Network Configuration Example

MPLS LSP Link Protection and Node Link Protection Feature Guide

Published: 2014-01-10

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

Network Configuration Example MPLS LSP Link Protection and Node Link Protection Feature Guide

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

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

The Juniper Networks product that is the subject of this technical documentation consists of (or is intended for use with) Juniper Networks software. Use of such software is subject to the terms and conditions of the End User License Agreement ("EULA") posted at http://www.juniper.net/support/eula.html. By downloading, installing or using such software, you agree to the terms and conditions of that EULA.

Table of Contents

List of Figures

PART 1

MPLS LSP Link Protection and Node Link Protection

CHAPTER 1

MPLS LSP Link Protection and Node Link Protection Concepts and Reference Materials

This section contains the following topics:

MPLS LSP Link Protection and Node-Link Protection Overview

Multiprotocol Label Switching (MPLS) label-switched path (LSP) link protection and node-link protection are facility-based methods used to reduce the amount of time needed to reroute LSP traffic. These protection methods are often compared to fast reroute—the other Junos OS LSP protection method.

While fast reroute can only protect LSPs on a one-to-one basis, link protection and node-link protection can protect multiple LSPs by using only a single, logical bypass LSP. Link protection can provide robust backup support for a link, node-link protection can bypass a node or a link, and both types of protection are designed to interoperate with other vendor equipment. Such functionality makes link protection and node-link protection excellent choices for scalability, redundancy, and performance in MPLS-enabled networks.

Prior to Junos OS Release 5.4, the two mechanisms used to enable rapid MPLS LSP reroutes in Juniper Networks routers were Packet Forwarding Engine local repair and fast reroute. Packet Forwarding Engine local repair is an infrastructure-based solution and fast reroute provides a single backup LSP for every protected primary LSP. However, configuring backup LSPs on a one-to-one basis can become a scaling challenge for a growing MPLS network.

Scalable solutions for LSP redundancy include link protection and node-link protection. Both approaches are explained in RFC 4090, *Fast Reroute Extensions to RSVP-TE for LSP Tunnels*. In general, these are facility-based methods that quickly reroute traffic from

multiple LSPs. They also reduce the amount of configuration necessary to implement LSP protection.

You can configure either link protection or node-link protection by itself, fast reroute by itself, or both fast reroute and one of the protection methods. Whenever one or more of these reroute options are enabled, Packet Forwarding Engine local repair is activated by default.

To enable Juniper Networks MPLS LSP fast reroute, you must first install the LSP as a valid next hop in the main **inet.0** routing table on the ingress PE router. You can accomplish this in one of several of ways:

- Enable the BGP learned routes to use the LSP.
- Set the **bgp-igp** or **bgp-igp-both-ribs** parameters at the **[edit protocols mpls traffic-engineering]** hierarchy level.
- Configure **install *prefix* active** at the **[edit protocols mpls lsp *lsp-name*]** hierarchy level.
- Configure a static route with an indirect next hop that goes to the LSP end.
- Configure a static route with an LSP next hop.
- Configure IS-IS support for bidirectional LSPs.

To summarize, the MPLS LSP protection options available in Junos OS are as follows:

- Packet Forwarding Engine local repair—This data plane method adds enhanced capabilities to the Packet Forwarding Engine subsystem and reduces the time needed for path switchover. With local repair, the Packet Forwarding Engine can correct a path failure before it receives recomputed paths from the Routing Engine. The Routing Engine pre-computes backup routes for every MPLS path and provides this information to the Packet Forwarding Engine before any failure. Packet Forwarding Engine local repair is enabled by default but also requires per-packet load-balancing to be configured.
- Fast reroute—The original control plane method for fast reroute of individual LSPs is described as “one-to-one” protection in the IETF Internet draft *Fast Reroute Extensions to RSVP-TE for LSP Tunnels*. Junos OS calculates LSP detours for LSPs and implements the rerouted paths as needed. You can configure the command **fast-reroute** at the **[edit protocols mpls *lsp-name*]** hierarchy level. For more information about MPLS LSP fast reroute, see the *Junos MPLS Applications Configuration Guide*.
- Link protection—Another control plane method discussed in this guide. In general, link protection is useful when you wish to protect LSPs after a supporting link is lost.
- Node-link protection—This is also a control plane method and is discussed in this guide. In general, node-link protection is useful when you wish to protect LSPs after a supporting node fails.

Related Documentation

- Example: Configuring MPLS LSP Link Protection on page 15
- Example: Node-Link Protection Configuration on page 34

Link Protection

Link protection offers per-link traffic protection. It supports fast rerouting of user traffic over one mission-critical link. It does this on a per-LSP basis, much like the fast reroute option. However, it can also aggregate several protected LSPs over a single bypass LSP.

This flexible approach to single-link, rapid reroute does not require any new protocol modification beyond the RSVP-TE specification. Bypass LSPs efficiently aggregate traffic from multiple LSPs when the reroute occurs.

When link protection is enabled on a router interface and a protected LSP traverses this protected interface, Junos OS creates a trunk-like, bypass LSP to provide an alternate path to the RSVP neighbor. Each bypass LSP keeps track of all protected LSPs that are associated with the neighbor. In case of a neighbor failure, the protected LSPs are rerouted over the bypass LSP. Bypass LSPs use label stacking to protect user traffic.

At the interface level, the router keeps track of bypass LSP characteristics. Whenever an interface enables or disables link protection, the changes are saved at the interface level and then propagated to the RSVP neighbor. When a neighbor requires link protection, the router checks the associated interface structure to determine how to create a bypass LSP.

On a per-RSVP neighbor basis, the router keeps track of all the LSP sessions passing through a neighbor as well as the bypass LSP status. For the bypass LSP, the router maintains information about protected neighbors. For regular LSPs, the router monitors all threads containing the LSP. When a regular LSP is lost, the bypass LSP reroutes user traffic by using information about the next hop, egress Explicit Route Object (ERO), interface, and peer address.

NOTE: **Fast reroute, link protection, and node-link protection all rely on Constrained Shortest Path First (CSPF) to select bypass LSPs. The CSPF computation attempts to find an LSP that bypasses an affected node first, but can select an alternate link through the affected node if a node bypass LSP is not available.**

Related Documentation

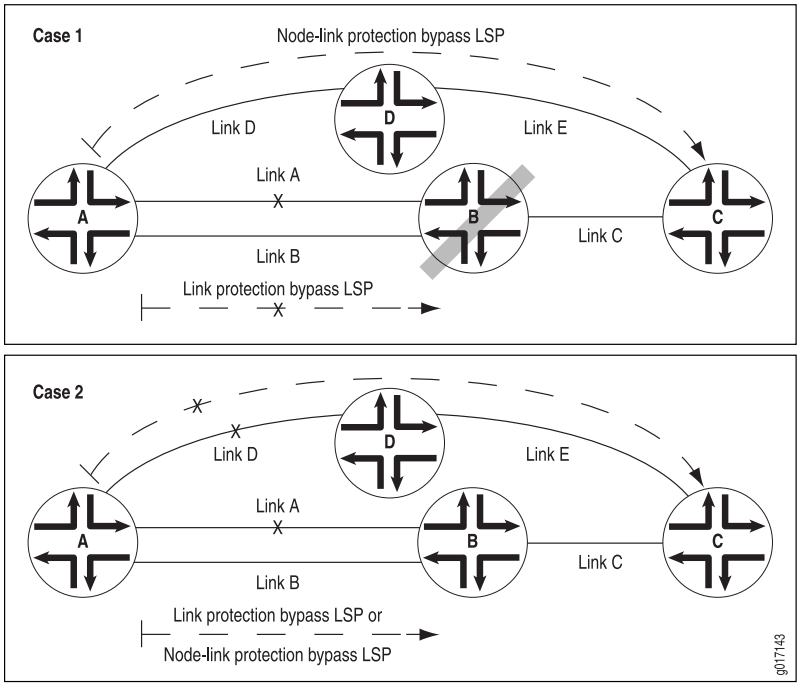
- Example: Configuring MPLS LSP Link Protection on page 15
- Example: Node-Link Protection Configuration on page 34

Node-Link Protection

While link protection is useful for selecting an alternate path to the same router when a link fails, node-link protection establishes a bypass LSP through a different router altogether. For Case 1 in Figure 1 on page 6, link protection allows an LSP to switch to link B and immediately bypass failed link A. However, if Router B fails, link B will fail and the link-protected LSP will be lost.

With node-link protection, the backup LSP can switch to link D instead and bypass the failed links and router. Another benefit of node-link protection shown in Case 2 is that a node-link-protected LSP can act like a link-protected LSP and switch to link B if link D is unavailable.

Figure 1: Link Protection and Node-Link Protection Comparison



Junos OS signals bypass LSPs dynamically when a protected LSP transverses the protected link. The software determines if the protected LSP needs a node bypass or a link bypass and prepares the necessary bypass LSP automatically. The bypass LSP is torn down automatically when a protected LSP does not use the link.

Because the creation and removal of bypass LSPs is automatic, network resources can be used for other purposes when the bypass LSP is not needed. Likewise, network administrators do not need to configure bypass LSPs statically and can focus their maintenance efforts elsewhere.

Related Documentation

- Example: Configuring MPLS LSP Link Protection on page 15
- Example: Node-Link Protection Configuration on page 34

MPLS LSP Link Protection and Node-Link Protection System Requirements

To implement MPLS LSP link protection or node-link protection, your system must meet these minimum requirements:

- Junos OS Release 8.2 or later for support on MX Series routers
- Junos OS Release 7.4 or later for enhanced operational commands and system log messages for link protection and node-link protection
- Junos OS Release 7.3 or later for link protection of point-to-multipoint LSPs and for class of service on link-protected LSPs and bypass LSPs
- Junos OS Release 7.1 or later for multiple bypass LSPs, manual bypass LSPs, and link protection priority
- Junos OS Release 5.4 or later for link protection
- Junos OS Release 6.0 and later for node-link protection
- Three Juniper Networks M Series, MX Series, or T Series routers

Related Documentation

- Example: Configuring MPLS LSP Link Protection on page 15
- Example: Node-Link Protection Configuration on page 34

MPLS LSP Link Protection and Node-Link Protection Terms and Acronyms

B

backup LSP A redundant LSP used to reroute a single, primary LSP. Backup LSPs are found in link protection, node-link protection, and fast reroute redundancy methods.

bypass LSP A logical trunk used to reroute multiple backup LSPs over a single connection protected with link protection.

L

link protection A method of establishing bypass LSPs to provide rapid reroute capability for primary LSPs on a per-link basis. For more information about link protection, see the *Junos MPLS Applications Configuration Guide*.

N

node-link protection A method of establishing bypass LSPs to provide rapid reroute capability for primary LSPs on a per-node basis. If node protection is unavailable, the LSP attempts to use link protection. For more information about node-link protection, see the *Junos MPLS Applications Configuration Guide*.

CHAPTER 2

MPLS LSP Link Protection and Node Link Protection Configuration

To implement MPLS LSP link protection or node-link protection, perform the following:

Configuring Link Protection or Node-Link Protection on the LSP

You enable the level of LSP protection you want on the ingress router. Link protection redirects LSP traffic to a bypass LSP that can traverse the same router that contains the affected link, whereas node-link protection sends LSP traffic to a bypass LSP that circumvents the affected router. To enable link protection for an LSP or point-to-multipoint LSP, include the **link-protection** statement at the **[edit protocols mpls label-switched-path *lsp-name*]** hierarchy level. To enable node-link protection for an LSP, include the **node-link-protection** statement at the **[edit protocols mpls label-switched-path *lsp-name*]** hierarchy level.

```
[edit]
protocols {
   mpls {
      label-switched-path lsp-name {
         ( link-protection | node-link-protection );
      }
   }
}
```

After link protection or node-link protection is established, the LSP marks the desired link protection bit in the RSVP Session Attribute (SA) object. To disable link protection or node-link protection for an LSP, delete the **link-protection** or **node-link-protection** statements at the **[edit protocols mpls label-switched-path *lsp-name*]** hierarchy level. For more information about point-to-multipoint LSPs, see the *Junos MPLS Applications Configuration Guide*.

Related Documentation
- Example: Configuring MPLS LSP Link Protection on page 15
- Example: Node-Link Protection Configuration on page 34

Configuring Link Protection on the RSVP Interfaces Traversed by the LSP

To complete your link protection or node-link protection configuration, configure RSVP interface-level link protection. Include the **link-protection** statement at the **[edit protocols rsvp interface *interface-name*]** hierarchy level. You must configure the **link-protection** statement on every RSVP interface used to exit each router in the LSP or point-to-multipoint LSP path. As an option, you can configure a loose or strict path for all bypass LSPs with the **path** statement at the **[edit protocols rsvp interface *interface-name* link-protection]** hierarchy level.

```
[edit]
protocols {
  rsvp {
    interface interface-name {
      link-protection {
        path ip-address {
          (loose | strict);
        }
      }
    }
  }
}
```

To disable link protection on an RSVP interface, include the **disable** statement at the **[edit protocols rsvp interface *interface-name* link-protection**] hierarchy level.

Related Documentation
- Example: Configuring MPLS LSP Link Protection on page 15
- Example: Node-Link Protection Configuration on page 34

Option: Configuring Multiple Bypass LSPs, Manual Bypass LSPs, and Link Protection Priority

You can configure multiple bypass LSP paths for a link-protected RSVP LSP. When you enable this option, RSVP signals multiple bypasses concurrently for a link-protected LSP. To configure, start by enabling link protection or node-link protection by including the **link-protection** or **node-link-protection** statement at the **[edit protocols mpls label-switched-path *lsp-name*]** hierarchy level. To configure an RSVP interface to include multiple bypasses, specify how much bandwidth the bypasses should consume by including the **bandwidth** statement at the **[edit protocols rsvp interface *interface-name* link-protection]** hierarchy level. To limit the total number of bypasses that can be created, include the **max-bypasses** statement at the **[edit protocols rsvp interface *interface-name* link-protection]** hierarchy level.

Other bypass options include limiting the maximum number of hops a bypass LSP will traverse, selectively disallowing node-link protection, setting a timer to redistribute data periodically across the bypass LSPs, requiring strict or loose paths for the bypass LSPs,

and establishing the percentage of bandwidth required for the bypass LSPs. To configure, include the **hop-limit**, **no-node-protection**, **optimize-timer**, **path**, and **subscription** statements, respectively, at the **[edit protocols rsvp interface *interface-name* link-protection]** hierarchy level.

Another option is to specify bypass LSPs manually. To configure, include the **to** and **bandwidth** statements at the **[edit protocols rsvp interface *interface-name* link-protection bypass *bypass-name*]** hierarchy level. Optionally, you can specify the hop limit and path type for the manual bypass LSP. To configure the options, include the **hop-limit** and **path** statements at the **[edit protocols rsvp interface *interface-name* link-protection bypass *bypass-name*]** hierarchy level.

Link protection priority enables you to provide preferred combinations of priority and class in a traffic engineering class matrix. When selecting a bypass LSP, the routing platform selects the bypass containing the lowest priority. To configure link protection priority for all bypass LSP paths, include the **priority** statement at the **[edit protocols rsvp interface *interface-name* link-protection]** hierarchy level. To configure link protection priority for a manually specified bypass LSP path, include the **priority** statement at the **[edit protocols rsvp interface *interface-name* link-protection bypass *bypass-name*]** hierarchy level.

```
[edit protocols]
mpls {
   label-switched-path lsp-name {
      (link-protection | node-link-protection);
   }
}
rsvp {
   interface interface-name {
      link-protection {
         bandwidth bps;
         bypass bypass-name {
            to ip-address;
            bandwidth bps;
            hop-limit maximum-hops; # The default value is 255 hops.
            path ip-address {
               (loose | strict);
            }
            priority priority;
         }
         hop-limit maximum-hops; # The range is 2 hops to the default (255 hops).
         max-bypasses number; # The range for this statement is 1 to 99.
         no-node-protection;
         optimize-timer seconds; # The default value of 0 disables this option.
         path ip-address {
            (loose | strict);
         }
         subscription percent; # The range for this statement is 1 to 65535.
      }
   }
}
```

For more information on multiple bypass LSPs, manually configured bypass LSPs, and link protection priority, see the *Junos MPLS Applications Configuration Guide*.

Related Documentation

- Example: Configuring MPLS LSP Link Protection on page 15
- Example: Node-Link Protection Configuration on page 34

Option: Adding Class of Service to a Link-Protected LSP or a Bypass LSP

For link-protected LSPs and bypass LSPs, you can specify a class-of-service designation to provide different levels of traffic quality. To configure class of service for link-protected LSPs, include the **class-of-service** statement at the **[edit protocols rsvp interface *interface-name* link-protection]** hierarchy level. To configure class of service for bypass LSPs, include the **class-of-service** statement at the **[edit protocols rsvp interface *interface-name* link-protection bypass *ip-address*]** hierarchy level.

For more information about class of service for link-protected LSPs and bypass LSPs, see the *Junos MPLS Applications Configuration Guide* and the *Junos Class of Service Configuration Guide*.

Related Documentation

- Example: Configuring MPLS LSP Link Protection on page 15
- Example: Node-Link Protection Configuration on page 34

Verifying MPLS LSP Link Protection and Node Link Protection

Purpose In Junos OS Release 7.4 and later, you can issue enhanced operational mode commands and receive system log messages that provide more details about the operation of your link-protected or node-link-protected LSPs. The following guidelines explain the type of information available from the output of each command or message.

Action

- **show rsvp session extensive**—Indicates if an LSP is protected, displays which backup and bypass LSPs provide the protection, and records the history of protection-related events (such as bypass LSP creation and detailed LSP failure information).
- **show rsvp interface extensive**—Indicates protection status for an interface, displays the number of LSPs protected by the RSVP interface, and records the history of bypass LSPs that protect the interface.
- **show rsvp session bypass extensive**—Displays active RSVP reservations for bypass LSPs.
- **RPD_RSVP_BACKUP_DOWN**—This system log message records when a backup LSP is not created, when a backup LSP stops operating, and when a bypass LSP carrying backup LSPs goes down.

Related Documentation

- Example: Configuring MPLS LSP Link Protection on page 15
- Example: Node-Link Protection Configuration on page 34
- For more information about the enhanced link protection and node-link protection operational commands, see the *Junos Routing Protocols and Policies Command Reference*.

- For more information about the system log message, see the *Junos System Log Messages Reference*.

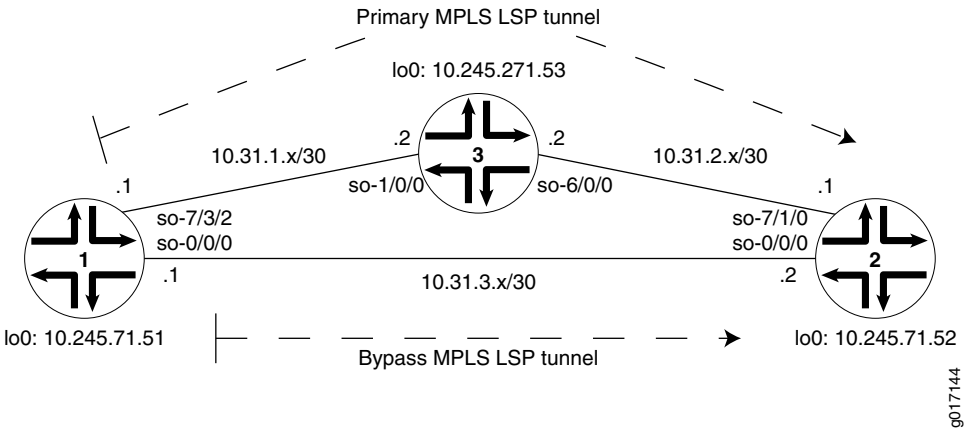
CHAPTER 3

MPLS LSP Link Protection and Node Link Protection Configuration Examples

This section contains configuration examples and commands you can issue to verify MPLS LSP link protection and node-link protection:

Example: Configuring MPLS LSP Link Protection

Figure 2: MPLS LSP Link Protection Topology Diagram



In Figure 2 on page 15, a primary MPLS LSP is established from Router 1 through Router 3 to destination Router 2. To implement link protection, include the **link-protection** statement on the primary LSP at the ingress point and on the appropriate downstream RSVP interfaces you wish to protect. In this case, the primary LSP named **Protected_LSP** on Router 1 requires link protection, as does the **so-7/3/2** RSVP interface of Router 1 and the **so-6/0/0** RSVP interface of Router 3. After link protection is enabled for the protected LSP, bypass LSPs are established automatically for the LSP-traversed interfaces of Routers 1 and 3.

On Router 1, configure an interior gateway protocol (IGP) routing protocol (in this case, IS-IS), RSVP, and MPLS on the **so-0/0/0** and **so-7/3/2** interfaces. Next, configure the

primary LSP on Router 1 to point to the loopback address of Router 2. The primary LSP's strict path must travel though Router 3.

Enable link protection on both the LSP itself and the outgoing RSVP interface traversed by the primary LSP (in this case, the **so-7/3/2** RSVP interface of Router 1). After you enable link protection, the router notices that the primary LSP is protected and prepares a bypass LSP.

Configure a static route of **10.31.5.1** in the LSP on Router 1. You can use this route for testing purposes. Also, if you want to enable Packet Forwarding Engine local repair, establish a policy that requires all traffic to use per-packet load balancing. Once this policy is configured, export it to the neighboring routers with the **export** statement at the [**edit routing-options forwarding-table**] hierarchy level.

Router 1

```
[edit]
interfaces {
    so-0/0/0 {
        unit 0 {
            family inet {
                address 10.31.3.1/30;
            }
            family iso;
            family mpls;
        }
    }
    so-7/3/2 {
        unit 0 {
            family inet {
                address 10.31.1.1/30;
            }
            family iso;
            family mpls;
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 10.245.71.51/32;
            }
            family iso {
            }
        }
    }
    protocols {
        rsvp {
            interface so-7/3/2.0 {
                link-protection; # Enable link protection on the interface carrying the main LSP.
            }
            interface so-0/0/0.0 {
            }
            mpls {
                label-switched-path Protected_LSP {
                    to 10.245.71.52;
                    install 10.31.5.1/32 active; # This route is used for testing the LSPs.
                    link-protection; # Enable link protection on the protected LSP.
```

```
            primary path1;
          }
          path path1 {
            10.31.1.2 strict;
          }
          interface so-0/0/0.0;
          interface so-7/3/2.0;
        }
        isis {
          level 2 wide-metrics-only;
          interface so-0/0/0.0 {
            level 1 disable;
            level 2 {
              metric 100;
              te-metric 100;
            }
          }
          interface so-7/3/2.0 {
            level 1 disable;
            level 2 {
              metric 10;
              te-metric 10;
            }
          }
          interface lo0.0 {
            passive;
          }
        }
      }
      routing-options {
        forwarding-table { # Apply this policy to the forwarding table only
          export pplb; # if Packet Forwarding Engine local repair is needed.
        }
      }
      policy-options {
        policy-statement pplb {
          then {# Configure this policy only if
            load-balance per-packet; # Packet Forwarding Engine local repair is needed.
          }
        }
      }
    }
  }
```

On Router 2, no link protection configuration is needed. However, you should configure MPLS, RSVP, and IS-IS to communicate with the other routers.

Router 2

```
[edit]
interfaces {
  so-0/0/0 {
    unit 0 {
      family inet {
        address 10.31.3.2/30;
      }
      family iso;
      family mpls;
```

```
        }
    }
    so-7/1/0 {
        unit 0 {
            family inet {
                address 10.31.2.1/30;
            }
            family iso;
            family mpls;
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 10.245.71.53/32;
            }
            family iso {
            }
        }
    }
    protocols {
        rsvp {
            interface so-0/0/0.0;
            interface so-7/1/0.0;
        }
        mpls {
            interface so-0/0/0.0;
            interface so-7/1/0.0;
        }
        isis {
            level 2 wide-metrics-only;
            interface so-0/0/0.0 {
                level 1 disable;
                level 2 {
                    metric 100;
                    te-metric 100;
                }
            }
            interface so-7/1/0.0 {
                level 1 disable;
                level 2 {
                    metric 10;
                    te-metric 10;
                }
            }
            interface lo0.0 {
                passive;
            }
        }
    }
}
```

On Router 3, include IS-IS, RSVP, and MPLS on the **so-1/0/0** and **so-6/0/0** interfaces. Enable link protection on the remaining RSVP interface traversed by the primary LSP (in

this case, the **so-6/0/0** RSVP interface). After you enable link protection, the router notices the primary LSP is protected and prepares a bypass LSP.

To enable Packet Forwarding Engine local repair, establish a policy that requires traffic to use per-packet load balancing. Once this policy is configured, export it to the neighboring routers.

Router 3

```
[edit]
interfaces {
    so-1/0/0 {
        unit 0 {
            family inet {
                address 10.31.1.2/30;
            }
            family iso;
            family mpls;
        }
    }
    so-6/0/0 {
        unit 0 {
            family inet {
                address 10.31.2.2/30;
            }
            family iso;
            family mpls;
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 10.245.271.53/32;
            }
            family iso {
            }
        }
    }
    protocols {
        rsvp {
            interface so-1/0/0.0;
            interface so-6/0/0.0 { # Primary interface going to Router 2.
                link-protection;
            }
        }
        mpls {
            interface so-1/0/0.0;
            interface so-6/0/0.0;
        }
        isis {
            level 2 wide-metrics-only;
            interface so-1/0/0.0 {
                level 1 disable;
                level 2 {
                    metric 10;
                    te-metric 10;
                }
            }
```

```
        interface so-6/0/0.0 {
          level 1 disable;
          level 2 {
            metric 10;
            te-metric 10;
          }
        }
        interface lo0.0 {
          passive;
        }
      }
    }
    policy-options {
      policy-statement pplb {
        then {
          load-balance per-packet; # If Packet Forwarding Engine local repair is needed.
        }
      }
    }
    routing-options {
      forwarding-table {
        export pplb; # If Packet Forwarding Engine local repair is needed.
      }
    }
}
```

Verifying Your Work

To verify proper operation of MPLS LSP link protection, use the following commands:

- **show mpls lsp**
- **show route**
- **show route forwarding-table**
- **show rsvp interface detail**
- **show rsvp neighbor detail**
- **show rsvp session detail**

The following sections show the output of these commands used with the configuration example:

- Case 1: Normal Operation on page 20
- Case 2: When the Link from Router 1 to Router 3 Is Disabled on page 27
- Case 3: When the Link from Router 3 to Router 2 Is Disabled on page 29

Case 1: Normal Operation

Once link protection is enabled on the required RSVP interfaces and primary LSP, the bypass LSPs are prepared.

Router 1

```
user@Router1> show mpls lsp
```

```
Ingress LSP: 1 sessions
To              From            State Rt ActivePath       P     LSPname
10.245.71.52    10.245.71.51    Up     1 path1            *     Protected_LSP
```

This is the main LSP.

```
Total 1 displayed, Up 1, Down 0
Egress LSP: 0 sessions
Total 0 displayed, Up 0, Down 0
Transit LSP: 1 sessions
To              From            State Rt Style Labelin Labelout LSPname
10.245.71.52    10.245.271.53   Up     1  1 SE  100003        0
Bypass->10.31.2.1
```

This is the bypass LSP from Router 3 to Router 2.

```
Total 1 displayed, Up 1, Down 0

user@Router1>   show rsvp session detail
Ingress RSVP: 2 sessions
10.245.71.52
   From: 10.245.71.51, LSPstate: Up, ActiveRoute: 1
 LSPname: Protected_LSP
```

This is the main LSP. Notice that a backup LSP is not signaled when the main LSP is still up.

```
  Resv style: 1 SE, Label in: -, Label out: 100007
  Time left:    -,  Since: Thu Aug  8 12:13:24 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 33 protocol 0
  Link protection desired
  Type: Link protected LSP
  PATH rcvfrom: localclient
  PATH sentto: 10.31.1.2 (so-7/3/2.0) 36 pkts
  RESV rcvfrom: 10.31.1.2  (so-7/3/2.0) 38 pkts
  Explct route: 10.31.1.2 10.31.2.1
  Record route: <self>  10.31.1.2  10.31.2.1
10.245.271.53
   From: 10.245.71.51, LSPstate: Up, ActiveRoute: 0
 LSPname: Bypass->10.31.1.2
```

This is the bypass from Router 1 to Router 2. This also appears in the **show mpls lsp** command output above.

```
  Resv style: 1 SE, Label in: -, Label out: 100000
  Time left:    -,  Since: Thu Aug  8 12:14:31 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 51 protocol 0
  Type: Bypass LSP
  PATH rcvfrom: localclient
  PATH sentto: 10.31.3.2 (so-0/0/0.0) 32 pkts
  RESV rcvfrom: 10.31.3.2  (so-0/0/0.0) 32 pkts
  Explct route: 10.31.3.2 10.31.2.2
  Record route: <self>  10.31.3.2  10.31.2.2
Total 2 displayed, Up 2, Down 0
Egress RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0
Transit RSVP: 1 sessions
10.245.71.52
  From: 10.245.271.53, LSPstate: Up, ActiveRoute: 1
  LSPname: Bypass->10.31.2.1
```

```
  Resv style: 1 SE, Label in: 100003, Label out: 0
  Time left:   52,  Since: Thu Aug  8 12:03:27 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 19 protocol 0
  PATH rcvfrom: 10.31.1.2  (so-7/3/2.0) 76 pkts
  PATH sentto: 10.31.3.2 (so-0/0/0.0) 77 pkts
  RESV rcvfrom: 10.31.3.2  (so-0/0/0.0) 78 pkts
  Explct route: 10.31.3.2
  Record route: 10.31.1.2  <self>  10.31.3.2
Total 1 displayed, Up 1, Down 0

user@Router1>  show rsvp interface detail
RSVP interface: 2 active
fxp0.0  Index 1, State Dis/Up
  NoAuthentication, NoAggregate, NoReliable, NoLinkProtection
  HelloInterval 9(second)
  Address 192.168.71.52
  PacketType              Total                 Last 5 seconds
                    Sent      Received        Sent      Received
  Path                 0             0           0             0
  PathErr              0             0           0             0
  PathTear             0             0           0             0
  Resv                 0             0           0             0
  ResvErr              0             0           0             0
  ResvTear             0             0           0             0
  Hello                0             0           0             0
  Ack                  0             0           0             0
  Srefresh             0             0           0             0
  EndtoEnd RSVP        0             0           0             0
so-0/0/0.0  Index 8, State Ena/Up
  NoAuthentication, NoAggregate, NoReliable, NoLinkProtection
  HelloInterval 20(second)
  Address 10.31.3.1, 10.245.71.51
  ActiveResv 2, PreemptionCnt 0, Update threshold 10%
  Subscription 100%, StaticBW 622.08Mbps, AvailableBW 622.08Mbps
  PacketType              Total                 Last 5 seconds
                    Sent      Received        Sent      Received
  Path               441             0           0             0
  PathErr              0             0           0             0
  PathTear             3             0           0             0
  Resv                 0           431           0             0
  ResvErr              0             0           0             0
  ResvTear             0             0           0             0
  Hello              489           487           0             0
  Ack                  0             0           0             0
  Srefresh             0             0           0             0
  EndtoEnd RSVP        0             0           0             0
so-7/3/2.0  Index 11, State Ena/Up
  NoAuthentication, NoAggregate, NoReliable,  LinkProtection
```

Link protection is enabled.

```
  HelloInterval 3(second)
  Address 10.31.1.1, 10.245.71.51
  ActiveResv 1, PreemptionCnt 0, Update threshold 10%
  Subscription 100%, StaticBW 2.48832Gbps, AvailableBW 2.48832Gbps
  PacketType              Total                 Last 5 seconds
                    Sent      Received        Sent      Received
  Path               225           138           0             0
  PathErr             12             4           0             0
  PathTear             5             3           0             0
  Resv               134           216           0             1
```

```
  ResvErr              0            0          0            0
  ResvTear             3            1          0            0
  Hello              750          799          1            1
  Ack                  0            0          0            0
  Srefresh             0            0          0            0
  EndtoEnd RSVP        0            0          0            0

user@Router1>  show rsvp neighbor detail
RSVP neighbor: 2 learned
Address: 10.31.1.2   via: so-7/3/2.0    status: Up
  Last changed time: 38:17, Idle: 5 sec, Up cnt: 1, Down cnt: 0
  Message received: 329
  Hello: sent 747, received: 747, interval: 3 sec
  Remote instance: 0x41b21a47, Local instance: 0x238fa919
  Refresh reduction:  not operational
  Link protection:   enabled            #   This should be enabled
    LSP name: Bypass->10.31.1.2
    Bypass LSP: operational,   Backup routes: 2 ,  Backup LSPs: 0
```

The number of backup routes equals 2 because the main LSP is already considered for protection.

```
    Bypass explicit route: 10.31.3.2 10.31.2.2

Address: 10.31.3.2   via: so-0/0/0.0    status: Up
  Last changed time: 17:46, Idle: 5 sec, Up cnt: 4, Down cnt: 3
  Message received: 430
  Hello: sent 506, received: 486, interval: 20 sec
  Remote instance: 0x194fa7af, Local instance: 0x507b7c2a
  Refresh reduction:  not operational
  Link protection:  disabled
    Bypass LSP: does not exist,  Backup routes: 0,  Backup LSPs: 0

user@Router1>show route 10.31.5.1 extensive

inet.0: 24 destinations, 24 routes (22 active, 0 holddown, 2 hidden)
10.31.5.1/32 (1 entry, 1 announced)
        State: <FlashAll>
TSI:
KRT in-kernel 10.31.5.1/32 -> {0.0.0.0, 0.0.0.0}
        *RSVP   Preference: 7
                 Next hop: via so-7/3/2.0 weight 1, selected
```

This is the main LSP.

```
                Label-switched-path Protected_LSP
                Label operation: Push 100007
                 Next hop: via so-0/0/0.0 weight 20001
```

This is a backup route, though the backup LSP has not been signaled yet.

```
                Label-switched-path Bypass->10.31.1.2
                Label operation: Push 100007, Push 100000(top)[0]
                State: <Active Int>
                Local AS:    69
                Age: 8:34       Metric: 20
                Task: RSVP
                Announcement bits (1): 0-KRT
                AS path: I

user@Router1>  show route forwarding-table destination 10.31.5.1 extensive
```

```
Routing table: inet [Index 0]
Internet:
    Destination:  10.31.5.1/32
  Route type: user                Route reference: 0
  Flags: sent to PFE
  Next-hop type: unilist              Index: 39       Reference: 1
   Next-hop type: Push 100007
 Next-hop interface: so-7/3/2.0     Weight: 1
```

Packet Forwarding Engine local repair is enabled (otherwise, only one entry appears for **Next-hop**).

```
  Next-hop type: Push 100007, Push 100000(top)[0]
  Next-hop interface: so-0/0/0.0        Weight: 20001
```

The Weight value for the backup starts at 20000 .

Router 3

```
user@Router3> show mpls lsp
Ingress LSP: 0 sessions
```

The ingress bypass LSP to Router 2 does not appear here.

```
Total 0 displayed, Up 0, Down 0
Egress LSP: 1 sessions
To              From            State Rt Style Labelin Labelout LSPname
10.245.271.53   10.245.71.51    Up     0  1 SE       3        -
Bypass->10.31.1.2
Total 1 displayed, Up 1, Down 0
Transit LSP: 1 sessions
To              From            State Rt Style Labelin Labelout LSPname
10.245.71.52    10.245.71.51    Up     1  1 SE  100000        0 Protected_LSP
Total 1 displayed, Up 1, Down 0

user@Router3>   show rsvp session detail
Ingress RSVP: 1 sessions

10.245.71.52
  From: 10.245.271.53, LSPstate: Up, ActiveRoute: 0
   LSPname: Bypass->10.31.2.1

  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 100004
  Resv style: 1 SE, Label in: -, Label out: 100004
  Time left:    -,  Since: Thu Aug  8 12:27:07 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 16 protocol 0
  Type: Bypass LSP
  PATH rcvfrom: localclient
  PATH sentto: 10.31.1.1 (so-1/0/0.0) 3 pkts
  RESV rcvfrom: 10.31.1.1  (so-1/0/0.0) 3 pkts
  Explct route: 10.31.1.1 10.31.3.2
  Record route: <self>  10.31.1.1  10.31.3.2
Total 1 displayed, Up 1, Down 0

Egress RSVP: 1 sessions

10.245.271.53
  From: 10.245.71.51, LSPstate: Up, ActiveRoute: 0
  LSPname: Bypass->10.31.1.2
```

This is the bypass from Router 1 to Router 3, arriving by way of Router 2.

```
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: -
  Resv style: 1 SE, Label in: 3, Label out: -
  Time left:   54,  Since: Thu Aug  8 12:26:48 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 52 protocol 0
  PATH rcvfrom: 10.31.2.1  (so-6/0/0.0) 5 pkts
  PATH sentto: localclient
  RESV rcvfrom: localclient
  Record route: 10.31.3.1  10.31.2.1  <self>
Total 1 displayed, Up 1, Down 0
Transit RSVP: 1 sessions
10.245.71.52
  From: 10.245.71.51, LSPstate: Up, ActiveRoute: 1
  LSPname: Protected_LSP
```

This is the main LSP.

```
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 0
  Resv style: 1 SE, Label in: 100000, Label out: 0
  Time left:   41,  Since: Thu Aug  8 12:26:39 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 33 protocol 0
  Link protection desired
  Type: Link protected LSP
  PATH rcvfrom: 10.31.1.1  (so-1/0/0.0) 9 pkts
  PATH sentto: 10.31.2.1 (so-6/0/0.0) 11 pkts
  RESV rcvfrom: 10.31.2.1  (so-6/0/0.0) 10 pkts
  Explct route: 10.31.2.1
  Record route: 10.31.1.1  <self>  10.31.2.1
Total 1 displayed, Up 1, Down 0

user@Router3>  show rsvp neighbor detail
RSVP neighbor: 2 learned
Address: 10.31.2.1   via: so-6/0/0.0    status: Up
  Last changed time: 27, Idle: 0 sec, Up cnt: 1, Down cnt: 0
  Message received: 19
  Hello: sent 6, received: 6, interval: 9 sec
  Remote instance: 0x625d2852, Local instance: 0x327317df
  Refresh reduction:  not operational
  Link protection:  enabled
    LSP name: Bypass->10.31.2.1
    Bypass LSP: operational,   Backup routes: 1 ,  Backup LSPs: 0
```

The number of backup routes is 1.

```
    Bypass explicit route: 10.31.1.1 10.31.3.2
Address: 10.31.1.1   via: so-1/0/0.0    status: Up
  Last changed time: 41, Idle: 0 sec, Up cnt: 1, Down cnt: 0
  Message received: 15
  Hello: sent 17, received: 17, interval: 3 sec
  Remote instance: 0x2ebdcf43, Local instance: 0x643d9e23
  Refresh reduction:  not operational
  Link protection:  disabled
    Bypass LSP: does not exist,  Backup routes: 0,  Backup LSPs: 0

user@Router3>  show rsvp interface detail
RSVP interface: 2 active
fxp0.0  Index 1, State Dis/Up
```

```
  NoAuthentication, NoAggregate, NoReliable, NoLinkProtection
  HelloInterval 9(second)
  Address 192.168.6.64
  PacketType              Total                 Last 5 seconds
                    Sent      Received        Sent      Received
  Path                 0             0           0             0
  PathErr              0             0           0             0
  PathTear             0             0           0             0
  Resv                 0             0           0             0
  ResvErr              0             0           0             0
  ResvTear             0             0           0             0
  Hello                0             0           0             0
  Ack                  0             0           0             0
  Srefresh             0             0           0             0
  EndtoEnd RSVP        0             0           0             0
so-1/0/0.0  Index 6, State Ena/Up
  NoAuthentication, NoAggregate, NoReliable, NoLinkProtection
  HelloInterval 3(second)
  Address 10.31.1.2, 10.245.271.53
  ActiveResv 1, PreemptionCnt 0, Update threshold 10%
  Subscription 100%, StaticBW 2.48832Gbps, AvailableBW 2.48832Gbps
  PacketType              Total                 Last 5 seconds
                    Sent      Received        Sent      Received
  Path                 5            14           0             1
  PathErr              0             0           0             0
  PathTear             0             0           0             0
  Resv                 8             9           0             0
  ResvErr              0             0           0             0
  ResvTear             0             0           0             0
  Hello               23            25           2             2
  Ack                  0             0           0             0
  Srefresh             0             0           0             0
  EndtoEnd RSVP        0             0           0             0
so-6/0/0.0  Index 9, State Ena/Up
  NoAuthentication, NoAggregate, NoReliable,  LinkProtection
```

Link protection is enabled.

```
  HelloInterval 9(second)
  Address 10.31.2.2, 10.245.271.53
  ActiveResv 1, PreemptionCnt 0, Update threshold 10%
  Subscription 100%, StaticBW 9.95328Gbps, AvailableBW 9.95328Gbps
  PacketType              Total                 Last 5 seconds
                    Sent      Received        Sent      Received
  Path                12             8           0             0
  PathErr              0             0           0             0
  PathTear             0             1           0             0
  Resv                 9            14           0             1
  ResvErr              0             0           0             0
  ResvTear             0             0           0             0
  Hello                8             8           1             1
  Ack                  0             0           0             0
  Srefresh             0             0           0             0
  EndtoEnd RSVP        0             0           0             0

user@Router3>  show route forwarding-table family mpls
Routing table: ccc
MPLS:
Destination        Type RtRef Next hop          Type Index NhRef Netif
default            perm     0                   dscd     1     1
0                  user     0                   recv     3     3
1                  user     0                   recv     3     3
```

```
2                  user     0                    recv     3     3
100000     user  0       ulst  77  1
```

This is the main LSP.

```
                                                Swap       0     so-6/0/0.0
                                                Swap  100004[0]  so-1/0/0.0
100000(S=0)        user     0                   ulst    78     1
                                                Pop              so-6/0/0.0
                                                Swap  100004[0]  so-1/0/0.0
100007     user  0       ulst  71  1
```

This is the bypass LSP from Router 1 to Router 2.

```
                                                Swap       0     so-6/0/0.0
                                                Swap  100003[0]  so-1/0/0.0
100007(S=0)        user     0                   ulst    73     1
                                                Pop              so-6/0/0.0
                                                Swap  100003[0]  so-1/0/0.0
```

Case 2: When the Link from Router 1 to Router 3 Is Disabled

```
[edit]
user@Router1# set interfaces so-7/3/2 disable

[edit]
user@Router1# commit
commit complete
```

The primary interface from Router 1 to Router 3 is disabled.

Router 1

```
user@Router1> show mpls lsp
Ingress LSP: 1 sessions
To              From            State  Rt ActivePath       P     LSPname
10.245.71.52    10.245.71.51    Up      0 path1            *     Protected_LSP
```

The main LSP is up.

```
Total 1 displayed, Up 1, Down 0
Egress LSP: 0 sessions
Total 0 displayed, Up 0, Down 0
Transit LSP: 1 sessions
To              From           State Rt Style Labelin Labelout LSPname
10.245.71.52    10.245.271.53  Up     0  1 SE  100004        0
Bypass->10.31.2.1
```

This is the bypass LSP from Router 3 to Router 2.

```
Total 1 displayed, Up 1, Down 0

user@Router1>   show rsvp session detail
Ingress RSVP: 3 sessions
10.245.71.52
  From: 10.31.3.1, LSPstate: Up, ActiveRoute: 0
 LSPname: Protected_LSP
```

This is the newly signaled backup LSP, as indicated by the To/From field.

```
  Resv style: 1 SE, Label in: -, Label out: 100000
  Time left:    -,  Since: Thu Aug  8 12:29:16 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
```

```
  Port number: sender 2 receiver 33 protocol 0
  Link protection desired
  Type: Backup LSP at Point-of-Local-Repair
  PATH rcvfrom: localclient
  PATH sentto: 10.31.1.2 (so-0/0/0.0) 4 pkts
  RESV rcvfrom: 10.31.2.2  (so-0/0/0.0) 3 pkts
  Explct route: 10.31.2.2 10.31.2.1
  Record route: <self>  10.31.2.2  10.31.2.1
10.245.71.52
  From: 10.245.71.51, LSPstate: Dn, ActiveRoute: 0
```

The original LSP is now down.

```
  LSPname: Protected_LSP
  Resv style: 0 -, Label in: -, Label out: -
  Time left:    -,  Since: Thu Aug  8 12:13:24 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 33 protocol 0
  Link protection desired
  Type: Link protected LSP
  PATH rcvfrom: localclient
  PATH sentto: [no route]
  Explct route: 10.31.1.2 10.31.2.1
  Record route: <self>  ...incomplete

10.245.271.53
  From: 10.245.71.51, LSPstate: Up, ActiveRoute: 1
  LSPname: Bypass->10.31.1.2
```

This is the bypass LSP from Router 1 to Router 2.

```
  Resv style: 1 SE, Label in: -, Label out: 100001
  Time left:    -,  Since: Thu Aug  8 12:26:48 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 52 protocol 0
  Type: Bypass LSP
  PATH rcvfrom: localclient
  PATH sentto: 10.31.3.2 (so-0/0/0.0) 13 pkts
  RESV rcvfrom: 10.31.3.2  (so-0/0/0.0) 13 pkts
  Explct route: 10.31.3.2 10.31.2.2
  Record route: <self>  10.31.3.2  10.31.2.2
Total 3 displayed, Up 2, Down 1

Egress RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0

Transit RSVP: 1 sessions

10.245.71.52
  From: 10.245.271.53, LSPstate: Up, ActiveRoute: 0
  LSPname: Bypass->10.31.2.1
```

This is the bypass LSP from Router 3 to Router 2, which will fail in the next case.

```
  Resv style: 1 SE, Label in: 100004, Label out: 0
  Time left:   38,  Since: Thu Aug  8 12:27:07 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 16 protocol 0
  PATH rcvfrom: 10.31.1.2  (so-7/3/2.0) 11 pkts
  PATH sentto: 10.31.3.2 (so-0/0/0.0) 12 pkts
  RESV rcvfrom: 10.31.3.2  (so-0/0/0.0) 12 pkts
  Explct route: 10.31.3.2
```



```
  Record route: 10.31.1.2  <self>  10.31.3.2
Total 1 displayed, Up 1, Down 0

user@Router1> show rsvp neighbor detail
RSVP neighbor: 2 learned
Address: 10.31.1.2  via: so-7/3/2.0  status: Down
```

The neighbor is down.

```
  Last changed time: 25, Idle: 25 sec, Up cnt: 2, Down cnt: 2
  Message received: 397
  Hello: sent 900, received: 890, interval: 3 sec
  Remote instance: 0x0, Local instance: 0x41b41b17
  Refresh reduction:  not operational
  Link protection:  enabled
    LSP name: Bypass->10.31.1.2
    Bypass LSP: operational,  Backup routes: 2,  Backup LSPs: 1
    Bypass explicit route: 10.31.3.2 10.31.2.2
Address: 10.31.3.2   via: so-0/0/0.0    status: Up
  Last changed time: 25:40, Idle: 5 sec, Up cnt: 4, Down cnt: 3
  Message received: 502
  Hello: sent 558, received: 538, interval: 20 sec
  Remote instance: 0x194fa7af, Local instance: 0x507b7c2a
  Refresh reduction:  not operational
  Link protection:  disabled
    Bypass LSP: does not exist,  Backup routes: 0,  Backup LSPs: 0

user@Router1> show route 10.31.5.1
inet.0: 23 destinations, 23 routes (22 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both
10.31.5.1/32    *[RSVP/7] 00:03:04, metric 20
        > via so-0/0/0.0, label-switched-path Bypass->10.31.1.2
```

The route can be reached by way of the backup LSP.

```
user@Router1>  show route forwarding-table destination 10.31.5.1
Routing table: inet
Internet:
Destination        Type RtRef Next hop          Type Index NhRef Netif
10.31.5.1/32       user     0                   Push 100000, Push 100001(top)[0]

so-0/0/0.0
```

Double-stacked labels appear on the backup LSP from Router 1 to Router 2 to Router 3.

Before proceeding to Case 3, reenable the **so-7/3/2** interface on Router 1.

```
[edit]
user@Router1# delete interfaces so-7/3/2 disable

[edit]
user@Router1# commit
commit complete
```

Case 3: When the Link from Router 3 to Router 2 Is Disabled

```
[edit]
user@Router3# set interfaces so-6/0/0 disable

[edit]
user@Router3# commit
commit complete
```

The primary interface from Router 3 to Router 2 is disabled.

Router 3

```
user@Router3> show rsvp session
Ingress RSVP: 2 sessions
To              From            State Rt Style Labelin Labelout LSPname
10.245.71.52    10.245.271.53   Up     1  1 SE       -   100005
Bypass->10.31.2.1
10.245.71.52    10.31.1.2       Up     0  1 SE       -        0 Protected_LSP
```

The backup is signaled from Router 3 to Router 2.

```
Total 2 displayed, Up 2, Down 0
Egress RSVP: 1 sessions
To              From            State Rt Style Labelin Labelout LSPname
10.245.271.53   10.245.71.51    Up     0  1 SE       3        -
Bypass->10.31.1.2
Total 1 displayed, Up 1, Down 0
Transit RSVP: 1 sessions
To              From             State  Rt Style Labelin Labelout LSPname
10.245.71.52    10.245.71.51     Dn      0  0  -  100000        - Protected_LSP
```

The main LSP is down.

```
Total 1 displayed, Up 0, Down 1

user@Router3> show rsvp session detail
Ingress RSVP: 2 sessions

10.245.71.52
  From: 10.245.271.53, LSPstate: Up, ActiveRoute: 1
  LSPname: Bypass->10.31.2.1
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 100005
  Resv style: 1 SE, Label in: -, Label out: 100005
  Time left:    -,  Since: Thu Aug  8 12:31:09 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 17 protocol 0
  Type: Bypass LSP
  PATH rcvfrom: localclient
  PATH sentto: 10.31.1.1 (so-1/0/0.0) 6 pkts
  RESV rcvfrom: 10.31.1.1  (so-1/0/0.0) 6 pkts
  Explct route: 10.31.1.1 10.31.3.2
  Record route: <self>  10.31.1.1  10.31.3.2

10.245.71.52
  From: 10.31.1.2, LSPstate: Up, ActiveRoute: 0
  LSPname: Protected_LSP
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 0
  Resv style: 1 SE, Label in: -, Label out: 0
  Time left:    -,  Since: Thu Aug  8 12:31:59 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 33 protocol 0
  Link protection desired
  Type: Backup LSP at Point-of-Local-Repair
```

This is the backup LSP.

```
  PATH rcvfrom: localclient
  PATH sentto: 10.31.2.1 (so-1/0/0.0) 5 pkts
```

```
  RESV rcvfrom: 10.31.3.2  (so-1/0/0.0) 2 pkts
  Explct route: 10.31.3.2
  Record route: <self>  10.31.3.2
Total 2 displayed, Up 2, Down 0

Egress RSVP: 1 sessions

10.245.271.53
  From: 10.245.71.51, LSPstate: Up, ActiveRoute: 0
  LSPname: Bypass->10.31.1.2
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: -
  Resv style: 1 SE, Label in: 3, Label out: -
  Time left:   31,  Since: Thu Aug  8 12:26:48 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 52 protocol 0
  PATH rcvfrom: 10.31.2.1  (so-6/0/0.0) 23 pkts
  PATH sentto: localclient
  RESV rcvfrom: localclient
  Record route: 10.31.3.1  10.31.2.1  <self>
Total 1 displayed, Up 1, Down 0

Transit RSVP: 1 sessions

10.245.71.52
  From: 10.245.71.51, LSPstate: Dn, ActiveRoute: 0
  LSPname: Protected_LSP
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: -
  Resv style: 0 -, Label in: 100000, Label out: -
  Time left:   53,  Since: Thu Aug  8 12:26:39 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 33 protocol 0
  Link protection desired
  Type: Link protected LSP
  PATH rcvfrom: 10.31.1.1  (so-1/0/0.0) 30 pkts
  PATH sentto: [no route]
  Explct route: 10.31.2.1
  Record route: 10.31.1.1  <self>  ...incomplete
Total 1 displayed, Up 0, Down 1

user@Router3> show route forwarding-table family mpls
Routing table: ccc
MPLS:
Destination        Type RtRef Next hop          Type Index NhRef Netif
default            perm     0                   dscd     1     1
0                  user     0                   recv     3     3
1                  user     0                   recv     3     3
2                  user     0                   recv     3     3
100000     user   0       Swap 100005[0] so-1/0/0.0
```

This shows label swapping for the main LSP traveling over the backup LSP through Router 2.

Router 1

```
user@Router1> show rsvp session detail
Ingress RSVP: 1 sessions
10.245.71.52
  From: 10.245.71.51, LSPstate: Up, ActiveRoute: 1
  LSPname: Protected_LSP
```

The main LSP is not affected.

```
  Resv style: 1 SE, Label in: -, Label out: 100000
  Time left:    -,  Since: Thu Aug  8 12:13:24 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 33 protocol 0
  Link protection desired
  PATH rcvfrom: localclient
  PATH sentto: 10.31.1.2 (so-7/3/2.0) 95 pkts
  RESV rcvfrom: 10.31.1.2  (so-7/3/2.0) 87 pkts
  Explct route: 10.31.1.2 10.31.2.1
  Record route: <self>  10.31.1.2  10.31.3.2
Total 1 displayed, Up 1, Down 0

Egress RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0

Transit RSVP: 1 sessions

10.245.71.52
  From: 10.245.271.53, LSPstate: Up, ActiveRoute: 0
  LSPname: Bypass->10.31.2.1
```

The bypass LSP is listed, because Router 1 does not detect the backup from Router 3 to Router 2.

```
  Resv style: 1 SE, Label in: 100005, Label out: 0
  Time left:   53,  Since: Thu Aug  8 12:31:09 2002
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 17 protocol 0
  PATH rcvfrom: 10.31.1.2  (so-7/3/2.0) 11 pkts
  PATH sentto: 10.31.3.2 (so-0/0/0.0) 11 pkts
  RESV rcvfrom: 10.31.3.2  (so-0/0/0.0) 11 pkts
  Explct route: 10.31.3.2
  Record route: 10.31.1.2  <self>  10.31.3.2
Total 1 displayed, Up 1, Down 0

user@Router1> show route forwarding-table family mpls
Routing table: ccc
MPLS:
Destination        Type RtRef Next hop          Type Index NhRef Netif
default            perm     0                   dscd     8     1
0                  user     0                   recv    10     3
1                  user     0                   recv    10     3
2                  user     0                   recv    10     3
100005     user   0       Swap   0   so-0/0/0.0
```

Labels are swapped on the bypass LSP.

```
100005(S=0)        user     0                   Pop              so-0/0/0.0
user@Router1> show route forwarding-table destination 10.31.5.1 extensive
Routing table: inet [Index 0]
Internet:
Destination:  10.31.5.1/32
  Route type: user                Route reference: 0
  Flags: sent to PFE
  Next-hop type: Push 100000
```


There is only one entry here. The bypass to Router 3 is broken because the connection between Router 3 and Router 2 is disabled.

```
Next-hop interface: so-7/3/2.0
user@Router1> show isis adjacency
Interface             System         L State       Hold (secs) SNPA
so-0/0/0.0            Router2        2 Up                   24
so-7/3/2.0            Router3        2 Up                   23

user@Router1>  show route 10.31.5.1 extensive

inet.0: 22 destinations, 22 routes (21 active, 0 holddown, 1 hidden)
10.31.5.1/32 (1 entry, 1 announced)
        State: <FlashAll>
TSI:
KRT in-kernel 10.31.5.1/32 -> {0.0.0.0}
        *RSVP   Preference: 7
                Next hop: via so-7/3/2.0 weight 1, selected
```

Only one entry is shown.

```
                Label-switched-path Protected_LSP
                Label operation: Push 100000
                State: <Active Int>
                Local AS:    69
                Age: 2:21       Metric: 100
                Task: RSVP
                Announcement bits (1): 0-KRT
                AS path: I

user@Router1> show rsvp neighbor detail
RSVP neighbor: 2 learned
Address: 10.31.1.2   via: so-7/3/2.0    status: Up
  Last changed time: 2:58, Idle: 0 sec, Up cnt: 3, Down cnt: 2
  Message received: 433
  Hello: sent 965, received: 950, interval: 3 sec
  Remote instance: 0x74be7c42, Local instance: 0x41b41b17
  Refresh reduction:  not operational
  Link protection:  disabled
    Bypass LSP: does not exist,  Backup routes: 0,  Backup LSPs: 0
Address: 10.31.3.2   via: so-0/0/0.0    status: Up
  Last changed time: 30:54, Idle: 0 sec, Up cnt: 4, Down cnt: 3
  Message received: 533
  Hello: sent 593, received: 573, interval: 20 sec
  Remote instance: 0x194fa7af, Local instance: 0x507b7c2a
  Refresh reduction:  not operational
  Link protection:  disabled
    Bypass LSP: does not exist,  Backup routes: 0,  Backup LSPs: 0

user@Router1>  show rsvp session
Ingress RSVP: 1 sessions
To              From            State Rt Style Labelin Labelout LSPname
10.245.71.52    10.245.71.51    Up     1  1 SE       -   100000 Protected_LSP
Total 1 displayed, Up 1, Down 0
Egress RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0
Transit RSVP: 1 sessions
To              From            State Rt Style Labelin Labelout LSPname
10.245.71.52    10.245.271.53   Up     0  1 SE  100005        0
Bypass->10.31.2.1
Total 1 displayed, Up 1, Down 0
```


Related Documentation

- MPLS LSP Link Protection and Node-Link Protection Overview on page 3
- Configuring Link Protection on the RSVP Interfaces Traversed by the LSP on page 10
- Configuring Link Protection or Node-Link Protection on the LSP on page 9
- Option: Adding Class of Service to a Link-Protected LSP or a Bypass LSP on page 12
- Option: Configuring Multiple Bypass LSPs, Manual Bypass LSPs, and Link Protection Priority on page 10
- Verifying MPLS LSP Link Protection and Node Link Protection on page 12

Example: Node-Link Protection Configuration

Figure 3: Node-Link Protection Topology Diagram

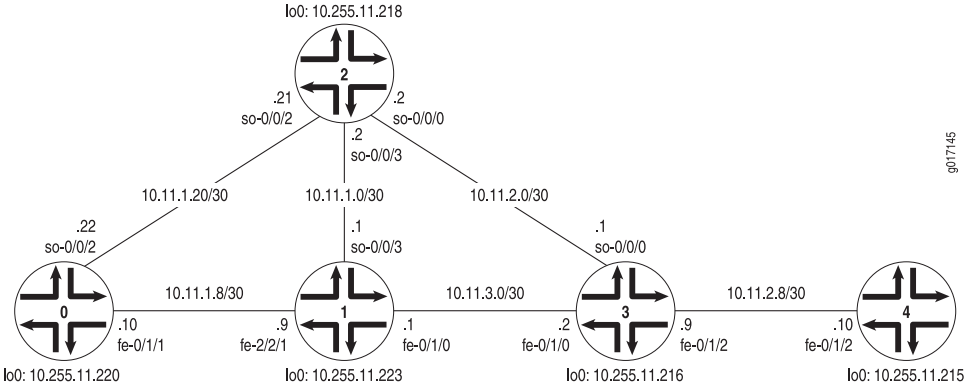


Figure 3 on page 34 shows an example of how you can implement node-link protection. An LSP is initiated on Router 0 with a strict path travelling through Router 1, Router 2, Router 3, and Router 4. You configure node-link protection within the LSP and link protection on all RSVP interfaces in the path.

On Router 0, configure an LSP to travel across routers 1, 2, 3, and 4. Include the **node-link-protection** statement in the LSP and configure link protection on outgoing RSVP interface **fe-0/1/1**. To support the LSP, configure OSPF, MPLS, and RSVP on the needed interfaces.

Router 0

```
[edit]
interfaces {
   fe-0/1/1 {
      unit 0 {
         family inet {
            address 10.11.1.10/30;
         }
         family mpls;
      }
   }
   so-0/0/2 {
      unit 0 {
         family inet {
            address 10.11.1.22/30;
```

```
        }
        family mpls;
      }
    }
    lo0 {
      unit 0 {
        family inet {
          address 10.255.11.220/32;
        }
      }
    }
}
protocols {
    ospf {
      area 0.0.0.0 {
        interface lo0.0 {
          passive;
        }
        interface fe-0/1/1.0;
        interface so-0/0/2.0;
      }
      traffic-engineering;
    }
    mpls {
      statistics {
        file mplsStat.log size 1m;
        interval 30;
        display-id;
      }
      traffic-engineering bgp-igp-both-ribs;
      traceoptions {
        file mpls.log size 5m world-readable;
        flag cspf;
        flag cspf-link;
        flag cspf-node;
        flag state;
        flag error;
      }
      explicit-null;
      label-switched-path test_r0_r4 {
        from 10.255.11.220;
        to 10.255.11.215;
        node-link-protection; # Apply node-link protection to the LSP.
        primary pathP;
      }
      path pathP {# Define the LSP path across routers 1, 2, 3, and 4.
        10.11.1.9 strict;
        10.11.1.2 strict;
        10.11.2.1 strict;
        10.11.2.10 strict;
      }
      interface fe-0/1/1.0;
      interface so-0/0/2.0;
    }
    rsvp {
      traceoptions {
```

```
        file rsvp.log size 3m files 12 world-readable;
        flag event;
        flag state;
        flag error;
        flag packets detail;
      }
      interface fe-0/1/1.0 {
        link-protection; # Apply link protection to RSVP interfaces in the LSP path.
      }
      interface so-0/0/2.0;
    }
  }
```

On Router 1, configure link protection on outgoing RSVP interface **so-0/0/3.** Configure OSPF, MPLS, and RSVP on all transit interfaces.

Router 1

```
[edit]
interfaces {
  fe-0/1/0 {
    unit 0 {
      family inet {
        address 10.11.3.1/30;
      }
      family mpls;
    }
  }
  fe-2/2/1 {
    unit 0 {
      family inet {
        address 10.11.1.9/30;
      }
      family mpls;
    }
  }
  so-0/0/3 {
    unit 0 {
      family inet {
        address 10.11.1.1/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.11.223/32;
      }
    }
  }
}
protocols {
  ospf {
    area 0.0.0.0 {
      interface lo0.0 {
        passive;
      }
```

```
        interface fe-0/1/0.0;
        interface fe-2/2/1.0;
        interface so-0/0/3.0;
      }
      traffic-engineering;
    }
    mpls {
      traffic-engineering bgp-igp-both-ribs;
      explicit-null;
      interface fe-0/1/0.0;
      interface fe-2/2/1.0;
      interface so-0/0/3.0;
    }
    rsvp {
      interface fe-0/1/0.0;
      interface fe-2/2/1.0;
      interface so-0/0/3.0 {
        link-protection; # Apply link protection on all RSVP interfaces in the LSP path.
      }
    }
  }
```

On Router 2, configure link protection on outgoing RSVP interface **so-0/0/0.** Configure OSPF, MPLS, and RSVP on all transit interfaces.

Router 2

```
[edit]
interfaces {
  so-0/0/0 {
    unit 0 {
      family inet {
        address 10.11.2.2/30;
      }
      family mpls;
    }
  }
  so-0/0/2 {
    unit 0 {
      family inet {
        address 10.11.1.21/30;
      }
      family mpls;
    }
  }
  so-0/0/3 {
    unit 0 {
      family inet {
        address 10.11.1.2/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.11.218/32;
      }
```

```
    }
  }
}
protocols {
  ospf {
    area 0.0.0.0 {
      interface lo0.0 {
        passive;
      }
      interface so-0/0/0.0;
      interface so-0/0/2.0;
      interface so-0/0/3.0;
    }
    traffic-engineering;
  }
  mpls {
    traffic-engineering bgp-igp-both-ribs;
    explicit-null;
    interface so-0/0/0.0;
    interface so-0/0/2.0;
    interface so-0/0/3.0;
  }
  rsvp {
    interface so-0/0/0.0 {
      link-protection; # Apply link protection to RSVP interfaces in the LSP path.
    }
    interface so-0/0/2.0;
    interface so-0/0/3.0;
  }
}
```

On Router 3, configure link protection on outgoing RSVP interface **fe-0/1/2.** Configure OSPF, MPLS, and RSVP on all transit interfaces.

Router 3

```
[edit]
interfaces {
  fe-0/1/0 {
    unit 0 {
      family inet {
        address 10.11.3.2/30;
      }
      family mpls;
    }
  }
  fe-0/1/2 {
    unit 0 {
      family inet {
        address 10.11.2.9/30;
      }
      family mpls;
    }
  }
  so-0/0/0 {
    unit 0 {
      family inet {
        address 10.11.2.1/30;
```

```
        }
        family mpls;
      }
    }
    lo0 {
      unit 0 {
        family inet {
          address 10.255.11.216/32;
        }
      }
    }
  }
  protocols {
    ospf {
      area 0.0.0.0 {
        interface lo0.0 {
          passive;
        }
        interface fe-0/1/0.0;
        interface fe-0/1/2.0;
        interface so-0/0/0.0;
      }
      traffic-engineering;
    }
    mpls {
      traffic-engineering bgp-igp-both-ribs;
      explicit-null;
      interface fe-0/1/0.0;
      interface fe-0/1/2.0;
      interface so-0/0/0.0;
    }
    rsvp {
      interface fe-0/1/0.0;
      interface fe-0/1/2.0 {
        link-protection; # Apply link protection to RSVP interfaces in the LSP path.
      }
      interface so-0/0/0.0;
    }
  }
```

Because Router 4 is the endpoint of the LSP, you can configure interfaces and protocols as usual. There is no need to configure any node-link protection or link protection statements on this router.

Router 4

```
[edit]
interfaces {
  fe-0/1/2 {
    unit 0 {
      family inet {
        address 10.11.2.10/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
```

```
        family inet {
          address 10.255.11.215/32;
        }
      }
    }
  }
  protocols {
    ospf {
      area 0.0.0.0 {
        interface lo0.0 {
          passive;
        }
        interface fe-0/1/2.0;
      }
      traffic-engineering;
    }
    mpls {
      traffic-engineering bgp-igp-both-ribs;
      explicit-null;
      interface fe-0/1/2.0;
    }
    rsvp {
      interface fe-0/1/2.0;
    }
  }
```

Verifying Your Work

To verify proper operation of MPLS LSP node-link protection, use the following commands:

- **show mpls lsp extensive**
- **show route detail**
- **show rsvp neighbor detail**
- **show rsvp session detail**

The following section shows the output of these commands used with the configuration example.

```
user@router0> show rsvp session detail
Ingress RSVP: 2 sessions
10.255.11.215
  From: 10.255.11.220, LSPstate: Up, ActiveRoute: 5
  LSPname: test_r0_r4, LSPpath: Primary
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 100128
  Resv style: 1 SE, Label in: -, Label out: 100128
  Time left:    -, Since: Thu May  8 13:36:58 2003
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 3 receiver 56517 protocol 0
  Node/Link protection desired
 Type: Node/Link protected LSP
  PATH rcvfrom: localclient
  PATH sentto: 10.11.1.9 (fe-0/1/1.0) 20 pkts
  RESV rcvfrom: 10.11.1.9 (fe-0/1/1.0) 37 pkts
  Explct route: 10.11.1.9 10.11.1.2 10.11.2.1 10.11.2.10
```

```
  Record route: <self> 10.11.1.9 10.11.1.2 10.11.2.1 10.11.2.10

10.255.11.218
  From: 10.255.11.220, LSPstate: Up, ActiveRoute: 0
  LSPname: Bypass->10.11.1.9->10.11.1.2 # 2 next hops indicate node-link  protection.
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 0
  Resv style: 1 SE, Label in: -, Label out: 0
  Time left:    -, Since: Thu May  8 13:36:58 2003
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 56521 protocol 0
  Type: Bypass LSP
    Number of data route tunnel through: 4
    Number of RSVP session tunnel through: 0
  PATH rcvfrom: localclient
  PATH sentto: 10.11.1.21 (so-0/0/2.0) 1 pkts
  RESV rcvfrom: 10.11.1.21 (so-0/0/2.0) 1 pkts
  Explct route: 10.11.1.21
  Record route: <self> 10.11.1.21
Total 2 displayed, Up 2, Down 0

Egress RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0

Transit RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0
```

The **show mpls lsp extensive** command provides some useful information about link protection and node-link protection. The protection flag entry indicates a series of values. By adding the values together, you can learn the protection state of an LSP based on the total sum. Significant values for the flags include: 1 = Available (Link Protection), 2 = In Use, and 8 = Node Protection. Thus, a value of 9 means that node protection is available (**1 + 8 = 9**) and a value of A means that a node protected link is in use (**8 + 2 = A**, in hexadecimal).

```
user@router0> show mpls lsp extensive
Ingress LSP: 1 sessions

10.255.11.215
  From: 10.255.11.220, State: Up, ActiveRoute: 5, LSPname: test_r0_r4
  ActivePath: pathP (primary)
  Node/Link protection desired
  LoadBalance: Random
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
 *Primary  pathP      State: Up
    OptimizeTimer: 30
    Reoptimization in 13 second(s).
    Computed ERO (S [L] denotes strict [loose] hops): (CSPF metric: 40)
 10.11.1.9 S 10.11.1.2 S 10.11.2.1 S 10.11.2.10 S
    Received RRO (ProtectionFlag 1=Available 2=InUse 4=B/W 8=Node):
          10.11.1.9(flag=9 Label=100128) 10.11.1.2(flag=9 Label=100080)
10.11.2.1(flag=1 Label=100080) 10.11.2.10(Label=0)
   67 May  8 13:46:14 CSPF: computation result ignored[18 times]
   66 May  8 13:37:31 Record Route:  10.11.1.9(flag=9 Label=100128)
10.11.1.2(flag=9 Label=100080) 10.11.2.1(flag=1 Label=100080) 10.11.2.10(Label=0)

   65 May  8 13:37:28 CSPF: computation result ignored
   64 May  8 13:37:07 Record Route:  10.11.1.9(flag=9 Label=100128)
10.11.1.2(flag=1 Label=100080) 10.11.2.1(Label=100080) 10.11.2.10(Label=0)
   63 May  8 13:37:01 Record Route:  10.11.1.9(flag=9 Label=100128)
```

```
10.11.1.2(Label=100080) 10.11.2.1(Label=100080) 10.11.2.10(Label=0)
   62 May  8 13:37:01 Link-protection Up
   61 May  8 13:36:58 Selected as active path
   60 May  8 13:36:58 Record Route:  10.11.1.9(Label=100128)
10.11.1.2(Label=100080) 10.11.2.1(Label=100080) 10.11.2.10(Label=0)
   59 May  8 13:36:58 Up
   58 May  8 13:36:58 Originate Call
   57 May  8 13:36:58 CSPF: computation result accepted
   56 May  8 13:36:29 CSPF failed: no route toward 10.11.2.10[10 times]
   55 May  8 13:32:04 Clear Call
   54 May  8 13:31:40 Deselected as active
   53 May  8 13:31:40 Link-protection Down
   52 May  8 13:31:40 Down
   51 May  8 13:31:36 CSPF failed: no route toward 10.11.2.10[6 times]
   50 May  8 13:29:00 10.11.2.1: Session preempted
   49 May  8 13:28:42 Record Route:  10.11.1.9(flag=9 Label=100064)
10.11.1.2(flag=9 Label=100064) 10.11.2.1(Label=100064) 10.11.2.10(Label=0)
   48 May  8 13:28:40 CSPF failed: no route toward 10.11.2.10
   47 May  8 13:28:35 Link-protection Up
   46 May  8 13:28:35 Link-protection Down
   45 May  8 13:28:30 Link-protection Up
   44 May  8 13:28:30 Link-protection Down
   43 May  8 13:28:10 CSPF failed: no route toward 10.11.2.10
   42 May  8 13:27:44 Link-protection Up
   41 May  8 13:27:44 Link-protection Down
   40 May  8 13:27:42 Link-protection Up
   39 May  8 13:27:42 Record Route:  10.11.1.9(flag=9 Label=100064)
10.11.1.2(flag=9 Label=100064) 10.11.2.1(flag=1 Label=100064) 10.11.2.10(Label=0)

   38 May  8 13:27:41 CSPF failed: no route toward 10.11.2.10[2 times]
   37 May  8 13:27:39 CSPF: link down/deleted
10.11.2.9(eagle.00/10.255.11.216)->0.0.0.0(eagle.04/0.0.0.0)
   36 May  8 13:27:39 Link-protection Down
   35 May  8 13:27:39 Record Route:  10.11.1.9(Label=100064)
10.11.1.2(Label=100064) 10.11.2.1(Label=100064) 10.11.2.10(Label=0)
   34 May  8 13:27:39 CSPF failed: no route toward 10.11.2.10
   33 May  8 13:27:39 CSPF: link down/deleted
0.0.0.0(eagle.04/0.0.0.0)->0.0.0.0(papst.00/10.255.11.215)
   32 May  8 13:27:12 CSPF: computation result ignored[16 times]
   31 May  8 13:19:35 Record Route:  10.11.1.9(flag=9 Label=100064)
10.11.1.2(flag=9 Label=100048) 10.11.2.1(flag=1 Label=100048) 10.11.2.10(Label=0)

   30 May  8 13:19:22 Link-protection Up
   29 May  8 13:19:22 Record Route:  10.11.1.9(flag=9 Label=100064)
10.11.1.2(flag=9 Label=100048) 10.11.2.1(Label=100048) 10.11.2.10(Label=0)
   28 May  8 13:19:22 Up
   27 May  8 13:19:22 Link-protection Down
   26 May  8 13:19:22 CSPF: computation result accepted
   25 May  8 13:19:16 Link-protection Up
   24 May  8 13:19:16 Link-protection Down
   23 May  8 13:18:54 CSPF failed: no route toward 10.11.2.1
   22 May  8 13:18:54 CSPF: link down/deleted
0.0.0.0(eagle.04/0.0.0.0)->0.0.0.0(papst.00/10.255.11.215)
   21 May  8 13:18:53 CSPF failed: no route toward 10.11.2.1[2 times]
   20 May  8 13:18:46 CSPF: link down/deleted
10.11.2.9(eagle.00/10.255.11.216)->0.0.0.0(eagle.04/0.0.0.0)
   19 May  8 13:18:35 Record Route:  10.11.1.9(flag=9 Label=100032)
10.11.1.2(flag=9 Label=100032) 10.11.2.1(Label=100016) 10.11.2.10(Label=0)
   18 May  8 13:18:35 Record Route:  10.11.1.9(flag=9 Label=100032)
10.11.1.2(Label=100032) 10.11.2.1(Label=100016) 10.11.2.10(Label=0)
  Created: Thu May  8 13:13:28 2003
```

```
Total 1 displayed, Up 1, Down 0
Egress LSP: 0 sessions
Total 0 displayed, Up 0, Down 0
Transit LSP: 0 sessions
Total 0 displayed, Up 0, Down 0

user@router0>  show rsvp neighbor detail
RSVP neighbor: 2 learned
Address: 10.11.1.9 via: fe-0/1/1.0 status: Up
  Last changed time: 33:02, Idle: 5 sec, Up cnt: 1, Down cnt: 0
  Message received: 130
  Hello: sent 221, received: 221, interval: 9 sec
  Remote instance: 0x66368e80, Local instance: 0x643f57b5
  Refresh reduction: incomplete
    Remote end: enabled, Ack-extension: disabled

Address: 10.11.1.21 via: so-0/0/2.0 status: Up
  Last changed time: 32:41, Idle: 10 sec, Up cnt: 1, Down cnt: 0
  Message received: 78
  Hello: sent 218, received: 218, interval: 9 sec
  Remote instance: 0x74b57f2a, Local instance: 0x66341d2f
  Refresh reduction:  operational
    Remote end: enabled, Ack-extension: enabled

user@router0>  show route 10.255.11.215 detail
inet.0: 33 destinations, 34 routes (31 active, 0 holddown, 2 hidden)
10.255.11.215/32 (2 entries, 1 announced)
        State: <FlashAll>
        *RSVP   Preference: 7
                Next hop: 10.11.1.9 via fe-0/1/1.0 weight 1, selected
                Label-switched-path test_r0_r4
                Label operation: Push 100128, selfID=RSVP-7
                 Next hop: via so-0/0/2.0 weight 20001
      Label-switched-path Bypass->10.11.1.9->10.11.1.2
      Label operation: Push 100080, selfID=RSVP-7, parentID=RSVP-8
                State: <Active Int>
                Local AS:    69
                Age: 13:14      Metric: 40
                Task: RSVP
                Announcement bits (2): 0-KRT 3-Resolve inet.0
                AS path: I
         IS-IS  Preference: 18
                Level: 2
                Next hop: 10.11.1.9 via fe-0/1/1.0, selected
                State: <Int>
                Inactive reason: Route Preference
                Local AS:    69
                Age: 13:20      Metric: 40
                Task: IS-IS
                AS path: I
inet.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
10.255.11.215/32 (1 entry, 1 announced)
        State: <FlashAll>
        *RSVP   Preference: 7
                Next hop: 10.11.1.9 via fe-0/1/1.0 weight 1, selected
                Label-switched-path test_r0_r4
                Label operation: Push 100128, selfID=RSVP-7
                Next hop: via so-0/0/2.0 weight 20001
                Label-switched-path Bypass->10.11.1.9->10.11.1.2
                Label operation: Push 100080, selfID=RSVP-7, parentID=RSVP-8
                State: <Active Int>
```

```
Local AS:    69
Age: 13:14      Metric: 40
Task: RSVP
Announcement bits (1): 1-Resolve inet.0
AS path: I
```

Related Documentation

- MPLS LSP Link Protection and Node-Link Protection Overview on page 3
- Configuring Link Protection on the RSVP Interfaces Traversed by the LSP on page 10
- Configuring Link Protection or Node-Link Protection on the LSP on page 9
- Option: Adding Class of Service to a Link-Protected LSP or a Bypass LSP on page 12
- Option: Configuring Multiple Bypass LSPs, Manual Bypass LSPs, and Link Protection Priority on page 10
- Verifying MPLS LSP Link Protection and Node Link Protection on page 12

For More Information

For additional information about MPLS LSP link protection or node-link protection, see the following:

- *Junos MPLS Applications Configuration Guide*
- RFC 4090, *Fast Reroute Extensions to RSVP-TE for LSP Tunnels*

PART 2

Index

Index

