }
    then {
        reject; #MoFRR disabled
    }
}
term E {
    from {
        route-filter 227.1.1.0/24 orlonger;
    }
    then accept;
}
...
}

```

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

**Related Documentation**

- [Understanding Multicast-Only Fast Reroute on page 9](#)
- [Example: Configuring Multicast-Only Fast Reroute in a PIM Domain](#)
- [Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119](#)

## policy (Protocols Multipoint LDP)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>policy <i>policy-name</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols pim mldp-inband-signalling],<br>[edit protocols pim mldp-inband-signalling]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 13.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b>              | <p>Multipoint LDP (M-LDP) in-band signaling enables you to carry multicast traffic across an existing IP/MPLS backbone, while avoiding the use of PIM in the provider core.</p> <p>On the egress nodes of the point-to-multipoint LSP, specify an M-LDP join translation filter policy where PIM messages are translated into M-LDP FEC bindings. The policy statement is needed when internal BGP (IBGP) is not available in the core site or to override IBGP-based LSP root detection.</p> <p>The filter policy is configured at the <b>[edit policy-options]</b> hierarchy level. The policy generally specifies one or more source-address filters and the point-to-multipoint LDP root IP address using the <b>p2mp-lsp-root</b> policy action.</p> |
| <b>Options</b>                  | <i>policy-name</i> —Name of a policy configured at the <b>[edit policy-options]</b> hierarchy level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Multipoint LDP In-Band Signaling for Point-to-Multipoint LSPs on page 88</a></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## preference (Protocols LDP)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>preference <i>preference</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit protocols ldp interface <i>interface-name</i> ],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit protocols ldp interface <i>interface-name</i> ],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp interface <i>interface-name</i> ] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>              | Set the route preference level for LDP routes.                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Options</b>                  | <i>preference</i> —Preferred value.<br><b>Range:</b> 0 through 255<br><b>Default:</b> 9                                                                                                                                                                                                                                                                                                                                                  |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                  |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring LDP Route Preferences on page 24</a></li> </ul>                                                                                                                                                                                                                                                                                                                         |

## reconnect-time

|                                 |                                                                                                                                                                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>reconnect-time <i>seconds</i>;</code>                                                                                                                                                                                      |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp graceful-restart],<br>[edit protocols ldp graceful-restart],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp graceful-restart]              |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.1.                                                                                                                                                                                    |
| <b>Description</b>              | Specify the length of time required to reestablish a Label Distribution Protocol (LDP) session after graceful restart.                                                                                                           |
| <b>Options</b>                  | <i>seconds</i> —Time required for reconnection.<br><b>Range:</b> 30 through 300<br><b>Default:</b> 60 seconds                                                                                                                    |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                              |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring LDP Graceful Restart on page 24 on LDP Feature Guide for Routing Devices</a></li> <li>• <a href="#">Configuring Graceful Restart Options for LDP</a></li> </ul> |

## recovery-time

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|                                 |                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>recovery-time seconds;</code>                                                                                                                                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp graceful-restart],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp graceful-restart],<br>[edit protocols ldp graceful-restart],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp graceful-restart] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>              | Specify the amount of time a router waits for LDP to restart gracefully.                                                                                                                                                                                                                                                                                |
| <b>Options</b>                  | <b>seconds</b> —Configure the recovery time, in seconds.<br><b>Range:</b> 120 through 1800 seconds<br><b>Default:</b> 140 seconds                                                                                                                                                                                                                       |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring Recovery Time and Maximum Recovery Time on page 26</a></li></ul>                                                                                                                                                                                                                        |

## session (ldp)

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|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>session address {<br/>    authentication-algorithm <i>algorithm</i>;<br/>    authentication-key <i>authentication-key</i>;<br/>    authentication-key-chain <i>key-chain-name</i>;<br/>}</pre>                                                                                 |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.<br><b>authentication-algorithm</b> statement introduced in Junos OS Release 7.6.                                                                                                                                                  |
| <b>Description</b>              | Specify the address for the remote end of the LDP session.<br><br>The remaining statements are explained separately.                                                                                                                                                                |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring the TCP MD5 Signature for LDP Sessions on page 47</a></li></ul>                                                                                                                                                     |



## session-protection

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|                                 |                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | session-protection {<br>timeout <i>seconds</i> ;<br>}                                                                                                                                                                                                                                                                                                                      |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp]                                                                                        |
| <b>Description</b>              | Configure when an LDP session is torn down and resigaled after the router stops receiving hello messages from a neighboring router. You might want to modify this behavior to prevent an LDP session from being unnecessarily terminated and reestablished. The LDP session remains up for the duration specified as long as the routers maintain IP network connectivity. |
| <b>Options</b>                  | <b>timeout <i>seconds</i></b> —Time in seconds before the LDP session is torn down and resigaled.<br><b>Range:</b> 1 through 65,535 seconds                                                                                                                                                                                                                                |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                        |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring LDP Session Protection on page 48</a></li> </ul>                                                                                                                                                                                                                                                          |

## stream-protection (Multicast-Only Fast Reroute)

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|                                 |                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>stream-protection {<br/>    mofrr-asm-starg;<br/>    mofrr-disjoint-upstream-only;<br/>    mofrr-no-backup-join;<br/>    mofrr-primary-selection-by-routing;<br/>    policy <i>policy-name</i>;<br/>}</pre>                                                                                                                                          |
| <b>Hierarchy Level</b>          | <pre>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i><br/>    routing-options multicast],<br/>[edit logical-systems <i>logical-system-name</i> routing-options multicast],<br/>[edit routing-instances <i>routing-instance-name</i> routing-options multicast],<br/>[edit routing-options multicast]</pre> |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 14.1.                                                                                                                                                                                                                                                                                                            |
| <b>Description</b>              | Enable multicast-only fast reroute (MoFRR) on a routing device. MoFRR minimizes packet loss in a network when there is a link failure.                                                                                                                                                                                                                    |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                       |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Understanding Multicast-Only Fast Reroute on page 9</a></li><li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a PIM Domain</a></li><li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119</a></li></ul>                        |

## strict-targeted-hellos

|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | strict-targeted-hellos;                                                                                                                                                                                                                                                             |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                   |
| <b>Description</b>              | Prevent LDP sessions from being established with remote neighbors that have not been specifically configured. LDP peers will not respond to targeted hellos coming from a source that is not one of the configured remote neighbors.                                                |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                                                             |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Enabling Strict Targeted Hello Messages for LDP on page 23</a></li> </ul>                                                                                                                                                      |

## targeted-hello

|                                 |                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | targeted-hello {<br>hello-interval <i>seconds</i> ;<br>hold-time <i>seconds</i> ;<br>}                                                                                                                                                                                              |
| <b>Hierarchy Level</b>          | [edit logical-systems <i>logical-system-name</i> protocols ldp],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br>[edit protocols ldp],<br>[edit routing-instances <i>routing-instance-name</i> protocols ldp] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.5.                                                                                                                                                                                                                                       |
| <b>Description</b>              | Specify the LDP timer and LDP hold time for targeted hellos.                                                                                                                                                                                                                        |
| <b>Options</b>                  | The remaining statements are explained separately.                                                                                                                                                                                                                                  |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring the LDP Timer for Hello Messages on page 20</a></li> <li>• <a href="#">Configuring the Delay Before LDP Neighbors Are Considered Down on page 21</a></li> </ul>                                                    |

## traceoptions (Protocols LDP)

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <pre> traceoptions {     file <i>filename</i> &lt;files <i>number</i>&gt; &lt;size <i>size</i>&gt; &lt;world-readable   no-world-readable&gt;;     flag <i>flag</i> &lt;flag-modifier&gt; &lt;disable&gt;; } </pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Hierarchy Level</b>     | <p>[edit logical-systems <i>logical-system-name</i> protocols ldp],<br/> [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br/> [edit protocols ldp],<br/> [edit routing-instances <i>routing-instance-name</i> protocols ldp]</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Release Information</b> | <p>Statement introduced before Junos OS Release 7.4.</p> <p><b>match-on address</b> option for the <b>filter</b> flag modifier added in Junos OS Release 10.4.</p> <p><b>nsr-synchronization</b> and <b>p2mp-nsr-synchronization</b> operations for <b>flag</b> statement introduced in Junos OS Release 13.3.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b>         | Specify LDP protocol-level trace options.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Default</b>             | The default LDP protocol-level trace options are inherited from the routing protocols <b>traceoptions</b> statement included at the [edit routing-options] hierarchy level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Options</b>             | <p><b>disable</b>—(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 <b>all</b>.</p> <p><b>file <i>filename</i></b>—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 <b>ldp-log</b>. We recommend that you place LDP tracing output in the file <b>ldp-log</b>.</p> <p><b>files <i>number</i></b>—(Optional) Maximum number of trace files. When a trace file named <b>trace-file</b> reaches its maximum size, it is renamed <b>trace-file.0</b>, then <b>trace-file.1</b>, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.</p> <p><b>Range:</b> 2 through 1000</p> <p><b>Default:</b> 2 files</p> <p>If you specify a maximum number of files, you must also include the <b>size</b> statement to specify the maximum file size.</p> <p><b>flag <i>flag</i></b>—Tracing operation to perform. To specify more than one tracing operation, include multiple <b>flag</b> statements.</p> <ul style="list-style-type: none"> <li>• <b>address</b>—Operation of address and address withdrawal messages</li> <li>• <b>binding</b>—Label-binding operations</li> <li>• <b>error</b>—Error conditions</li> <li>• <b>event</b>—Protocol events</li> </ul> |

- **initialization**—Operation of initialization messages
- **label**—Operation of label request, label map, label withdrawal, and label release messages
- **notification**—Operation of notification messages
- **nsr-synchronization**—Nonstop active routing synchronization events
- **p2mp-nsr-synchronization**—Point-to-multipoint nonstop active routing synchronization events
- **packets**—Equivalent to setting **address**, **initialization**, **label**, **notification**, and **periodic** flags (see also the **filter** flag modifier)
- **path**—Label-switched path operations
- **periodic**—Operation of hello and keepalive messages
- **route**—Operation of route messages
- **state**—Protocol state transitions

**flag-modifier**—(Optional) Modifier for the tracing flag. You can specify one or more of these modifiers:

- **detail**—Provide detailed trace information.
- **disable**—Disable this trace flag.
- **filter**—Filter to apply to this flag. The **filter** flag modifier can be applied only to the **route**, **path**, and **binding** flags. This flag modifier has the following options:
  - **match-on**—Match on argument specified. The **match-on** option has the following suboptions:
    - **address**—Filter based on the source and destination addresses of packets. Available for the **packets** flag option only.
    - **fec**—Filter based on the FEC associated with the traced object.
    - **policy** *policy-name*—Specify the filter policy.
  - **receive**—Packets being received.
  - **send**—Packets being transmitted.

**no-world-readable**—(Optional) Prevent all users 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 this 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.

**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:** 1 MB

If you specify a maximum file size, you must also include the **files** statement to specify the maximum number of files.

**world-readable**—(Optional) Enable 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**

- [Tracing LDP Protocol Traffic on page 42](#)
- *Network Management Administration Guide for Routing Devices*

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## track-igp-metric

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**Syntax** track-igp-metric;

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

**Release Information** Statement introduced before Junos OS Release 7.4.

**Description** Cause the IGP route metric to be used for the LDP routes instead of the default LDP route metric (the default LDP route metric is 1).

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

**Related Documentation**

- [Configuring LDP to Use the IGP Route Metric on page 45](#)

## traffic-statistics (Protocols LDP)

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <pre> traffic-statistics {     file <i>filename</i> &lt;files <i>number</i>&gt; &lt;size <i>size</i>&gt; &lt;world-readable   no-world-readable&gt;;     interval <i>seconds</i>;     no-penultimate-hop; } </pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Hierarchy Level</b>     | <p>[edit logical-systems <i>logical-system-name</i> protocols <i>ldp</i>],<br/> [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols <i>ldp</i>],<br/> [edit protocols <i>ldp</i>],<br/> [edit routing-instances <i>routing-instance-name</i> protocols <i>ldp</i>]</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Release Information</b> | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b>         | LDP traffic statistics display the amount of traffic passed through a router for a particular FEC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Options</b>             | <p><b>file <i>filename</i></b>—Name of the file to receive the output of the LDP statistics operation. Enclose the name within quotation marks. All files are placed in the directory <b>/var/log</b>.</p> <p><b>files <i>number</i></b>—(Optional) Maximum number of LDP statistics files. When a statistics file named <b><i>ldp-stat</i></b> reaches its maximum size, it is renamed <b><i>ldp-stat.0</i></b>, then <b><i>ldp-stat.1</i></b>, and so on, until the maximum number of LDP statistics files is reached. Then the oldest file is overwritten.</p> <p><b>Range:</b> 2 through 1000<br/> <b>Default:</b> 2 files</p> <p>If you specify a maximum number of files, you also must include the <b>size</b> statement to specify the maximum file size.</p> <p><b>interval <i>seconds</i></b>—(Optional) Specify the interval at which the statistics are polled and written to the file.</p> <p><b>Default:</b> 300 seconds (5 minutes)</p> <p><b>no-penultimate-hop</b>—(Optional) Do not collect traffic statistics on the penultimate hop router.</p> <p><b>no-world-readable</b>—(Optional) Prevent all users from reading the log file.</p> <p><b>size <i>size</i></b>—(Optional) Maximum size of each statistics file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a statistics file named <b><i>ldp-stat</i></b> reaches this size, it is renamed <b><i>ldp-stat.0</i></b>. When <b><i>ldp-stat</i></b> again reaches this size, <b><i>ldp-stat.0</i></b> is renamed <b><i>ldp-stat.1</i></b> and <b><i>ldp-stat</i></b> is renamed <b><i>ldp-stat.0</i></b>. This renaming scheme continues until the maximum number of statistics files is reached. Then the oldest statistics file is overwritten.</p> <p><b>Syntax:</b> <b><i>xk</i></b> to specify KB, <b><i>xm</i></b> to specify MB, or <b><i>xg</i></b> to specify GB<br/> <b>Range:</b> 10 KB through the maximum file size supported on your system<br/> <b>Default:</b> 1 MB</p> |

If you specify a maximum file size, you also must also include the **files** statement to specify the maximum number of files.

**world-readable**—(Optional) Enable log file access for all users.

|                           |                                                             |
|---------------------------|-------------------------------------------------------------|
| <b>Required Privilege</b> | routing—To view this statement in the configuration.        |
| <b>Level</b>              | routing-control—To add this statement to the configuration. |

|                              |                                                                                                        |
|------------------------------|--------------------------------------------------------------------------------------------------------|
| <b>Related Documentation</b> | <ul style="list-style-type: none"><li>• <a href="#">Collecting LDP Statistics on page 40</a></li></ul> |
|------------------------------|--------------------------------------------------------------------------------------------------------|



## transport-address

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>transport-address (interface   router-id);</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Hierarchy Level</b>          | <p>[edit logical-systems <i>logical-system-name</i> protocols ldp],<br/>         [edit logical-systems <i>logical-system-name</i> protocols ldp interface <i>interface-name</i>],<br/>         [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols ldp],<br/>         [edit protocols ldp],<br/>         [edit protocols ldp interface <i>interface-name</i>],<br/>         [edit routing-instances <i>routing-instance-name</i> protocols ldp interface <i>interface-name</i>]</p>                                                                                                                                                                                                                                                                                             |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>              | <p>Enables you to configure the IP address used to specify the TCP session for the LDP session. Routers must first establish a TCP session between one another before they can establish an LDP session. The TCP session enables the routers to exchange the label advertisements needed for the LDP session. To establish the TCP session, each router must learn the other router's transport address. The transport address is an IP address used to identify the TCP session over which the LDP session will run.</p>                                                                                                                                                                                                                                                                                                             |
| <b>Default</b>                  | <b>router-id</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Options</b>                  | <p><b>interface</b>—The first IP address on the interface is used as the transport address for any LDP sessions to neighbors that can be reached over that interface. You cannot specify the <b>interface</b> option when there are multiple parallel links to the same LDP neighbor, because the LDP specification requires that the same transport address be advertised on all interfaces to the same neighbor. If LDP detects multiple parallel links to the same neighbor, it disables interfaces to that neighbor one by one until the condition is cleared, either by disconnecting the neighbor on an interface or by specifying the <b>router-id</b> option.</p> <p><b>router-id</b>—The router identifier is used as the transport address. Unless otherwise configured, the router identifier is the loopback address.</p> |
| <b>Required Privilege Level</b> | <p><b>interface</b>—To view this statement in the configuration.</p> <p><b>interface-control</b>—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Specifying the Transport Address Used by LDP on page 30</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## version (BFD)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | version (0   1   automatic);                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Hierarchy Level</b>          | <p>[edit logical-systems <i>logical-system-name</i> protocols ldp oam <a href="#">bfd-liveness-detection</a>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols ldp oam fec <i>address</i> <a href="#">bfd-liveness-detection</a>],</p> <p>[edit system services dhcp-local-server liveness-detection method bfd],</p> <p>[edit system services dhcp-local-server dhcpv6 liveness-detection method bfd],</p> <p>[edit forwarding-options dhcp-relay liveness-detection method bfd],</p> <p>[edit forwarding-options dhcp-relay dhcpv6 liveness-detection method bfd],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> liveness-detection method bfd],</p> <p>[edit system services dhcp-local-server dhcpv6 group <i>group-name</i> liveness-detection method bfd],</p> <p>[edit forwarding-options dhcp-relay group <i>group-name</i> liveness-detection method bfd],</p> <p>[edit forwarding-options dhcp-relay dhcpv6 group <i>group-name</i> liveness-detection method bfd],</p> <p>[edit protocols ldp oam <a href="#">bfd-liveness-detection</a>],</p> <p>[edit protocols ldp oam fec <i>address</i> <a href="#">bfd-liveness-detection</a>]</p> |
| <b>Release Information</b>      | <p>Statement introduced in Junos OS Release 12.1.</p> <p>Statement introduced in Junos OS Release 12.3R2 for EX Series switches.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b>              | Configure the BFD protocol version to detect.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Options</b>                  | <p>0—Use BFD protocol version 0.</p> <p>1—Use BFD protocol version 1.</p> <p><b>automatic</b>—Autodetect the BFD protocol version.</p> <p><b>Default:</b> automatic</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Example: Configuring Group Liveness Detection for DHCP Local Server Clients</i></li> <li>• <i>Example: Configuring Global Liveness Detection for DHCP Relay Agent Clients</i></li> <li>• <a href="#">Configuring BFD for LDP LSPs on page 34</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## PART 3

# Administration

- [LDP Standards on page 195](#)
- [Operational Commands on page 197](#)



## CHAPTER 5

# LDP Standards

- [Supported LDP Standards on page 195](#)

### Supported LDP Standards

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Junos OS substantially supports the following RFCs and Internet drafts, which define standards for LDP.

- RFC 3212, *Constraint-Based LSP Setup using LDP*
- RFC 3478, *Graceful Restart Mechanism for Label Distribution Protocol*
- Internet draft draft-napierala-mpls-targeted-mldp-01.txt, *Using LDP Multipoint Extensions on Targeted LDP Sessions*

The following RFCs do not define standards, but provide information about LDP. The IETF classifies them as “Informational.”

- RFC 3215, *LDP State Machine*
- RFC 5036, *LDP Specification*

For the following features described in the indicated sections of the RFC, Junos OS supports one of the possible modes but not the others:

- Label distribution control (section 2.6.1): Ordered mode is supported, but not Independent mode.
- Label retention (section 2.6.2): Liberal mode is supported, but not Conservative mode.
- Label advertisement (section 2.6.3): Downstream Unsolicited mode is supported, but not Downstream on Demand mode.
- RFC 5443, *LDP IGP Synchronization*
- RFC 6826, *Multipoint LDP In-Band Signaling for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths*

Junos OS support limited to point-to-multipoint extensions for LDP.

#### Related Documentation

- [Supported GMPLS Standards](#)

- *Supported MPLS Standards*
- *Supported RSVP Standards*
- *Accessing Standards Documents on the Internet*

## CHAPTER 6

# Operational Commands

- clear ldp neighbor
- clear ldp session
- clear ldp statistics
- ping mpls ldp
- show ldp database
- show ldp fec-filters
- show ldp interface
- show ldp neighbor
- show ldp p2mp tunnel
- show ldp path
- show ldp route
- show ldp session
- show ldp statistics
- show ldp traffic-statistics
- show security keychain
- traceroute mpls ldp

## clear ldp neighbor

---

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>clear ldp neighbor</code><br><code>&lt;instance <i>instance-name</i>&gt;</code><br><code>&lt;logical-system (all   <i>logical-system-name</i>)&gt;</code><br><code>&lt;neighbor&gt;</code>                                                                                                                                                                                                                                                                                  |
| <b>Description</b>              | Tear down Label Distribution Protocol (LDP) neighbor connections.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Options</b>                  | <p><b>none</b>—Tear down connections with all LDP neighbors for all routing instances.</p> <p><b>instance <i>instance-name</i></b>—(Optional) Clear the LDP session for the specified routing instance only.</p> <p><b>logical-system (all   <i>logical-system-name</i>)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p><b>neighbor</b>—(Optional) Clear an LDP session for the specified neighbor (IP address) only.</p> |
| <b>Required Privilege Level</b> | clear                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">show ldp neighbor on page 215</a></li></ul>                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>List of Sample Output</b>    | <a href="#">clear ldp neighbor on page 198</a>                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Output Fields</b>            | When you enter this command, you are provided feedback on the status of your request.                                                                                                                                                                                                                                                                                                                                                                                             |

## Sample Output

### clear ldp neighbor

```
user@host> clear ldp neighbor
```



## clear ldp session

---

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | clear ldp session<br><destination><br><instance <i>instance-name</i> ><br><logical-system (all   <i>logical-system-name</i> )>                                                                                                                                                                                                                                                                                                                                                |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b>              | Clear Label Distribution Protocol (LDP) sessions.                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Options</b>                  | <p><b>none</b>—Clear LDP sessions for all destinations for all routing instances.</p> <p><b>destination</b>—(Optional) Clear an LDP session for the specified destination (IP address).</p> <p><b>instance <i>instance-name</i></b>—(Optional) Clear the LDP session for the specified routing instance only.</p> <p><b>logical-system (all   <i>logical-system-name</i>)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> |
| <b>Required Privilege Level</b> | clear                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">show ldp session on page 224</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                              |
| <b>List of Sample Output</b>    | <a href="#">clear ldp session on page 199</a>                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Output Fields</b>            | When you enter this command, you are provided feedback on the status of your request.                                                                                                                                                                                                                                                                                                                                                                                         |

## Sample Output

### clear ldp session

```
user@host> clear ldp session
```

## clear ldp statistics

---

|                                 |                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>clear ldp statistics</code><br><code>&lt;instance <i>instance-name</i>&gt;</code><br><code>&lt;logical-system (all   <i>logical-system-name</i>)&gt;</code>                                                                                                                                                                                          |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                            |
| <b>Description</b>              | Set all Label Distribution Protocol (LDP) statistics to zero.                                                                                                                                                                                                                                                                                              |
| <b>Options</b>                  | <b>none</b> —Set all LDP statistics to zero for all routing instances.<br><br><b>instance <i>instance-name</i></b> —(Optional) Clear the LDP session for the specified routing instance only.<br><br><b>logical-system (all   <i>logical-system-name</i>)</b> —(Optional) Perform this operation on all logical systems or on a particular logical system. |
| <b>Required Privilege Level</b> | clear                                                                                                                                                                                                                                                                                                                                                      |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">show ldp statistics on page 229</a></li><li>• <a href="#">show ldp traffic-statistics on page 233</a></li></ul>                                                                                                                                                                                        |
| <b>List of Sample Output</b>    | <a href="#">clear ldp statistics on page 200</a>                                                                                                                                                                                                                                                                                                           |
| <b>Output Fields</b>            | When you enter this command, you are provided feedback on the status of your request.                                                                                                                                                                                                                                                                      |

## Sample Output

### clear ldp statistics

```
user@host> clear ldp statistics
```

## ping mpls ldp

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <pre>ping mpls ldp fec &lt;count count&gt; &lt;destination address&gt; &lt;detail&gt; &lt;exp forwarding-class&gt; &lt;instance routing-instance-name&gt; &lt;logical-system (all   logical-system-name)&gt; &lt;p2mp root-addr ip-address lsp-id identifier&gt; &lt;size bytes&gt; &lt;source source-address&gt; &lt;sweep&gt;</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Release Information</b> | <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><b>size</b> and <b>sweep</b> options introduced in Junos OS Release 9.6.</p> <p><b>instance</b> option introduced in Junos OS Release 10.0.</p> <p><b>p2mp</b>, <b>root-address</b>, and <b>lsp-id</b> options introduced in Junos OS Release 11.2.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>         | <p>Check the operability of MPLS LDP-signaled label-switched path (LSP) connections. Type Ctrl+c to interrupt a <b>ping mpls</b> command.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Options</b>             | <p><b>count</b> <i>count</i>—(Optional) Number of ping requests to send. If <b>count</b> is not specified, five ping requests are sent. The range of values is 1 through <b>1,000,000</b>. The default value is <b>5</b>.</p> <p><b>destination</b> <i>address</i>—(Optional) Specify an address other than the default (<b>127.0.0.1/32</b>) for the ping echo requests. The address can be anything within the <b>127/8</b> subnet.</p> <p><b>detail</b>—(Optional) Display detailed information about the echo requests sent and received.</p> <p><b>exp</b> <i>forwarding-class</i>—(Optional) Value of the forwarding class for the MPLS ping packets.</p> <p><b>fec</b>—Ping an LDP-signaled LSP using the forwarding equivalence class (FEC) prefix and length.</p> <p><b>instance</b> <i>routing-instance-name</i>—(Optional) Allows you to ping a combination of the routing instance and forwarding equivalence class (FEC) associated with an LSP.</p> <p><b>logical-system</b> (<i>all</i>   <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on the specified logical system.</p> <p><b>p2mp</b> <i>root-addr ip-address lsp-id identifier</i>—(Optional) Ping the end points of a point-to-multipoint LSP. Enter the IP address of the point-to-multipoint LSP root and the ID number of the point-to-multipoint LSP.</p> <p><b>size</b> <i>bytes</i>—(Optional) Size of the LSP ping request packet (<b>88</b> through <b>65468</b> bytes). Packets are 4-byte aligned. For example, If you enter a size of 89, 90, 91, or 92, the router or switch uses a size value of 92 bytes. If you enter a packet size that is smaller than the minimum size, an error message is displayed reminding you of the 88-byte minimum.</p> |

**source *source-address***—(Optional) IP address of the outgoing interface. This address is sent in the IP source address field of the ping request. If this option is not specified, the default address is usually the loopback interface (**lo.0**).

**sweep**—(Optional) Automatically determine the size of the maximum transmission unit (MTU).

**Additional Information** If the LSP changes, the label and interface information displayed when you issued the **ping** command continues to be used. You must configure MPLS at the **[edit protocols mpls]** hierarchy level on the remote router or switch to ping an LSP terminating there. You must configure MPLS even if you intend to ping only LDP forwarding equivalence classes (FECs).

You can configure the ping interval for the **ping mpls ldp** command by specifying a new time in seconds using the **lsp-ping-interval** statement at the **[edit protocols ldp oam]** hierarchy level. For more information, see the *Junos OS MPLS Applications Library for Routing Devices*.

In asymmetric MTU scenarios, the echo response may be dropped. For example, if the MTU from System A to System B is 1000 bytes, the MTU from System B to System A is 500 bytes, and the ping request packet size is 1000 bytes, the echo response is dropped because the PAD TLV is included in the echo response, making it too large.

**Required Privilege Level** network

**List of Sample Output** [ping mpls ldp fec count on page 202](#)  
[ping mpls ldp p2mp root-addr lsp-id on page 202](#)

**Output Fields** When you enter this command, you are provided feedback on the status of your request. An exclamation point (!) indicates that an echo reply was received. A period (.) indicates that an echo reply was not received within the timeout period. An x indicates that an echo reply was received with an error code. Packets with error codes are not counted in the received packets count. They are accounted for separately.

## Sample Output

### ping mpls ldp fec count

```
user@host> ping mpls ldp 10.255.245.222 count 10
!!!xxx...x--- 1sping statistics ---10 packets transmitted, 3 packets received,
70% packet loss 4 packets received with error status, not counted as received.
```

### ping mpls ldp p2mp root-addr lsp-id

```
user@host> ping mpls ldp p2mp root-addr 10.1.1.1/32 lsp-id 1 count 1
Request for seq 1, to interface 71, no label stack.
Request for seq 1, to interface 70, label 299786
Reply for seq 1, egress 10.1.1.3, return code: Egress-ok, time: 18.936 ms
    Local transmit time: 2009-01-12 03:50:03 PST 407.281 ms
    Remote receive time: 2009-01-12 03:50:03 PST 426.217 ms
Reply for seq 1, egress 10.1.1.4, return code: Egress-ok, time: 18.936 ms
    Local transmit time: 2009-01-12 03:50:03 PST 407.281 ms
    Remote receive time: 2009-01-12 03:50:03 PST 426.217 ms
```

```
Reply for seq 1, egress 10.1.1.5, return code: Egress-ok, time: 18.936 ms
Local transmit time: 2009-01-12 03:50:03 PST 407.281 ms
Remote receive time: 2009-01-12 03:50:03 PST 426.217 ms
```

## show ldp database

---

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>show ldp database</code><br><code>&lt;brief   detail   extensive&gt;</code><br><code>&lt;inet   l2circuit&gt;</code><br><code>&lt;instance <i>instance-name</i>&gt;</code><br><code>&lt;logical-system (all   <i>logical-system-name</i>)&gt;</code><br><code>&lt;session <i>session</i>&gt;</code><br><code>p2mp</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>              | Display entries in the LDP database.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Options</b>                  | <p><b>none</b>—Display standard information about all entries in the LDP database for all routing instances.</p> <p><b>brief   detail   extensive</b>—(Optional) Display the specified level of output.</p> <p><b>inet   l2circuit</b>—(Optional) Display only IPv4 or Layer 2 circuit bindings.</p> <p><b>instance <i>instance-name</i></b>—(Optional) Display routing instance information for the specified instance only.</p> <p><b>logical-system (all   <i>logical-system-name</i>)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p><b>session <i>session</i></b>—(Optional) Display database for the specified session only. <b><i>session</i></b> is the destination address of the LDP session.</p> <p><b>p2mp</b>—(Optional) Display point-to-multipoint binding information.</p> |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>List of Sample Output</b>    | <a href="#">show ldp database (master) on page 206</a><br><a href="#">show ldp database (standby) on page 207</a><br><a href="#">show ldp database l2circuit detail on page 208</a><br><a href="#">show ldp database l2circuit extensive on page 208</a><br><a href="#">show ldp database p2mp (master) on page 208</a><br><a href="#">show ldp database p2mp (standby) on page 209</a><br><a href="#">show ldp database p2mp (master) on page 209</a><br><a href="#">show ldp database p2mp (standby) on page 209</a><br><a href="#">show ldp database session on page 210</a><br><a href="#">show ldp database (Ingress Node with Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs) on page 210</a><br><a href="#">show ldp database (Egress Node with Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs) on page 211</a> |
| <b>Output Fields</b>            | <a href="#">Table 5 on page 205</a> describes the output fields for the <b>show ldp database</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

Table 5: show ldp database Output Fields

| Field Name                 | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Level of Output |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Input label database       | Label received from the other router.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | All levels      |
| Output label database      | Label advertised to the other router.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | All levels      |
| <i>session-identifier</i>  | Session identifier, which includes the local and remote label space identifiers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | All levels      |
| Label                      | Label binding to a route prefix.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | All levels      |
| Prefix                     | <p>Route prefix.</p> <p>It can be one of the following values:</p> <ul style="list-style-type: none"> <li>• IP prefix.</li> <li>• Point-to-multipoint root address, multicast source address, and multicast group address when multipoint LDP (M-LDP) inband signaling is configured.</li> <li>• Layer 2 encapsulation type.</li> </ul> <p>Layer 2 encapsulation types are displayed in the format <b>L2CKT control word status encapsulation-type vc-number</b>, for example, <b>L2CKT CtlfWord FRAME RELAY VC 2</b></p> <ul style="list-style-type: none"> <li>• <b>control-word-status</b>—Displays whether the use of the control word has been negotiated for this virtual circuit: <ul style="list-style-type: none"> <li>• <b>NoCtrlWord</b></li> <li>• <b>CtrlWord</b></li> </ul> </li> <li>• <b>encapsulation-type</b>—Encapsulation type: <ul style="list-style-type: none"> <li>• <b>FRAME RELAY</b></li> <li>• <b>ATM AAL5</b></li> <li>• <b>ATM CELL</b></li> <li>• <b>VLAN</b></li> <li>• <b>ETHERNET</b></li> <li>• <b>CISCO_HDLC</b></li> <li>• <b>PPP</b></li> </ul> </li> <li>• <b>VC number</b>—Virtual circuit number. It can have any numeric value.</li> <li>• <b>(Stale)</b>—When you display the LDP database for the neighbor of a restarting router, the bindings learned from the restarting neighbor are displayed as (Stale). Stale bindings are deleted if they are not refreshed within the recovery time.</li> </ul> | All levels      |
| MTU                        | MTU of the Layer 2 circuit. MTU is displayed for all encapsulation types except ATM cell encapsulations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | detail          |
| VCCV Control Channel types | <p>Virtual Circuit Connection Verification (VCCV) control channel types.</p> <ul style="list-style-type: none"> <li>• MPLS router alert label</li> <li>• MPLS PW label with TTL=1</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | extensive       |

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

| Field Name                      | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Level of Output  |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| VCCV Control Verification types | The only valid VCCV control verification type is <b>LSP ping</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>extensive</b> |
| TDM payload size                | Size of the Time Division Multiplex (TDM) payload.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | All levels       |
| TDM bitrate                     | Bit rate for the TDM traffic.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | All levels       |
| Requested VLAN ID               | (VLANs) VLAN identifier of the Layer 2 circuit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>detail</b>    |
| Cell bundle size                | (ATM cell encapsulations) Maximum number of cells that the Layer 2 circuit can receive in a packet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>detail</b>    |
| State                           | State of the label binding: <ul style="list-style-type: none"> <li>• <b>Active</b>—Label binding has been installed and distributed appropriately. A label binding is almost always in this state.</li> <li>• <b>New</b>—New label that has not yet been distributed.               <ul style="list-style-type: none"> <li>• <b>MapRcv</b>—Waiting to receive a label mapping message.</li> <li>• <b>MapSend</b>—Waiting to send a label mapping message.</li> <li>• <b>RelRcv</b>—Waiting to receive a label release message.</li> <li>• <b>RelRsnd</b>—Waiting to receive a label release message before resending label mapping message.</li> <li>• <b>RelSend</b>—Waiting to send a label release message.</li> <li>• <b>ReqSend</b>—Waiting to send a label request message.</li> <li>• <b>W/dSend</b>—Waiting to send a label withdrawal message.</li> </ul> </li> </ul> | <b>detail</b>    |
| Age                             | Time elapsed since the binding was created.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>detail</b>    |

## Sample Output

### show ldp database (master)

```

user@host> show ldp database extensive
Input label database, 10.255.107.232:0--10.255.107.236:0
Label Prefix
299840 10.255.107.232/32
      State: Active
      Age: 9:35
      Entropy Label Capability: No
      3 10.255.107.236/32
      State: Active
      Age: 9:35
      Entropy Label Capability: No
299776 L2CKT CtrlWord VLAN VC 100
      MTU: 1500 Requested VLAN ID: 600 Flow Label T Bit: 1 Flow Label R
Bit: 1
      State: Active
      Age: 9:35
      Entropy Label Capability: No
      VCCV Control Channel types:

```



```

PWE3 control word
MPLS router alert label
MPLS PW label with TTL=1
VCCV Control Verification types:
LSP ping
BFD with PW-ACH-encapsulation for Fault Detection
BFD with IP/UDP-encapsulation for Fault Detection

```

Output label database, 10.255.107.232:0--10.255.107.236:0

```

Label Prefix
3      10.255.107.232/32
      State: Active
      Age: 9:35
      Entropy Label Capability: No
299776 10.255.107.236/32
      State: Active
      Age: 9:35
      Entropy Label Capability: No

```

### show ldp database (standby)

user@host> show ldp database extensive

Input label database, 10.255.107.236:0--10.255.107.234:0

```

Label Prefix
299808 10.255.107.230/32
      State: Active
      Age: 1d 2:46:36
      Standby binding state:
        Map messages: 1
        Release messages: 0
Label Prefix
301136 10.255.107.232/32
      State: Active
      Age: 1d 2:46:36
      Standby binding state:
        Map messages: 1
        Release messages: 0
Label Prefix
3      10.255.107.234/32
      State: Active
      Age: 1d 2:46:36
      Standby binding state:
        Map messages: 1
        Release messages: 0
Label Prefix
302480 10.255.107.236/32
      State: Active
      Age: 1d 2:46:36
      Standby binding state:
        Map messages: 1
        Release messages: 0

```

Output label database, 10.255.107.236:0--10.255.107.234:0

```

Label Prefix
299904 10.255.107.230/32
      State: Active
      Age: 1d 2:46:36
299936 10.255.107.232/32
      State: Active
      Age: 1d 2:46:36

```

```

299872      10.255.107.234/32
            State: Active
            Age: 1d 2:46:36
      3      10.255.107.236/32
            State: Active
            Age: 1d 2:46:36
299952      P2MP root-addr 10.255.107.230, lsp-id 16777217
            State: Active
            Age: 1d 2:46:36

```

#### show ldp database l2circuit detail

```

user@host> show ldp database l2circuit detail
Input label database, 10.255.245.44:0--10.255.245.45:0
  Label Prefix
  100176 L2CKT CtrlWord ATM CELL (VC Mode) VC 100
          Cell bundle size: 80
          State: Active
          Age: 9:48
  100256 L2CKT CtrlWord FRAME RELAY VC 101
          MTU: 4470
          State: Active
          Age: 9:48

Output label database, 10.255.245.44:0--10.255.245.45:0
  Label Prefix
  100048 L2CKT CtrlWord ATM CELL (VC Mode) VC 100
          Cell bundle size: 80
          State: Active
          Age: 9:48
  100112 L2CKT CtrlWord FRAME RELAY VC 101
          MTU: 4470
          State: Active
          Age: 9:48

```

#### show ldp database l2circuit extensive

```

user@host> show ldp database l2circuit extensive
Input label database, 10.255.245.198:0--10.255.245.194:0
  Label Prefix
  299872 L2CKT CtrlWord PPP VC 100
          MTU: 4470
          VCCV Control Channel types:
            MPLS router alert label
            MPLS PW label with TTL=1
          VCCV Control Verification types:
            LSP ping
  Label Prefix
          State: Active
          Age: 19:23:08

```

#### show ldp database p2mp (master)

```

user@host> show ldp database p2mp extensive

Input label database, 10.255.107.232:0--10.255.107.236:0
  Label Prefix
  569649 P2MP root-addr 10.255.107.232, lsp-id 16777217
          State: Active
          Age: 2d 6:41:46

```

Output label database, 10.255.107.232:0--10.255.107.236:0

Input label database, 10.255.107.232:0--10.255.107.238:0

Output label database, 10.255.107.232:0--10.255.107.238:0

```
Label Prefix
299888 P2MP root-addr 10.255.107.230, lsp-id 16777217
State: Active
Age: 2d 6:41:35
```

### show ldp database p2mp (standby)

user@host> show ldp database p2mp extensive

Input label database, 10.255.107.236:0--10.255.107.232:0

```
Label Prefix
299968 P2MP root-addr 10.255.107.230, lsp-id 16777217
State: Active
Age: 4d 22:21:57
Standby binding state:
Map messages: 1
Release messages: 0
```

Output label database, 10.255.107.236:0--10.255.107.232:0

```
Label Prefix
3 P2MP root-addr 10.255.107.232, lsp-id 1
State: Active
Age: 4d 22:21:57
```

### show ldp database p2mp (master)

user@host> show ldp database p2mp extensive

Input label database, 10.255.107.232:0--10.255.107.236:0

```
Label Prefix
569649 P2MP root-addr 10.255.107.232, lsp-id 16777217
State: Active
Age: 2d 6:41:46
```

Output label database, 10.255.107.232:0--10.255.107.236:0

Input label database, 10.255.107.232:0--10.255.107.238:0

Output label database, 10.255.107.232:0--10.255.107.238:0

```
Label Prefix
299888 P2MP root-addr 10.255.107.230, lsp-id 16777217
State: Active
Age: 2d 6:41:35
```

### show ldp database p2mp (standby)

user@host> show ldp database p2mp extensive

Input label database, 10.255.107.236:0--10.255.107.232:0

```
Label Prefix
299968 P2MP root-addr 10.255.107.230, lsp-id 16777217
State: Active
Age: 4d 22:21:57
Standby binding state:
Map messages: 1
Release messages: 0
```

```

Output label database, 10.255.107.236:0--10.255.107.232:0
Label Prefix
  3      P2MP root-addr 10.255.107.232, lsp-id 1
        State: Active
        Age: 4d 22:21:57

```

#### show ldp database session

```

user@host> show ldp database session 10.1.1.195
Input label database, 10.0.0.194:0--10.1.1.195:0
Label Prefix
100002 10.255.245.197/32
100003 10.255.245.196/32
100004 10.0.0.194/32
  3      10.1.1.195/32
100000 L2CKT NoCtrlWord FRAME RELAY VC 1
100001 L2CKT CtrlWord FRAME RELAY VC 2
Output label database, 10.0.0.194:0--10.1.1.195:0
Label Prefix
100003 10.255.245.197/32
100004 10.1.1.195/32
100002 10.255.245.196/32
  3      10.0.0.194/32
100000 L2CKT CtrlWord FRAME RELAY VC 2
100001 L2CKT NoCtrlWord FRAME RELAY VC 1

```

#### show ldp database (Ingress Node with Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs)

```

user@host> show ldp database
Input label database, 1.1.1.2:0--1.1.1.3:0
Label Prefix
299808 1.1.1.2/32
  3      1.1.1.3/32
299792 1.1.1.6/32
299776 10.255.2.227/32
299840 P2MP root-addr 1.1.1.2, grp: 232.2.2.2, src: 1.2.7.7
299824 P2MP root-addr 1.1.1.2, grp: 232.1.1.2, src: 192.168.219.11

Output label database, 1.1.1.2:0--1.1.1.3:0
Label Prefix
  3      1.1.1.2/32
299776 1.1.1.3/32
299808 1.1.1.6/32
299792 10.255.2.227/32

Input label database, 1.1.1.2:0--1.1.1.6:0
Label Prefix
299856 1.1.1.2/32
299792 1.1.1.3/32
  3      1.1.1.6/32
299776 10.255.2.227/32
299888 P2MP root-addr 1.1.1.2, grp: 232.2.2.2, src: 1.2.7.7
299808 P2MP root-addr 1.1.1.2, grp: 232.1.1.1, src: 192.168.219.11
299824 P2MP root-addr 1.1.1.2, grp: 232.1.1.2, src: 192.168.219.11
299840 P2MP root-addr 1.1.1.2, grp: 232.1.1.3, src: 192.168.219.11
299872 P2MP root-addr 1.1.1.2, grp: ff3e::1:2, src: abcd::1:2:7:7

Output label database, 1.1.1.2:0--1.1.1.6:0
Label Prefix
  3      1.1.1.2/32

```

```

299776    1.1.1.3/32
299808    1.1.1.6/32
299792    10.255.2.227/32

```

### show ldp database (Egress Node with Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs)

```

user@host> show ldp database
Input label database, 10.255.2.227:0--1.1.1.3:0
  Label    Prefix
299808     1.1.1.2/32
   3       1.1.1.3/32
299792     1.1.1.6/32
299776     10.255.2.227/32

Output label database, 10.255.2.227:0--1.1.1.3:0
  Label    Prefix
299856     1.1.1.2/32
299776     1.1.1.3/32
299792     1.1.1.6/32
   3       10.255.2.227/32

Input label database, 10.255.2.227:0--1.1.1.6:0
  Label    Prefix
299856     1.1.1.2/32
299792     1.1.1.3/32
   3       1.1.1.6/32
299776     10.255.2.227/32

Output label database, 10.255.2.227:0--1.1.1.6:0
  Label    Prefix
299856     1.1.1.2/32
299776     1.1.1.3/32
299792     1.1.1.6/32
   3       10.255.2.227/32
299888     P2MP root-addr 1.1.1.2, grp: 232.2.2.2, src: 1.2.7.7
299808     P2MP root-addr 1.1.1.2, grp: 232.1.1.1, src: 192.168.219.11
299824     P2MP root-addr 1.1.1.2, grp: 232.1.1.2, src: 192.168.219.11
299840     P2MP root-addr 1.1.1.2, grp: 232.1.1.3, src: 192.168.219.11
299872     P2MP root-addr 1.1.1.2, grp: ff3e::1:2, src: abcd::1:2:7:7

```

## show ldp fec-filters

|                                 |                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ldp fec-filters<br><fec><br><instance <i>instance-name</i> ><br><logical-system (all   <i>logical-system-name</i> )>                                                                                                                                                                                                                                        |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b>              | Display information about configured Label Distribution Protocol (LDP) forwarding equivalence class (FEC) filters.                                                                                                                                                                                                                                               |
| <b>Options</b>                  | <p><b>fec</b>—(Optional) Display FEC filter information for the specified FEC.</p> <p><b>instance <i>instance-name</i></b>—(Optional) Display FEC filter information for the specified instance.</p> <p><b>logical-system (all   <i>logical-system-name</i>)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                             |
| <b>List of Sample Output</b>    | <a href="#">show ldp fec-filters on page 212</a>                                                                                                                                                                                                                                                                                                                 |
| <b>Output Fields</b>            | <a href="#">Table 6 on page 212</a> lists the output fields for the <b>show ldp fec-filters</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                                 |

**Table 6: show ldp fec-filters Output Fields**

| Field Name | Field Description                                |
|------------|--------------------------------------------------|
| Ingress    | Names of the FEC filters on the ingress routers. |
| Transit    | Names of the FEC filters on the transit routers. |

## Sample Output

### show ldp fec-filters

```
user@host> show ldp fec-filters 10/8
10.22.1.2/32
  Ingress: f1-10.22.1.2/32 (index: 3)
  Transit: (null) (index: 0)
```

## show ldp interface

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ldp interface<br><brief   detail   extensive><br><interface-name><br><instance instance-name><br><logical-system (all   logical-system-name)>                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>              | Display the status of Label Distribution Protocol (LDP)-enabled interfaces.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Options</b>                  | <p><b>none</b>—Display standard status information about all LDP-enabled interface for all routing instances.</p> <p><b>interface-name</b>—(Optional) Display information for the specified interface.</p> <p><b>brief   detail   extensive</b>—(Optional) Display the specified level of output.</p> <p><b>instance instance-name</b>—(Optional) Display information for the specified routing instance.</p> <p><b>logical-system (all   logical-system-name)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>List of Sample Output</b>    | <a href="#">show ldp interface extensive on page 214</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Output Fields</b>            | <p><a href="#">Table 7 on page 213</a> describes the output fields for the <b>show ldp interface</b> command. Output fields are listed in the approximate order in which they appear.</p>                                                                                                                                                                                                                                                                                                                                                                          |

Table 7: show ldp interface Output Fields

| Field Name     | Field Description                                                                                                                                                              | Level of Output     |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Interface      | Interface name.                                                                                                                                                                | All levels          |
| Label space ID | Label space identifier that the router is advertising on the interface.                                                                                                        | All levels          |
| Nbr count      | Number of neighbors on the interface.                                                                                                                                          | All levels          |
| Next hello     | How long until the next hello packet is sent on this interface, in seconds.                                                                                                    | All levels          |
| Hello interval | One-third of the negotiated hold time (in seconds). If the user-configured value for the hello interval is smaller than the computed value, the user-configured value is used. | detail<br>extensive |
| Hold time      | Configured hold time, in seconds.                                                                                                                                              | detail<br>extensive |

Table 7: show ldp interface Output Fields (*continued*)

| Field Name           | Field Description                                                                 | Level of Output |
|----------------------|-----------------------------------------------------------------------------------|-----------------|
| Transport address    | Address to which the neighbor wants the local route to establish the LDP session. | extensive       |
| Local hello interval | Locally configured hello interval.                                                | extensive       |

## Sample Output

### show ldp interface extensive

```
user@host> show ldp interface extensive
Interface          Label space ID      Nbr count  Next hello
fe-0/0/3.0         10.255.245.6:0      2          0
Hello interval: 1, Hold time: 15, Transport address: 10.255.245.6
Local hello interval: 2, Index: 69
```



## show ldp neighbor

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ldp neighbor<br><brief   detail   extensive><br><instance <i>instance-name</i> ><br><logical-system (all   <i>logical-system-name</i> )><br><neighbor-address>                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.<br><b>neighbor-address</b> option added in Junos OS Release 8.5.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>              | Display Label Distribution Protocol (LDP) neighbor information.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Options</b>                  | <p><b>none</b>—Display standard information about LDP neighbors for all routing instances.</p> <p><b>brief   detail   extensive</b>—(Optional) Display the specified level of output.</p> <p><b>instance <i>instance-name</i></b>—(Optional) Display information for the specified routing instance.</p> <p><b>logical-system (all   <i>logical-system-name</i>)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p><b>neighbor-address</b>—(Optional) Display information about the specified LDP neighbor.</p> |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">clear ldp neighbor on page 198</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>List of Sample Output</b>    | <a href="#">show ldp neighbor extensive on page 216</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Output Fields</b>            | Table 8 on page 215 describes the output fields for the <b>show ldp neighbor</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                                                                                                                                                                                                                                                    |

Table 8: show ldp neighbor Output Fields

| Field Name             | Field Description                                                                 | Level of Output |
|------------------------|-----------------------------------------------------------------------------------|-----------------|
| Address                | IP address of the neighbor.                                                       | All levels      |
| Interface              | Interface over which the neighbor was discovered.                                 | All levels      |
| Label space ID         | Label space identifier advertised by the neighbor.                                | All levels      |
| Hold time              | Remaining hold time before the neighbor expires, in seconds.                      | All levels      |
| Transport address      | Address to which the neighbor wants the local route to establish the LDP session. | <b>detail</b>   |
| Configuration sequence | Counter that increments whenever the neighbor changes its configuration.          | <b>detail</b>   |

Table 8: show ldp neighbor Output Fields (*continued*)

| Field Name          | Field Description                                                                                           | Level of Output  |
|---------------------|-------------------------------------------------------------------------------------------------------------|------------------|
| Up for              | Length of time the LDP neighbor has been in operation.                                                      | detail extensive |
| Reference count     | Reference count for the LDP neighbor.                                                                       | extensive        |
| Hold time           | Displays the neighbor's hold time. The hold time is the proposed hold times for the local and peer routers. | extensive        |
| Proposed local/peer | Hold time value proposed by the local router and the peer router.                                           | extensive        |

## Sample Output

### show ldp neighbor extensive

```
user@host> show ldp neighbor extensive
Address          Interface          Label space ID      Hold Time
192.168.37.23    so-1/0/0.0        10.255.245.5:0      44
  Transport address: 10.255.245.5, Configuration sequence: 6
  Up for 00:03:37
  Reference count: 1
  Hold time: 45, Proposed local/peer: 15/45
```

## show ldp p2mp tunnel

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ldp p2mp tunnel<br><brief   detail   extensive><br><instance <i>instance-name</i> ><br><logical-system (all   <i>logical-system-name</i> )>                                                                                                                                                                                                                                                                   |
| <b>Release Information</b>      | Command introduced in Junos OS Release 13.3.                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>              | Display LDP point-to-multipoint tunnel table information.                                                                                                                                                                                                                                                                                                                                                          |
| <b>Options</b>                  | <p><b>brief   detail   extensive</b>—(Optional) Display the specified level of output.</p> <p><b>instance <i>instance-name</i></b>—(Optional) Display routing instance information for the specified instance only.</p> <p><b>logical-system (all   <i>logical-system-name</i>)</b>—(Optional) Display LDP point-to-multipoint tunnel table information of all logical systems or a particular logical system.</p> |
| <b>Required Privilege Level</b> | View                                                                                                                                                                                                                                                                                                                                                                                                               |

## Sample Output

show ldp p2mp tunnel

```
user@host> show ldp p2mp tunnel extensive
```

```

Instance      Tunnel type      Tunnel name
0             Name            10.254.1.1:1:ldp-p2mp:mvpn:vpn-1
P2MP root-addr 10.255.107.232, lsp-id 16777217
Self id 805306372
Reference count 2
```

## show ldp path

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>show ldp path &lt;brief   detail   extensive&gt; &lt;destination&gt; &lt;instance instance-name&gt; &lt;logical-system (all   logical-system-name)&gt;</pre>                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b>              | Display Label Distribution Protocol (LDP) label-switched paths (LSPs).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Options</b>                  | <p><b>none</b>—Display standard information about all LDP LSPs for all routing instances.</p> <p><b>brief   detail   extensive</b>—(Optional) Display the specified level of output.</p> <p><b>destination</b>—(Optional) Restrict the output to entries that match the specified destination prefix.</p> <p><b>instance instance-name</b>—(Optional) Display information for the specified routing instance only.</p> <p><b>logical-system (all   logical-system-name)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>List of Sample Output</b>    | <a href="#">show ldp path extensive on page 219</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Output Fields</b>            | <a href="#">Table 9 on page 218</a> describes the output fields for the <b>show ldp path</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                                                                                                                                                                                                                                               |

**Table 9: show ldp path Output Fields**

| Field Name                    | Field Description                                                                                            |
|-------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Output Session (label)</b> | Session ID and labels that this system has sent using LDP. These correspond to MPLS packets received.        |
| <b>Input Session (label)</b>  | Session ID and labels that this system has received using LDP. These correspond to MPLS packets transmitted. |
| <b>route</b>                  | MPLS route.                                                                                                  |
| <b>Attached route</b>         | Route corresponding to the LSP.                                                                              |
| <b>Ingress route</b>          | The router acts as the ingress for the LSP.                                                                  |
| <b>Reference count</b>        | Reference count for the LDP neighbor.                                                                        |
| <b>Transit route</b>          | Names of the forwarding equivalence class (FEC) filters on the transit routers.                              |

Table 9: show ldp path Output Fields (*continued*)

| Field Name   | Field Description                 |
|--------------|-----------------------------------|
| Global label | MPLS label that is used globally. |

## Sample Output

### show ldp path extensive

```
user@host> show ldp path extensive
Output Session (label)      Input Session (label)
10.255.14.220:0(3)         ( )
    Attached route: 10.255.14.221/32
    Reference count: 3, Global label: 3
10.255.14.220:0(100000)     10.255.14.220:0(3)
    Attached route: 10.255.14.220/32, Ingress route
    Reference count: 2, Transit route, Global label: 100000
10.255.14.220:0(100001)     10.255.14.220:0(100001)
    Attached route: 10.255.14.214/32, Ingress route
    Reference count: 2, Transit route, Global label: 100001
```

## show ldp route

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>show ldp route &lt;brief   detail   extensive&gt; &lt;destination&gt; &lt;instance instance-name&gt; &lt;logical-system (all   logical-system-name)&gt;</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>              | Display the entries in the Label Distribution Protocol (LDP) internal topology table. The internal topology table contains routes from inet.0 and inet.3 and is used when binding a label to a forwarding equivalence class (FEC).                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Options</b>                  | <p><b>none</b>—Display standard information about all entries in the LDP internal topology table for all routing instances.</p> <p><b>brief   detail   extensive</b>—(Optional) Display the specified level of output.</p> <p><b>destination</b>—(Optional) Restrict the output to entries that are longer than the specified destination prefix and prefix length.</p> <p><b>instance instance-name</b>—(Optional) Display entries for the specified routing instance only.</p> <p><b>logical-system (all   logical-system-name)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>List of Sample Output</b>    | <a href="#">show ldp route detail on page 222</a><br><a href="#">show ldp route extensive on page 222</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Output Fields</b>            | <a href="#">Table 10 on page 220</a> describes the output fields for the <b>show ldp route</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

**Table 10: show ldp route Output Fields**

| Field Name                     | Field Description                                                                                                                                               |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Destination</b>             | Destination prefix.                                                                                                                                             |
| <b>Next-hop intf/lsp/table</b> | Interface that is the next hop to the destination prefix.                                                                                                       |
| <b>Next-hop address</b>        | IP address of the next hop.                                                                                                                                     |
| <b>Session ID</b>              | LDP session ID.                                                                                                                                                 |
| <b>Route flags</b>             | Information about the route. For example, the <b>Ingress TTL propagate</b> flag indicates that the time-to-live (TTL) value is being propagated with the route. |

Table 10: show ldp route Output Fields (*continued*)

| Field Name                     | Field Description                                                                        |
|--------------------------------|------------------------------------------------------------------------------------------|
| <b>Bound to outgoing label</b> | The route has been bound to LSPs with the label being distributed for that LSP.          |
| <b>Topology entry</b>          | The topology that the route is bound to.                                                 |
| <b>Ingress route status</b>    | Status of the ingress route. For example, it could be <b>Active</b> or <b>Inactive</b> . |
| <b>Last modified</b>           | The length of time since the ingress route status last changed.                          |

## Sample Output

### show ldp route detail

```

user@host> show ldp route 10.255.8.5 detail
Destination      Next-hop intf/lsp      Next-hop address
10.255.8.5/32     f1
  Session ID 10.255.170.84:0--10.255.170.92:0
                    fe-0/0/0.0      192.168.100.2
  Session ID 10.255.170.84:0--10.255.8.5:0
                    so-0/2/1.0
  Session ID 10.255.170.84:0--10.255.8.5:0
                    so-0/2/2.0
  Session ID 10.255.170.84:0--10.255.8.3:0
  Bound to outgoing label 299776, Topology entry: 0x8c38a80
  BFD dest addr   BFD state LSP-ping Next-hop addr Next-hop intf/lsp
127.0.0.64       up        up        192.168.100.2 fe-0/0/0.0
127.0.1.64       up        up                so-0/2/1.0
127.0.2.64       up        up                so-0/2/2.0
127.0.3.64       up        up                f1
.....

```

### show ldp route extensive

```

user@host> show ldp route extensive

Destination      Next-hop intf/lsp/table Next-hop address
10.0.0.0/30      ge-1/2/0.18            10.0.0.17
  Session ID 192.168.0.6:0--192.168.0.5:0
  Route flags: None
Destination      Next-hop intf/lsp/table Next-hop address
10.0.0.4/30      ge-1/2/0.18            10.0.0.17
  Session ID 192.168.0.6:0--192.168.0.5:0
  Route flags: None
Destination      Next-hop intf/lsp/table Next-hop address
10.0.0.8/30      ge-1/2/1.21            10.0.0.22
  Session ID 192.168.0.6:0--192.168.0.4:0
  Route flags: None
Destination      Next-hop intf/lsp/table Next-hop address
10.0.0.12/30     ge-1/2/1.21            10.0.0.22
  Session ID 192.168.0.6:0--192.168.0.4:0
  Route flags: None
Destination      Next-hop intf/lsp/table Next-hop address
10.0.0.16/30     ge-1/2/0.18            10.0.0.17
  Route flags: None
Destination      Next-hop intf/lsp/table Next-hop address
10.0.0.18/32     ge-1/2/1.21            10.0.0.22
  Route flags: None
Destination      Next-hop intf/lsp/table Next-hop address
10.0.0.20/30     ge-1/2/1.21            10.0.0.22
  Route flags: None
Destination      Next-hop intf/lsp/table Next-hop address
10.0.0.21/32     ge-1/2/1.21            10.0.0.22
  Route flags: None
Destination      Next-hop intf/lsp/table Next-hop address
192.168.0.1/32   ge-1/2/0.18            10.0.0.17
  Session ID 192.168.0.6:0--192.168.0.5:0
  Route flags: None
Destination      Next-hop intf/lsp/table Next-hop address
192.168.0.2/32   ge-1/2/1.21            10.0.0.22
  Session ID 192.168.0.6:0--192.168.0.4:0

```



```

                                ge-1/2/0.18                10.0.0.17
Session ID 192.168.0.6:0--192.168.0.5:0
Route flags: None
Destination      Next-hop intf/lsp/table      Next-hop address
192.168.0.3/32   ge-1/2/1.21                10.0.0.22
Session ID 192.168.0.6:0--192.168.0.4:0
Route flags: None
Destination      Next-hop intf/lsp/table      Next-hop address
192.168.0.4/32   ge-1/2/1.21                10.0.0.22
Session ID 192.168.0.6:0--192.168.0.4:0
Bound to outgoing label 299808, Topology entry: 0x92a483c
Ingress route status: Active, Last modified: 00:01:19 ago
Route flags: Ingress TTL propagate, Transit TTL propagate
Destination      Next-hop intf/lsp/table      Next-hop address
192.168.0.5/32   ge-1/2/0.18                10.0.0.17
Session ID 192.168.0.6:0--192.168.0.5:0
Bound to outgoing label 299792, Topology entry: 0x92a47f8
Ingress route status: Active, Last modified: 00:01:19 ago
Route flags: Ingress TTL propagate, Transit TTL propagate
Destination      Next-hop intf/lsp/table      Next-hop address
192.168.0.6/32   lo0.6
Bound to outgoing label 3, Topology entry: 0x92a4a5c
Ingress route status: Inactive
Route type: Egress route
Route flags: None

```

## show ldp session

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>show ldp session &lt;brief   detail   extensive&gt; &lt;destination&gt; &lt;instance instance-name&gt; &lt;logical-system (all   logical-system-name)&gt;</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b>              | Display information about Label Distribution Protocol (LDP) sessions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Options</b>                  | <p><b>none</b>—Display standard information about all LDP sessions for all routing instances.</p> <p><b>brief   detail   extensive</b>—(Optional) Display the specified level of output.</p> <p><b>destination</b>—(Optional) Restrict LDP session display to the specified address.</p> <p><b>instance instance-name</b>—(Optional) Display routing instance information for the specified instance. If <b>instance-name</b> is omitted, information is displayed for the master instance.</p> <p><b>logical-system (all   logical-system-name)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li><a href="#">clear ldp session on page 199</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>List of Sample Output</b>    | <a href="#">show ldp session brief on page 227</a><br><a href="#">show ldp session detail on page 227</a><br><a href="#">show ldp session extensive on page 228</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Output Fields</b>            | Table 11 on page 224 describes the output fields for the <b>show ldp session</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

Table 11: show ldp session Output Fields

| Field Name | Field Description                                                                                                                                                                                                                                                                           | Level of Output  |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Address    | Transport address of the session.                                                                                                                                                                                                                                                           | any              |
| State      | State of the session: <b>Nonexistent</b> , <b>Connecting</b> , <b>Initialized</b> , <b>OpenRec</b> , <b>OpenSent</b> , <b>Operational</b> , or <b>Closing</b> . The states correspond to the state diagram specified in Internet Draft LDP Specification draft-ietf-mpls-rfc3036bis-01.txt. | any              |
| Connection | TCP connection state: <b>Closed</b> , <b>Opening</b> , or <b>Open</b> .                                                                                                                                                                                                                     | any              |
| Hold time  | Time remaining until the session will be closed, in seconds.                                                                                                                                                                                                                                | any              |
| Session ID | LDP identifiers of the peers of this session.                                                                                                                                                                                                                                               | detail extensive |

Table 11: show ldp session Output Fields (*continued*)

| Field Name                    | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Level of Output         |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Next keepalive</b>         | Time until next keepalive is sent, in seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>detail extensive</b> |
| <b>Active</b>                 | Whether the local router is playing the active role in the session and during session establishment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>detail extensive</b> |
| <b>Passive</b>                | Whether the local router is playing the passive role in the session and during session establishment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>detail extensive</b> |
| <b>Maximum PDU</b>            | Maximum protocol data unit (PDU) size (packet size) for the session.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>detail extensive</b> |
| <b>Hold time</b>              | Time remaining until the session will be closed, in seconds. This value corresponds to the one configured using the <b>keepalive-timeout</b> statement configured at the <b>[edit protocols ldp]</b> hierarchy level.                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>detail extensive</b> |
| <b>Neighbor count</b>         | Number of neighbors that are contributing to the session.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>detail extensive</b> |
| <b>Keepalive interval</b>     | Keepalive interval, in seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>detail extensive</b> |
| <b>Connect retry interval</b> | TCP connection retry interval, in seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>detail extensive</b> |
| <b>Local address</b>          | Local transport address.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>detail extensive</b> |
| <b>Remote address</b>         | Remote transport address.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>detail extensive</b> |
| <b>Up for</b>                 | Time that this session has been up.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>detail extensive</b> |
| <b>Last down</b>              | Time since the session last went down.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>detail extensive</b> |
| <b>Reason</b>                 | Reason the session went down: <ul style="list-style-type: none"> <li>• Aborted graceful restart</li> <li>• Authentication key was changed</li> <li>• Bad type length value (TLV)</li> <li>• Bad protocol data unit (PDU) packets</li> <li>• Command-line interface (CLI) command</li> <li>• Connect time expired</li> <li>• Connection error</li> <li>• Connection reset</li> <li>• Error during initialization</li> <li>• Hold time expired</li> <li>• No adjacency or all adjacencies down</li> <li>• Notification received</li> <li>• Received notification from peer</li> <li>• Unexpected End of File (EOF)</li> <li>• Unknown reason</li> </ul> | <b>detail extensive</b> |

Table 11: show ldp session Output Fields (*continued*)

| Field Name                          | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Level of Output  |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Number of session flaps             | Number of times the session changes from up to down.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | detail extensive |
| Restarting                          | LDP is in the process of gracefully restarting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | detail extensive |
| Capabilities advertised             | LDP capabilities advertised to a peer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | detail extensive |
| Capabilities received               | LDP capabilities received from a peer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | detail extensive |
| Protection                          | Information about the status of MPLS LDP session protection.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | detail extensive |
| restart complete in <i>nnn msec</i> | Amount of time (in milliseconds) remaining until graceful restart is declared complete.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | detail extensive |
| Local                               | <p>Information about graceful restart for the local end of an LDP session. Graceful restart and helper mode are independent.</p> <ul style="list-style-type: none"> <li>• <b>Restart</b>—Status of the graceful restart feature at the local end of the LDP session: <b>enabled</b> or <b>disabled</b>.</li> <li>• <b>Helper mode</b>—Status of the helper mode feature at the local end of the LDP session: <b>enabled</b> or <b>disabled</b>. When this feature is enabled, the local end of the LDP session can help the restarting router with its LDP restart procedures.</li> <li>• <b>Reconnect time</b>—Amount of time to wait from when a restart is initiated until the router can exchange LDP messages with its neighbors. The default is <b>60000 msec</b> and is not configurable. (<b>Reconnect timeout</b> refers to "FT Reconnect timeout" in draft-ietf-mpls-ldp-restart-06, <i>Internet Draft Graceful Restart Mechanism for LDP</i>.)</li> </ul> | detail extensive |
| Remote                              | <p>Information about graceful restart at the remote end of an LDP session. Graceful restart and helper mode are independent.</p> <ul style="list-style-type: none"> <li>• <b>Restart</b>—Status of the graceful restart feature at the remote end of the LDP session: <b>enabled</b> or <b>disabled</b>.</li> <li>• <b>Helper mode</b>—Status of the helper mode feature at the remote end of the LDP session: <b>enabled</b> or <b>disabled</b>. When this feature is enabled, the remote end of the LDP session can help the restarting router with its LDP restart procedures.</li> <li>• <b>Reconnect time</b>—Amount of time in milliseconds from when a restart is initiated until the remote router can exchange LDP messages with its neighbors.</li> </ul>                                                                                                                                                                                                  | detail extensive |
| Local maximum recovery time         | Amount of time during which the restarting node attempts to recover its lost states with help from its neighbors (in milliseconds).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | detail extensive |
| Next-hop addresses received         | Next-hop addresses received on the session.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | detail extensive |
| Queue depth                         | Number of messages that are queued for sending to the peers in the group.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | extensive        |

Table 11: show ldp session Output Fields (*continued*)

| Field Name   | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Level of Output |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Message type | <p>Type of message being sent:</p> <ul style="list-style-type: none"> <li>• <b>Initialization</b>—Session initialization negotiation messages sent by an LSR to an LDP peer when the transport connection is established.</li> <li>• <b>Keepalive</b>—Keepalive timer messages sent by an LSR to an LDP peer to keep the session active when there is no information or PDU exchanged between them.</li> <li>• <b>Notification</b>—Notification messages (such as state of the LDP session) or error information (such as bad PDU length) sent by an LSR to an LDP peer.</li> <li>• <b>Address</b>—Message sent by an LSR to an LDP peer to advertise interface addresses.</li> <li>• <b>Address withdraw</b>—Message sent by an LSR to an LDP peer to withdraw a previously advertised interface address.</li> <li>• <b>Label mapping</b>—Message sent by an LSR to an LDP peer to advertise label mapping for a forwarding equivalence class (FEC).</li> <li>• <b>Label request</b>—Message sent by an LSR to an LDP peer to request a label mapping for an FEC.</li> <li>• <b>Label withdraw</b>—Message sent by an LSR to an LDP peer to withdraw a previously advertised FEC-label mapping.</li> <li>• <b>Label release</b>—Message sent by an LSR to an LDP peer to notify the peer that a specific FEC-label mapping has been released.</li> <li>• <b>Label abort</b>—Message sent by an LSR to an LDP peer to abort a label request message.</li> <li>• <b>Total</b>—Messages sent and received during the lifetime of the session.</li> <li>• <b>Last 5 seconds</b>—Messages sent and received during the current session.</li> </ul> | extensive       |

## Sample Output

### show ldp session brief

```

user@host> show ldp session brief
      Address      State      Connection      Hold time
10.255.72.160      Operational Open           21
10.255.72.164      Operational Open           20
10.255.72.172      Operational Open           21

```

### show ldp session detail

```

user@host> show ldp session detail
Address: 192.168.0.3, State: Operational, Connection: Open, Hold time: 27
Session ID: 192.168.0.2:0--192.168.0.3:0
Next keepalive in 7 seconds
Passive, Maximum PDU: 4096, Hold time: 30, Neighbor count: 1
Neighbor types: discovered
Keepalive interval: 10, Connect retry interval: 1
Local address: 192.168.0.2, Remote address: 192.168.0.3
Up for 00:00:02
Capabilities advertised: none
Capabilities received: none
Protection: disabled
Local - Restart: enabled, Helper mode: enabled, Reconnect time: 60000
Remote - Restart: enabled, Helper mode: enabled, Reconnect time: 60000

```

```

Local maximum neighbor reconnect time: 120000 msec
Local maximum neighbor recovery time: 240000 msec
Local Label Advertisement mode: Downstream unsolicited
Remote Label Advertisement mode: Downstream unsolicited
Negotiated Label Advertisement mode: Downstream unsolicited
Nonstop routing state: Not in sync
Next-hop addresses received:
  10.0.0.5
  10.0.0.33

```

### show ldp session extensive

```

user@host> show ldp session extensive
Address: 192.168.0.3, State: Operational, Connection: Open, Hold time: 22
Session ID: 192.168.0.2:0--192.168.0.3:0
Next keepalive in 2 seconds
Passive, Maximum PDU: 4096, Hold time: 30, Neighbor count: 1
Neighbor types: discovered
Keepalive interval: 10, Connect retry interval: 1
Local address: 192.168.0.2, Remote address: 192.168.0.3
Up for 00:05:37
Capabilities advertised: none
Capabilities received: none
Protection: disabled
Local - Restart: enabled, Helper mode: enabled, Reconnect time: 60000
Remote - Restart: enabled, Helper mode: enabled, Reconnect time: 60000
Local maximum neighbor reconnect time: 120000 msec
Local maximum neighbor recovery time: 240000 msec
Local Label Advertisement mode: Downstream unsolicited
Remote Label Advertisement mode: Downstream unsolicited
Negotiated Label Advertisement mode: Downstream unsolicited
Nonstop routing state: Not in sync
Next-hop addresses received:
  10.0.0.5
  10.0.0.33
Queue depth: 0

```

| Message type     | Total |          | Last 5 seconds |          |
|------------------|-------|----------|----------------|----------|
|                  | Sent  | Received | Sent           | Received |
| Initialization   | 1     | 1        | 0              | 0        |
| Keepalive        | 33    | 33       | 1              | 1        |
| Notification     | 0     | 0        | 0              | 0        |
| Address          | 1     | 1        | 0              | 0        |
| Address withdraw | 0     | 0        | 0              | 0        |
| Label mapping    | 7     | 5        | 0              | 0        |
| Label request    | 0     | 0        | 0              | 0        |
| Label withdraw   | 3     | 1        | 0              | 0        |
| Label release    | 1     | 3        | 0              | 0        |
| Label abort      | 0     | 0        | 0              | 0        |

## show ldp statistics

|                                 |                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ldp statistics<br><instance <i>instance-name</i> ><br><logical-system (all   <i>logical-system-name</i> )>                                                                                                                                                                                                                                      |
| <b>Release Information</b>      | Command introduced before Junos OS Release 7.4.                                                                                                                                                                                                                                                                                                      |
| <b>Description</b>              | Display Label Distribution Protocol (LDP) statistics.                                                                                                                                                                                                                                                                                                |
| <b>Options</b>                  | <p><b>none</b>—Display LDP statistics for all routing instances.</p> <p><b>instance <i>instance-name</i></b>—(Optional) Display information for the specified routing instance only.</p> <p><b>logical-system (all   <i>logical-system-name</i>)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">clear ldp statistics on page 200</a></li> </ul>                                                                                                                                                                                                                                                 |
| <b>List of Sample Output</b>    | <a href="#">show ldp statistics on page 232</a>                                                                                                                                                                                                                                                                                                      |
| <b>Output Fields</b>            | <a href="#">Table 12 on page 229</a> lists the output fields for the <b>show ldp statistics</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                     |

**Table 12: show ldp statistics Output Fields**

| Field Name                    | Field Description                                                    |
|-------------------------------|----------------------------------------------------------------------|
| Total Sent, Received          | Total number of each message type sent and received.                 |
| Last 5 seconds Sent, Received | Number of each message type sent and received in the last 5 seconds. |

Table 12: show ldp statistics Output Fields (*continued*)

| Field Name          | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Message type</b> | <p>LDP message types:</p> <ul style="list-style-type: none"> <li>• <b>Hello</b>—Messages that enable LDP nodes to discover one another and to detect the failure of a neighbor or of the link to the neighbor.</li> <li>• <b>Initialization</b>—Messages that indicate an LDP session has started.</li> <li>• <b>Keepalive</b>—Messages that ensure that the keepalive timeout is not exceeded.</li> <li>• <b>Notification</b>—Advisory information and signal error information.</li> <li>• <b>Address</b>—Messages with address information.</li> <li>• <b>Address withdrawal</b>—Messages regarding address withdrawal.</li> <li>• <b>Label mapping</b>—Messages with label mapping information.</li> <li>• <b>Label request</b>—Request for a label mapping from a neighboring router.</li> <li>• <b>Label withdrawal</b>—Withdrawal message sent by the downstream LSR to recall a label that it previously mapped. If an LSR that has received a label mapping subsequently determines that it no longer needs that label, it can send a label release message that frees the label for use.</li> <li>• <b>Label release</b>—Message sent by the downstream LSR to recall a label that it previously mapped. If an LSR that has received a label mapping subsequently determines that it no longer needs that label, it can send a label release message that frees the label for use.</li> <li>• <b>Label abort</b>—Messages about label interruptions.</li> <li>• <b>All UDP</b>—All hello messages sent by LSRs to the well-known UDP port, 646.</li> <li>• <b>All TCP</b>—All LDP session messages.</li> </ul> |



Table 12: show ldp statistics Output Fields (*continued*)

| Field Name            | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Event type</b>     | <p>LDP events and errors:</p> <ul style="list-style-type: none"> <li>• <b>Sessions opened</b>—Number of LDP sessions that have been opened.</li> <li>• <b>Sessions closed</b>—Number of LDP sessions that have been closed.</li> <li>• <b>Topology changes</b>—Number of changes to the known LDP topology.</li> <li>• <b>No interface</b>—Number of missing interface address messages. When a new LDP session is initialized and before sending label lapping or label request messages, the LSR advertises its interface addresses with one or more address messages.</li> <li>• <b>No session</b>—Number of missing session messages. Session messages are used to establish, maintain, and terminate sessions between LDP peers.</li> <li>• <b>No adjacency</b>—The exchange of hello adjacency messages results in the creation of an adjacency. The LDP identifier, together with the sender's LDP identifier in the PDU header, enables the receiver to match the initialization message with one of its hello adjacencies. If there is no matching hello adjacency, the LSR sends a session the initialization message is rejected.</li> <li>• <b>Unknown version</b>—The LDP protocol version is not supported by the receiver, or it is supported but is not the version negotiated for the session during session establishment.</li> <li>• <b>Malformed PDU</b>—An LDP PDU received on a TCP connection for an LDP session is malformed if the LDP identifier in the PDU header is unknown to the receiver, or if it is known but is not the LDP identifier associated by the receiver with the LDP peer for this LDP session.<br/> An LDP PDU is considered to be malformed if the LDP protocol version is not supported by the receiver, or it is supported but is not the version negotiated for the session during session establishment.<br/> An LDP PDU is considered malformed if the PDU length field is too small (less than 14) or too large (greater than maximum PDU length).</li> <li>• <b>Malformed message</b>—Malformed LDP messages that are part of the LDP discovery mechanism are handled by silently discarding them.<br/> An LDP message is malformed if the message type is unknown. If the message type is less than 0x8000 (high order bit = 0), it is an error signaled by the unknown message type status code.<br/> An LDP message is considered to be malformed if the message length is too large, meaning that the message extends beyond the end of the containing LDP PDU.<br/> The LDP message is considered to be malformed if the message length is too small, meaning that it is smaller than the smallest possible value component.<br/> The LDP message is considered to be malformed if the message is missing one or more mandatory parameters.</li> <li>• <b>Unknown message type</b>—If the message type is less than 0x8000 (high order bit = 0) or greater than or equal to 0x8000 (high order bit = 1) it is considered to be an unknown message.</li> <li>• <b>Inappropriate message</b>—The message is not of the type that the receiver expects to receive.</li> <li>• <b>Malformed TLV</b>—The TLV Length is too large or the receiver cannot decode the TLV value. This can indicate an issue in either the sending or receiving LSR.</li> <li>• <b>Bad TLV value</b>—The TLV Length is too large.</li> <li>• <b>Missing TLV</b>—The TLV is missing one or more mandatory parameters.</li> <li>• <b>PDU too large</b>—The PDF is greater than the maximum PDU length. Section "Initialization Message" in RFC 5036 describes how the maximum PDU length for a session is determined.</li> </ul> |
| <b>Total</b>          | Total number of each event or error.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Last 5 seconds</b> | Number of each event or error in the last 5 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## Sample Output


### show ldp statistics

```
user@host> show ldp statistics
```

| Message type     | Total |          | Last 5 seconds |          |
|------------------|-------|----------|----------------|----------|
|                  | Sent  | Received | Sent           | Received |
| Hello            | 265   | 263      | 2              | 2        |
| Initialization   | 2     | 2        | 0              | 0        |
| Keepalive        | 112   | 111      | 1              | 0        |
| Notification     | 0     | 0        | 0              | 0        |
| Address          | 2     | 2        | 0              | 0        |
| Address withdraw | 0     | 0        | 0              | 0        |
| Label mapping    | 7     | 6        | 0              | 0        |
| Label request    | 0     | 0        | 0              | 0        |
| Label withdraw   | 2     | 0        | 0              | 0        |
| Label release    | 0     | 2        | 0              | 0        |
| Label abort      | 0     | 0        | 0              | 0        |
| All UDP          | 265   | 263      | 2              | 2        |
| All TCP          | 123   | 121      | 1              | 0        |

| Event type            | Total | Last 5 seconds |          |
|-----------------------|-------|----------------|----------|
|                       |       | Sent           | Received |
| Sessions opened       | 2     |                | 0        |
| Sessions closed       | 0     |                | 0        |
| Topology changes      | 11    |                | 0        |
| No interface          | 0     |                | 0        |
| No session            | 0     |                | 0        |
| No adjacency          | 0     |                | 0        |
| Unknown version       | 0     |                | 0        |
| Malformed PDU         | 0     |                | 0        |
| Malformed message     | 0     |                | 0        |
| Unknown message type  | 0     |                | 0        |
| Inappropriate message | 0     |                | 0        |
| Malformed TLV         | 0     |                | 0        |
| Bad TLV value         | 0     |                | 0        |
| Missing TLV           | 0     |                | 0        |
| PDU too large         | 0     |                | 0        |

## show ldp traffic-statistics

|                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                                                                                                                                                                                                                                        | <pre>show ldp traffic-statistics &lt;instance <i>instance-name</i>&gt; &lt;logical-system (all   <i>logical-system-name</i>)&gt; &lt;p2mp&gt;</pre>                                                                                                                                                                                                                                                                                                                           |
| <b>Release Information</b>                                                                                                                                                                                                                           | <p>Command introduced before Junos OS Release 7.4.</p> <p><b>p2mp</b> option added in Junos OS Release 11.2.</p> <p>Command introduced in Junos OS Release 13.2X51-D15 for the QFX Series.</p>                                                                                                                                                                                                                                                                                |
| <b>Description</b>                                                                                                                                                                                                                                   | Display Label Distribution Protocol (LDP) traffic statistics.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <div>  <b>NOTE:</b> If nonstop active routing features is configured, <b>show ldp traffic-statistics</b> command is not supported on backup Routing Engines. </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Options</b>                                                                                                                                                                                                                                       | <p><b>none</b>—Display LDP traffic statistics for all routing instances.</p> <p><b>instance <i>instance-name</i></b>—(Optional) Display LDP traffic statistics for the specified routing instance only.</p> <p><b>logical-system (all   <i>logical-system-name</i>)</b>—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p><b>p2mp</b>—(Optional) Display only the data traffic statistics for a point-to-multipoint LSP.</p> |
| <b>Additional Information</b>                                                                                                                                                                                                                        | To collect output from this command on a periodic basis, configure the <a href="#">traffic-statistics</a> statement for the LDP protocol. For more information, see the <i>Junos MPLS Applications Configuration Guide</i> .                                                                                                                                                                                                                                                  |
| <b>Required Privilege Level</b>                                                                                                                                                                                                                      | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Related Documentation</b>                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• <a href="#">clear ldp statistics on page 200</a></li> <li>• <a href="#">Example: Configuring Multicast-Only Fast Reroute in a Multipoint LDP Domain on page 119</a></li> <li>• <a href="#">Example: Configuring Multipoint LDP In-Band Signaling for Point-to-Multipoint LSPs on page 98</a></li> </ul>                                                                                                                              |
| <b>List of Sample Output</b>                                                                                                                                                                                                                         | <p><a href="#">show ldp traffic-statistics on page 234</a></p> <p><a href="#">show ldp traffic-statistics p2mp on page 235</a></p> <p><a href="#">show ldp traffic-statistics p2mp (Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs) on page 235</a></p> <p><a href="#">show ldp traffic-statistics p2mp (Multipoint LDP with Multicast-Only Fast Reroute) on page 235</a></p>                                                                                   |

**Output Fields** Table 13 on page 234 lists the output fields for the **show ldp traffic-statistics** command. Output fields are listed in the approximate order in which they appear.

**Table 13: show ldp traffic-statistics Output Fields**

| Field Name          | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Message type</b> | LDP message types.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>FEC</b>          | Forwarding equivalence class (FEC) for which LDP traffic statistics are collected.<br><br>For P2MP LSPs, FEC appears as a combination of root address and the LSP ID ( <b>root_addr:lsp_id</b> ).<br><br>For M-LDP P2MP LSPs, FEC appears as a combination of root address multicast source address, and multicast group address ( <b>root_addr:lsp_id/grp,src</b> ).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Type</b>         | Type of traffic originating from a router, either <b>Ingress</b> (originating from this router) or <b>Transit</b> (forwarded through this router).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Packets</b>      | Number of packets passed by the FEC since its LSP came up.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Bytes</b>        | Number of bytes of data passed by the FEC since its LSP came up.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Shared</b>       | Whether a label is shared by prefixes: <b>Yes</b> or <b>No</b> . A <b>Yes</b> value indicates that several prefixes are bound to the same label (for example, when several prefixes are advertised with an egress policy). The LDP traffic statistics for this case apply to all the prefixes and should be treated as such.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Nexthop</b>      | The next hop address for P2MP LSPs. (This is the downstream LDP Session ID.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Label</b>        | For multipoint LDP with multicast-only fast reroute (MoFRR), the multipoint LDP node selects two separate upstream peers and sends two separate labels, one to each upstream peer. The same algorithm described in RFC 6388 is used to select the primary upstream path. The backup upstream path selection again uses the same algorithm but excludes the primary upstream LSR as a candidate. Two streams of MPLS traffic are sent to the egress node from the two different upstream peers. The MPLS traffic from only one of the upstream neighbors is selected as the primary path to accept the traffic, and the other becomes the backup path. The traffic on the backup path is dropped. When the primary upstream path fails, the traffic from the backup path is then accepted. The multipoint LDP node selects the two upstream paths based on the interior gateway protocol (IGP) root node next hop.<br><br>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. |
| <b>Backup route</b> | For multipoint LDP with MoFRR, the route that is used if the primary route becomes unavailable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## Sample Output

### show ldp traffic-statistics

```
user@host> show ldp traffic-statistics
```

| FEC          | Type    | Packets | Bytes | Shared |
|--------------|---------|---------|-------|--------|
| 10.35.3.0/30 | Transit | 0       | 0     | Yes    |

|                        |              |         |          |        |
|------------------------|--------------|---------|----------|--------|
|                        | Ingress      | 0       | 0        | No     |
| 10.35.10.1/32          | Transit      | 0       | 0        | Yes    |
|                        | Ingress      | 0       | 0        | No     |
| 10.255.245.214/32      | Transit      | 0       | 0        | No     |
|                        | Ingress      | 11      | 752      | No     |
| 192.168.37.36/30       | Transit      | 0       | 0        | Yes    |
|                        | Ingress      | 0       | 0        | No     |
|                        |              |         |          |        |
| FEC(root_addr:lsp_id)  | Nexthop      | Packets | Bytes    | Shared |
| 10.255.72.160:16777217 | 192.168.8.81 | 152056  | 14597376 | No     |
|                        | 192.168.8.1  | 152056  | 14597376 | No     |
|                        | 192.168.8.65 | 152056  | 14597376 | No     |

#### show ldp traffic-statistics p2mp

```
user@host> show ldp traffic-statistics p2mp
FEC(root_addr:lsp_id) Nexthop      Packets      Bytes Shared
10.255.72.160:16777217 192.168.8.81 152056      14597376 No
                        192.168.8.1 152056      14597376 No
                        192.168.8.65 152056      14597376 No
```

#### show ldp traffic-statistics p2mp (Multipoint LDP Inband Signaling for Point-to-Multipoint LSPs)

```
user@host> show ldp traffic-statistics p2mp
P2MP FEC Statistics:

FEC(root_addr:lsp_id/grp,src)  Nexthop      Packets      Bytes
Shared
11.99.0.73:239.10.0.1,11.98.0.10 11.99.0.117 243408      121217184
No
                        11.99.0.13 236286      117670428
No
11.99.0.73:239.10.0.2,11.98.0.10 11.99.0.117 248800      123902400
No
                        11.99.0.13 240759      119897982
No
11.99.0.73:239.10.0.1,11.98.0.20 11.99.0.117 250286      124642428
No
                        11.99.0.13 243741      121383018
No
11.99.0.73:239.10.0.2,11.98.0.20 11.99.0.117 252970      125979060
No
                        11.99.0.13 245218      122118564
No
```

#### show ldp traffic-statistics p2mp (Multipoint LDP with Multicast-Only Fast Reroute)

```
user@host> show ldp traffic-statistics p2mp

P2MP FEC Statistics:
```

| FEC(root_addr:lsp_id/grp,src)                                 | Nexthop | Packets | Bytes |
|---------------------------------------------------------------|---------|---------|-------|
| Shared                                                        |         |         |       |
| 1.1.1.1:232.1.1.1,192.168.219.11, Label: 301568               | 1.3.8.2 | 0       | 0     |
| No                                                            |         |         |       |
|                                                               | 1.3.4.2 | 0       | 0     |
| No                                                            |         |         |       |
| 1.1.1.1:232.1.1.1,192.168.219.11, Label: 301584, Backup route | 1.3.4.2 | 0       | 0     |
| No                                                            |         |         |       |
|                                                               | 1.3.8.2 | 0       | 0     |
| No                                                            |         |         |       |
| 1.1.1.1:232.1.1.2,192.168.219.11, Label: 301600               | 1.3.8.2 | 0       | 0     |
| No                                                            |         |         |       |
|                                                               | 1.3.4.2 | 0       | 0     |
| No                                                            |         |         |       |
| 1.1.1.1:232.1.1.2,192.168.219.11, Label: 301616, Backup route | 1.3.4.2 | 0       | 0     |
| No                                                            |         |         |       |
|                                                               | 1.3.8.2 | 0       | 0     |
| No                                                            |         |         |       |

## show security keychain

|                                 |                                                                                                                                                                                                                                                                                           |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show security keychain<br><brief   detail>                                                                                                                                                                                                                                                |
| <b>Release Information</b>      | Command introduced in Junos OS Release 11.2.                                                                                                                                                                                                                                              |
| <b>Description</b>              | Display information about authentication keychains configured for the Border Gateway Protocol (BGP), the Label Distribution Protocol (LDP) routing protocols, the Bidirectional Forwarding Detection (BFD) protocol, and the Intermediate System-to-Intermediate System (IS-IS) protocol. |
| <b>Options</b>                  | <b>none</b> —Display information about authentication keychains.<br><br><b>brief   detail</b> —(Optional) Display the specified level of output.                                                                                                                                          |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                      |
| <b>List of Sample Output</b>    | <a href="#">show security keychain brief on page 239</a><br><a href="#">show security keychain detail on page 239</a>                                                                                                                                                                     |
| <b>Output Fields</b>            | <a href="#">Table 14 on page 237</a> describes the output fields for the <b>show security keychain</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                   |

**Table 14: show security keychain Output Fields**

| Field Name               | Field Description                                                                        | Level of Output |
|--------------------------|------------------------------------------------------------------------------------------|-----------------|
| <b>keychain</b>          | The name of the keychain in operation.                                                   | All levels      |
| <b>Active-ID Send</b>    | Number of routing protocols packets sent with the active key.                            | All levels      |
| <b>Active-ID Receive</b> | Number of routing protocols packets received with the active key.                        | All levels      |
| <b>Next-ID Send</b>      | Number of routing protocols packets sent with the next key.                              | All levels      |
| <b>Next-ID Receive</b>   | Number of routing protocols packets received with the next key.                          | All levels      |
| <b>Transition</b>        | Amount of time until the current key will be replaced with the next key in the keychain. | All levels      |
| <b>Tolerance</b>         | Configured clock-skew tolerance, in seconds, for accepting keys for a key chain.         | All levels      |
| <b>Id</b>                | Identification number configured for the current key.                                    | <b>detail</b>   |

Table 14: show security keychain Output Fields (*continued*)

| Field Name        | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Level of Output |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Algorithm</b>  | Authentication algorithm configured for the current key.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>detail</b>   |
| <b>State</b>      | <p>State of the current key.</p> <p>The value can be:</p> <ul style="list-style-type: none"> <li>• <b>receive</b></li> <li>• <b>send</b></li> <li>• <b>send-receive</b></li> </ul> <p>For the active key, the <b>State</b> can be <b>send-receive</b>, <b>send</b>, or <b>receive</b>. For keys that have a future start time, the <b>State</b> is <b>inactive</b>. Compare the <b>State</b> field to the <b>Mode</b> field.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>detail</b>   |
| <b>Option</b>     | <p>For IS-IS only, the option determines how Junos OS encodes the message authentication code in routing protocol packets.</p> <p>The values can be:</p> <ul style="list-style-type: none"> <li>• <b>basic</b>—Based on RFC 5304.</li> <li>• <b>isis-enhanced</b>—Based on RFC 5310.</li> </ul> <p>The default value is <b>basic</b>. When you configure the <b>isis-enhanced</b> option, Junos OS sends RFC 5310-encoded routing protocol packets and accepts both RFC 5304-encoded and RFC 5310-encoded routing protocol packets that are received from other devices.</p> <p>When you configure <b>basic</b> (or do not include the <b>options</b> statement in the key configuration) Junos OS sends and receives RFC 5304-encoded routing protocols packets, and drops 5310-encoded routing protocol packets that are received from other devices.</p> <p>Because this setting is for IS-IS only, the TCP and the BFD protocol ignore the encoding option configured in the key.</p> | <b>detail</b>   |
| <b>Start-time</b> | Time that the current key became active.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>detail</b>   |



Table 14: show security keychain Output Fields (*continued*)

| Field Name  | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Level of Output |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Mode</b> | <p>Mode of each key (Informational only.)</p> <p>The value can be</p> <ul style="list-style-type: none"> <li>• <b>receive</b></li> <li>• <b>send</b></li> <li>• <b>send-receive</b></li> </ul> <p>The mode of the key is based on the configuration. Suppose you configure two keys, one with a start-time of today and the other with a start-time of next week. For both keys, the <b>Mode</b> can be <b>send-receive</b>, <b>send</b>, or <b>receive</b>, regardless of the configured start-time. Compare the <b>Mode</b> field to the <b>State</b> field.</p> | <b>detail</b>   |

## Sample Output

### show security keychain brief

```

user@host> show security keychain brief
keychain          Active-ID      Next-ID      Transition  Tolerance
                  Send  Receive    Send  Receive
hakr              3     3           1     1         1d 23:58    3600

```

### show security keychain detail

```

user@host> show security keychain detail
keychain          Active-ID      Next-ID      Transition  Tolerance
                  Send  Receive    Send  Receive
hakr              3     3           1     1         1d 23:58    3600
Id 3, Algorithm hmac-md5, State send-receive, Option basic
Start-time Wed Aug 11 16:28:00 2010, Mode send-receive
Id 1, Algorithm hmac-md5, State inactive, Option basic
Start-time Fri Aug 20 11:30:57 2010, Mode send-receive

```

## traceroute mpls ldp

---

**Syntax**    `traceroute mpls <ldp> fec`  
              `<destination>`  
              `<detail>`  
              `<exp>`  
              `<fanout>`  
              `<logical-system>`  
              `<no-resolve>`  
              `<paths>`  
              `<retries>`  
              `<routing-instance>`  
              `<source>`  
              `<ttl>`  
              `<update>`  
              `<wait>`

**Release Information**    Command introduced in Junos OS Release 8.4.

**Description**    Trace route to a remote host for an MPLS label-switched path signaled by the LDP. Use **traceroute mpls ldp** as a debugging tool to locate MPLS label-switched path forwarding issues in a network. (Currently supported for IPv4 packets only.)

**Options**    *fec*—Specify the IP address and optional prefix of the forwarding equivalence class (FEC).

**destination**—(Optional) Specify the destination address to use when sending probes.

**detail**—(Optional) Display detailed output.

**exp**—(Optional) Specify the class-of-service to use when sending probes. The range of values is 0 through 7. The default value is 7.

**fanout**—(Optional) Specify the maximum number of nexthops to search per node. The range of values is 1 through 16. The default value is 16.

**logical-system**—(Optional) Specify the name of the logical system for the traceroute attempt.

**no-resolve**—(Optional) Specify not to resolve the hostname that corresponds to the IP address.

**paths**—(Optional) Specify the number of paths to search. The range of values is 1 through 255. The default value is 16.

**retries**—(Optional) Specify the number of times to resend probe. values. The range of values is 1 through 9. The default value is 3.

**routing-instance** *routing-instance-name*—(Optional) Specify the name of the routing instance for the traceroute attempt.

**source** *source-address*—(Optional) Specify the source address of the outgoing traceroute packets.

**ttl value**—(Optional) Specify the maximum time-to-live value to include in the traceroute request, in seconds. The range of values is **1** through **125** and the default value is **64**.

**wait seconds**—(Optional) Specify the number of seconds to wait before resending a probe. The range of values is **5** through **15** and the default value is **10** seconds.

**Required Privilege Level** network

**List of Sample Output** [traceroute mpls ldp on page 242](#)  
[traceroute mpls ldp detail on page 242](#)

**Output Fields** [Table 15 on page 241](#) describes the output fields for the **traceroute mpls ldp fec** command and the **traceroute mpls ldp fec detail** commands. Output fields are listed in the approximate order in which they appear.

**Table 15: traceroute mpls ldp Output Fields**

| Field Name     | Field Description                                                                                                        | Level of Output |
|----------------|--------------------------------------------------------------------------------------------------------------------------|-----------------|
| Probe options  | Probe options specified in the <b>traceroute mpls ldp fec</b> command.                                                   | all levels      |
| ttl            | Time to live value of the labeled packet.                                                                                | none specified  |
| Label          | Outgoing label used for forwarding the packet along the label-switched paths.                                            | none specified  |
| Protocol       | Signaling protocol used. For this command, it is LDP.                                                                    | none specified  |
| Address        | Address of the next hop.                                                                                                 | none specified  |
| Previous Hop   | Address of the previous hop. Previous hop address of the first hop is <b>null</b> .                                      | none specified  |
| Probe status   | Forwarding status from the first hop to the last-hop label-switching router (egress point in the label-switched paths).  | none specified  |
| Hop            | Address of the hops in the label-switched path from the first hop to the last hop. Depth indicates the level of the hop. | <b>detail</b>   |
| Parent         | Address of the previous hop. Parent value for the first hop is <b>null</b> .                                             | <b>detail</b>   |
| Return Code    | Return code for reporting the result of processing the echo request by the receiver.                                     | <b>detail</b>   |
| Response time  | Time for the echo request to reach the receiver.                                                                         | <b>detail</b>   |
| Multipath type | Labels or addresses used by the specified multipath type. If multipaths are not used, the value is <b>none</b> .         | <b>detail</b>   |

Table 15: traceroute mpls ldp Output Fields (*continued*)

| Field Name  | Field Description                       | Level of Output |
|-------------|-----------------------------------------|-----------------|
| Label Stack | Label stack used to forward the packet. | <b>detail</b>   |

## Sample Output

### traceroute mpls ldp

```
user@router> traceroute mpls ldp 4.4.4.4
```

```
Probe options: ttl 64, retries 3, wait 10, paths 16, exp 7, fanout 16
ttl  Label Protocol Address Previous Hop Probe Status
 1  100016 LDP      24.24.24.1 (null) Success
 2  100000 LDP      20.20.20.2 24.24.24.1 Success
 3      3 LDP      22.22.22.4 20.20.20.2 Egress
```

```
Path 1 via fe-0/3/3.101 destination 127.0.0.64
```

### traceroute mpls ldp detail

```
user@router> traceroute mpls ldp 4.4.4.4 detail
```

```
Probe Options: ttl 64, retries 3, wait 10, paths 3, exp 7
Hop 24.24.24.1 Depth 1
  Parent (null)
  Return code: Label switched at stack-depth 1
  Response time 165.93 msec
  Multipath type: IP bitmask
  Address Range 1: 127.0.0.0 ~ 127.0.3.255
  Label Stack:
    Label 1 Value 100032 Protocol LDP

Hop 20.20.20.2 Depth 2
  Parent 24.24.24.1
  Return code: Upstream interface index unknown label-switched at stack-depth
1
  Response time 19.05 msec
  Multipath type: IP bitmask
  Address Range 1: 127.0.0.0 ~ 127.0.3.255
  Label Stack:
    Label 1 Value 100000 Protocol LDP

Hop 22.22.22.4 Depth 3
  Parent 20.20.20.2
  Return code: Egress-ok at stack-depth 1
  Response time 0.79 msec
  Multipath type: None
  Label Stack:
    Label 1 Value 3 Protocol LDP
```

## PART 4

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