Chapter 2

Checking the MPLS and RSVP Configuration

This chapter describes how to verify the correct configuration of both the Multiprotocol Label Switching (MPLS) protocol and Resource Reservation Protocol (RSVP). Incorrect configuration of either protocol prevents successful label-switched path (LSP) creation. (See Table 6.)

Table 6: Checklist for Checking the MPLS and RSVP Configuration

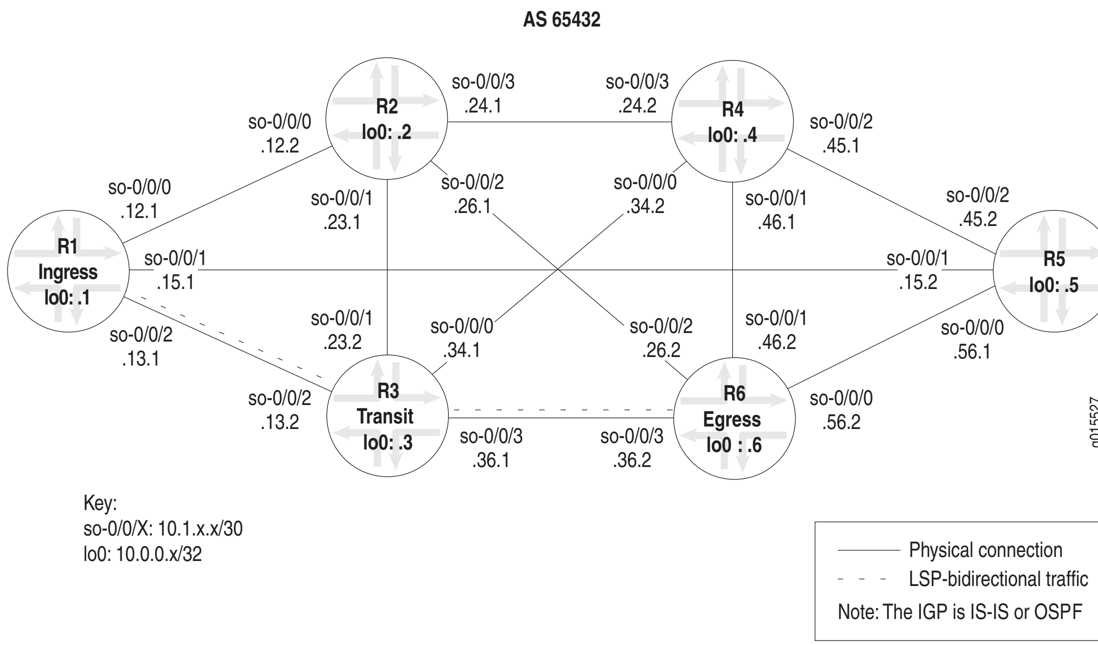
Checking the MPLS and RSVP Configuration Tasks	Command or Action
Verifying the MPLS Configuration on page 46	
1. Verify MPLS Interfaces on page 47	show mpls interface
2. Verify the RSVP Protocol on page 49	show rsvp version
3. Verify RSVP Interfaces on page 50	show rsvp interface
4. Verify Protocol Families on page 52	show interfaces terse
5. Verify MPLS Labels on page 55	
a. Use the traceroute Command to Verify MPLS Labels on page 55	traceroute *host-name* or *ip-address-of-remote-host*
b. Use the ping Command to Verify MPLS Labels on page 56	On the egress router, enter the following commands: [edit] edit interfaces lo0 unit *number* set family inet address 127.0.0.1/32 show commit ping mpls rsvp *lsp-name* detail

Verifying the MPLS Configuration

Purpose After configuring MPLS on your network, you must verify the correct configuration of both the MPLS and RSVP protocols. Incorrect configuration of either protocol prevents successful LSP creation.

Figure 5 illustrates the network with the example configurations used in this chapter. For more details about the router configurations in this network, see “Configuring MPLS on a Network” on page 3.

Figure 5: MPLS Network Topology



Steps To Take To verify the MPLS configuration, follow these steps:

1. Verify MPLS Interfaces on page 47
2. Verify the RSVP Protocol on page 49
3. Verify RSVP Interfaces on page 50
4. Verify Protocol Families on page 52
5. Verify MPLS Labels on page 55

Step 1: Verify MPLS Interfaces

Purpose If the MPLS protocol is not configured correctly on the routers in your network, the interfaces are not able to perform MPLS switching.

Action To verify MPLS interfaces, enter the following JUNOS command-line interface (CLI) operational mode command:

user@host> **show mpls interface**

Sample Output 1 The following sample output is for all routers in the network shown in Figure 5 on page 46.

```
user@R1> show mpls interface
Interface        State       Administrative groups
so-0/0/0.0       Up         <none>
so-0/0/1.0       Up         <none>
so-0/0/2.0       Up         <none>

user@R2> show mpls interface
Interface        State       Administrative groups
so-0/0/0.0       Up         <none>
so-0/0/1.0       Up         <none>
so-0/0/2.0       Up         <none>
so-0/0/3.0       Up         <none>

user@R3> show mpls interface
Interface        State       Administrative groups
so-0/0/0.0       Up         <none>
so-0/0/1.0       Up         <none>
so-0/0/2.0       Up         <none>
so-0/0/3.0       Up         <none>

user@R4> show mpls interface
Interface        State       Administrative groups
so-0/0/0.0       Up         <none>
so-0/0/1.0       Up         <none>
so-0/0/2.0       Up         <none>
so-0/0/3.0       Up         <none>

user@R5> show mpls interface
Interface        State       Administrative groups
so-0/0/0.0       Up         <none>
so-0/0/1.0       Up         <none>
so-0/0/2.0       Up         <none>

user@R6> show mpls interface
Interface        State       Administrative groups
so-0/0/0.0       Up         <none>
so-0/0/1.0       Up         <none>
so-0/0/2.0       Up         <none>
so-0/0/3.0       Up         <none>
```

Sample Output 2

```
user@R6> show mpls interface
Interface        State      Administrative groups
so-0/0/0.0       Up         <none>
so-0/0/1.0       Up         <none>
so-0/0/3.0       Up         <none>#so-0/0/2.0 is missing
```

Sample Output 3

```
user@host> show mpls interface
MPLS not configured
```

What It Means

Sample Output 1 shows that all MPLS interfaces on all routers in the network are enabled (Up) and can perform MPLS switching. If you fail to configure the correct interface at the [edit protocols mpls] hierarchy level or include the family mpls statement at the [edit interfaces *type-fpc/pic/port* unit *number*] hierarchy level, the interface cannot perform MPLS switching, and does not appear in the output for the show mpls interface command.

Administrative groups are not configured on any of the interfaces shown in the example network in Figure 5 on page 46. However, if they were, the output would indicate which affinity class bits are enabled on the router.

Sample Output 2 shows that interface so-0/0/2.0 is missing and therefore might be incorrectly configured. For example, the interface might not be included at the [edit protocols mpls] hierarchy level, or the family mpls statement might not be included at the [edit interfaces *type-fpc/pic/port* unit *number*] hierarchy level. If the interface is configured correctly, RSVP might not have signaled over this interface yet. For more information on determining which interface is incorrectly configured, see “Verify Protocol Families” on page 52.

Sample Output 3 shows that the MPLS protocol is not configured at the [edit protocols mpls] hierarchy level.

For more information on configuring MPLS on routers in your network, see “Configuring MPLS on a Network” on page 3.

Step 2: Verify the RSVP Protocol

Purpose If the RSVP protocol is not enabled on the routers in your network, the interface cannot signal LSPs.

Action To verify that the RSVP protocol is enabled, enter the following JUNOS CLI command:

user@host> **show rsvp version**

Sample Output

```
user@R1> show rsvp version
Resource ReSerVation Protocol, version 1. rfc2205
   RSVP protocol           = Enabled
   R(refresh timer)        = 30 seconds
   K(keep multiplier)      = 3
   Preemption              = Normal
   Soft-preemption cleanup = 30 seconds
   Graceful restart        = Disabled
   Restart helper mode     = Enabled
   Restart time            = 0 msec
```

What It Means The sample output shows that the RSVP protocol is enabled on R1. The supported RSVP protocol is version 1, as defined in RFC 2205.

The RSVP refresh timer is set to 30 seconds, indicating that every 30 seconds, plus or minus 50 percent, the router will refresh the RSVP state with its directly connected neighbors by sending either a Path or a Resv message. The variable refresh time helps prevent harmonic oscillations in network traffic caused by periodic protocol updates.

The keepalive multiplier, K(keep multiplier), is input to a formula that helps determine the lifetime of an RSVP session. The session lifetime is reset each time the state is updated. The lifetime represents the duration of an RSVP session that does not receive any state updates (Path or Resv messages). The formula is:

RSVP session lifetime = (keep-multiplier + 0.5) * 1.5 * refresh-time

The RSVP preemption state is currently configured for normal preemption, indicating that only an LSP with a stronger priority can preempt an existing session; that is, the setup value of the new LSP is lower than the hold value of the existing LSP. Other options include aggressive preemption, which always preempts when there is insufficient bandwidth, and disabled, which prevents any preemption, regardless of LSP priority values.

Graceful restart is currently disabled and Restart helper mode is enabled. There are four combinations for Graceful restart and restart helper mode:

1. Both Graceful restart and Restart helper mode are enabled.

2. Graceful restart is enabled but Restart helper mode is disabled. An LSR with this configuration can restart gracefully but cannot help a neighbor with its restart and recovery procedures.

3. Graceful restart is disabled but Restart helper mode is enabled. An LSR with this configuration can only help a restarting neighbor. It cannot restart gracefully itself.

4. Graceful restart and Restart helper mode are both disabled. This configuration completely disables RSVP graceful restart (including restart and recovery procedures and helper mode). It is the same as an LSR that is not supported by RSVP graceful restart.

Restart time is the estimated time (in milliseconds) for an LSR to restart the RSVP traffic engineering component. In the example output, the restart time is 0 milliseconds, indicating that it is disabled.

The output is identical for all routers in the network shown in Figure 5 on page 46.

Step 3: Verify RSVP Interfaces

Purpose If the RSVP protocol is not configured correctly on the routers in your network, the interfaces cannot signal LSPs.

Action To verify RSVP interfaces, enter the following JUNOS CLI operational mode command:

user@host> **show rsvp interface**

Sample Output 1

```
user@R1> show rsvp interface
RSVP interface: 4 active
                  Active Subscr- Static      Available   Reserved    Highwater
Interface   State resv   iption  BW          BW          BW          mark
so-0/0/0.0  Up         2   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/1.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/2.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps

user@R2> show rsvp interface
RSVP interface: 5 active
                  Active Subscr- Static      Available   Reserved    Highwater
Interface   State resv   iption  BW          BW          BW          mark
so-0/0/0.0  Up         1   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/1.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/2.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/3.0  Up         1   100%  155.52Mbps  155.52Mbps  0bps        0bps

user@R3> show rsvp interface
RSVP interface: 5 active
                  Active Subscr- Static      Available   Reserved    Highwater
Interface   State resv   iption  BW          BW          BW          mark
so-0/0/0.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/1.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/2.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/3.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps

user@R4> show rsvp interface
RSVP interface: 5 active
                  Active Subscr- Static      Available   Reserved    Highwater
Interface   State resv   iption  BW          BW          BW          mark
so-0/0/0.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/1.0  Up         1   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/2.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/3.0  Up         1   100%  155.52Mbps  155.52Mbps  0bps        0bps
```

```
user@R5> show rsvp interface
RSVP interface: 4 active
                  Active Subscr- Static      Available   Reserved    Highwater
Interface   State resv   iption  BW          BW          BW          mark
so-0/0/0.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/1.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/2.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps

user@R6> show rsvp interface
RSVP interface: 5 active
                  Active Subscr- Static      Available   Reserved    Highwater
Interface   State resv   iption  BW          BW          BW          mark
so-0/0/0.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/1.0  Up         1   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/2.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/3.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
```

Sample Output 2

```
user@R6> show rsvp interface
RSVP interface: 3 active
                  Active Subscr- Static      Available   Reserved    Highwater
Interface   State resv   iption  BW          BW          BW          mark
so-0/0/0.0  Up         1   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/1.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
so-0/0/2.0  Up         0   100%  155.52Mbps  155.52Mbps  0bps        0bps
#so-0/0/3.0 is missing
```

Sample Output 3

```
user@host# show rsvp interface
RSVP not configured
```

What It Means

Sample Output 1 shows that all interfaces on all routers in the network are enabled with RSVP, including the management interface (fxp0). The output for all routers in the network includes similar information, so we will examine R6 in detail.

R6 has five interfaces enabled with RSVP (Up). Interface so-0/1/1.0 has a single active RSVP reservation (Active resv) that did not change the default subscription percentage of 100 percent (Subscription). Interface so-0/1/1.0 did not assign a static bandwidth (Static BW) to the logical unit and therefore inherited 100 percent of the physical interface rate as the bandwidth available (Available BW) for RSVP sessions. Interface so-0/1/1.0 has no bandwidth assigned (Reserved BW), and no RSVP bandwidth allocation at any single instant in time (Highwater mark).

Sample Output 2 shows that interface so-0/0/3.0 is missing. If you do not configure the correct interface at the [edit protocols rsvp] hierarchy level, the interface cannot signal LSPs, and does not appear in the output for the show rsvp interface command. For more information on configuring MPLS on routers in your network, see “Configuring MPLS on a Network” on page 3.

Sample Output 3 shows that the RSVP protocol is not configured at the [edit protocols rsvp] hierarchy level.

Step 4: Verify Protocol Families

Purpose If a logical interface does not have MPLS enabled, it cannot perform MPLS switching. This step allows you to quickly determine which interfaces are configured with MPLS and other protocol families.

Action To verify the protocol families configured on the routers in your network, enter the following JUNOS CLI operational mode command:

user@host> **show interfaces terse**

Sample Output 1

```
user@R1> show interfaces terse
Interface               Admin Link Proto Local                 Remote
so-0/0/0                up    up
so-0/0/0.0              up    up   inet  10.1.12.1/30
                                   iso
                                   mpls
so-0/0/1                up    up
so-0/0/1.0              up    up   inet  10.1.15.1/30
                                   iso
                                   mpls
so-0/0/2                up    up
so-0/0/2.0              up    up   inet  10.1.13.1/30
                                   iso
                                   mpls
so-0/0/3                up    down

user@R2> show interfaces terse
Interface               Admin Link Proto Local                 Remote
so-0/0/0                up    up
so-0/0/0.0              up    up   inet  10.1.12.2/30
                                   iso
                                   mpls
so-0/0/1                up    up
so-0/0/1.0              up    up   inet  10.1.23.1/30
                                   iso
                                   mpls
so-0/0/2                up    up
so-0/0/2.0              up    up   inet  10.1.26.1/30
                                   iso
                                   mpls
so-0/0/3                up    up
so-0/0/3.0              up    up   inet  10.1.24.1/30
                                   iso
                                   mpls

user@R3> show interfaces terse
Interface               Admin Link Proto Local                 Remote
so-0/0/0                up    up
so-0/0/0.0              up    up   inet  10.1.34.1/30
                                   iso
                                   mpls
so-0/0/1                up    up
so-0/0/1.0              up    up   inet  10.1.23.2/30
                                   iso
                                   mpls
```

```
so-0/0/2                up    up
so-0/0/2.0              up    up   inet  10.1.13.2/30
                                   iso
                                   mpls
so-0/0/3                up    up
so-0/0/3.0              up    up   inet  10.1.36.1/30
                                   iso
                                   mpls

user@R4> show interfaces terse
Interface               Admin Link Proto Local                 Remote
so-0/0/0                up    up
so-0/0/0.0              up    up   inet  10.1.34.2/30
                                   iso
                                   mpls
so-0/0/1                up    up
so-0/0/1.0              up    up   inet  10.1.46.1/30
                                   iso
                                   mpls
so-0/0/2                up    up
so-0/0/2.0              up    up   inet  10.1.45.1/30
                                   iso
                                   mpls
so-0/0/3                up    up
so-0/0/3.0              up    up   inet  10.1.24.2/30
                                   iso
                                   mpls

user@R5> show interfaces terse
Interface               Admin Link Proto Local                 Remote
so-0/0/0                up    up
so-0/0/0.0              up    up   inet  10.1.56.1/30
                                   iso
                                   mpls
so-0/0/1                up    up
so-0/0/1.0              up    up   inet  10.1.15.2/30
                                   iso
                                   mpls
so-0/0/2                up    up
so-0/0/2.0              up    up   inet  10.1.45.2/30
                                   iso
                                   mpls
so-0/0/3                up    down

user@R6> show interfaces terse
Interface               Admin Link Proto Local                 Remote
so-0/0/0                up    up
so-0/0/0.0              up    up   inet  10.1.56.2/30
                                   iso
                                   mpls
so-0/0/1                up    up
so-0/0/1.0              up    up   inet  10.1.46.2/30
                                   iso
                                   mpls
so-0/0/2                up    up
so-0/0/2.0              up    up   inet  10.1.26.2/30
                                   iso
                                   mpls
so-0/0/3                up    up
so-0/0/3.0              up    up   inet  10.1.36.2/30
                                   iso
                                   mpls
```

Sample Output 2

```
user@R6> show interfaces terse
Interface               Admin Link Proto Local                 Remote
so-0/0/0                up    up
so-0/0/0.0              up    up   inet  10.1.56.2/30
                                   iso
                                   mpls
so-0/0/1                up    up
so-0/0/1.0              up    up   inet  10.1.46.2/30
                                   iso
                                   mpls
so-0/0/2                up    up
so-0/0/2.0              up    up   inet  10.1.26.2/30
                                   iso  #The mpls statement is missing.
so-0/0/3                up    up
so-0/0/3.0              up    up   inet  10.1.36.2/30
                                   iso
                                   mpls
```

What It Means

Sample Output 1 shows the interface, the administrative status of the link (Admin), the data link layer status of the link (Link), the protocol families configured on the interface (Proto), and the local and remote addresses on the interface.

All interfaces on all routes in the network shown in Figure 5 on page 46 are administratively enabled and functioning at the data link layer with MPLS and IS-IS, and have an inet address. All are configured with an IPv4 protocol family (inet), and have the IS-IS (iso) and MPLS (mpls) protocol families configured at the [edit interfaces *type-fpc/pic/port* unit *number*] hierarchy level.

Sample Output 2 shows that interface so-0/0/2.0 on R6 does not have the mpls statement included at the [edit interfaces *type-fpc/pic/port* unit *number*] hierarchy level. For information on how to configure MPLS on an interface, see "Configuring MPLS on a Network" on page 3.

Step 5: Verify MPLS Labels

Purpose You can use the traceroute command or the ping mpls command to verify that packets are being sent over the LSP.

Steps To Take To verify MPLS labels and that packets are sent over the LSP, follow these steps:

1. Use the traceroute Command to Verify MPLS Labels on page 55

2. Use the ping Command to Verify MPLS Labels on page 56

1. Use the traceroute Command to Verify MPLS Labels

Action To verify MPLS labels, enter the following JUNOS CLI operational mode command, where *host-name* is the IP address or the name of the remote host:

user@host> **traceroute** *host-name*

Sample Output 1

```
user@R1> traceroute 100.100.6.1
traceroute to 100.100.6.1 (100.100.6.1), 30 hops max, 40 byte packets
 1  10.1.12.2 (10.1.12.2)  0.861 ms  0.718 ms  0.679 ms
     MPLS Label=100048 CoS=0 TTL=1 S=1
 2  10.1.24.2 (10.1.24.2)  0.822 ms  0.731 ms  0.708 ms
     MPLS Label=100016 CoS=0 TTL=1 S=1
 3  10.1.46.2 (10.1.46.2)  0.571 ms !N  0.547 ms !N  0.532 ms !N
```

Sample Output 2

```
user@R1> traceroute 10.0.0.6
traceroute to 10.0.0.6 (10.0.0.6), 30 hops max, 40 byte packets
 1  10.1.13.2 (10.1.13.2)  0.605 ms  0.548 ms  0.503 ms
 2  10.0.0.6 (10.0.0.6)  0.761 ms  0.676 ms  0.675 ms
```

What It Means Sample Output 1 shows that MPLS labels are used to forward packets through the network. Included in the output is a label value (MPLS Label=100048), the time-to-live value (TTL=1), and the stack bit value (S=1).

The MPLS Label field is used to identify the packet to a particular LSP. It is a 20-bit field, with a maximum value of (2^^20-1), or approximately 1,000,000.

The TTL value contains a limit on the number of hops that this MPLS packet can travel through the network (1). It is decremented at each hop, and if the TTL value drops below one, the packet is discarded.

The bottom of the stack bit value (S=1) indicates that is the last label in the stack and that this MPLS packet has one label associated with it. The MPLS implementation in the JUNOS software supports a stacking depth of 3 on the M-series routers and up to 5 on the T-series platforms. For more information on MPLS label stacking, see RFC 3032, *MPLS Label Stack Encoding*.

MPLS labels appear in Sample Output 1 because the traceroute command is issued to a BGP destination where the BGP next hop for that route is the LSP egress address. The JUNOS software default behavior uses LSPs for BGP traffic when the BGP next hop equals the LSP egress address.

Sample Output 2 shows that MPLS labels do not appear in the output for the traceroute command. If the BGP next hop does not equal the LSP egress address or the destination is an IGP route, the BGP traffic does not use the LSP. Instead of using the LSP, the BGP traffic is using the IGP (IS-IS, in this case) to reach the egress address (R6).

2. Use the ping Command to Verify MPLS Labels

Purpose On the egress router (the router receiving the MPLS echo packets), you must configure the address 127.0.0.1/32 on its loopback (lo0) interface, resulting in echo requests being sent as MPLS packets destined for the address 127.0.0.1 and the well-known port 3503. When the echo request arrives at the egress router, the receiver checks the contents of the packet and sends a reply containing the correct return value. The sender of the echo request waits 2 seconds for the echo reply, then times out. In the example network shown in Figure 5 on page 46, the egress router is R6. If address 127.0.0.1/32 is not configured, the egress router does not have this forwarding entry and therefore simply drops the incoming MPLS pings and replies with "ICMP host unreachable" messages.

Action To verify MPLS labels, follow these steps:

1. On the egress router, in configuration mode, go to the following hierarchy level:

   [edit]
   user@egress-router# **edit interfaces lo0 unit** *number*

2. Configure the loopback (lo0) interface with the following IP address:

   [edit interfaces lo0 unit *number*]
   user@egress-router# **set family inet address 127.0.0.1/32**

3. Verify the configuration:

   user@egress-router# **show**
   user@egress-router# **commit**

4. On the ingress router, in operational mode, enter the following command to ping the egress router:

   user@ingress-router> **ping mpls rsvp** *lsp-name* **detail**

Sample Output 1

```
user@R6> edit
Entering configuration mode

[edit]
user@R6# edit interfaces lo0 unit 0

[edit interfaces lo0 unit 0]
user@R6# set family inet address 127.0.0.1/32

[edit interfaces lo0 unit 0]
user@R6# show
family inet {
    address 10.0.0.6/32;
    address 127.0.0.1/32;
}
```

```
family iso {
    address 49.0004.1000.0000.0006.00;
}

[edit interfaces lo0 unit 0]
user@R6# commit
commit complete
```

Sample Output 2

```
user@R1> ping mpls rsvp R1-to-R6 detail
Request for seq 1, to interface 69, label 100064
Reply for seq 1, return code: Egress-ok
Request for seq 2, to interface 69, label 100064
Reply for seq 2, return code: Egress-ok
Request for seq 3, to interface 69, label 100064
Reply for seq 3, return code: Egress-ok
Request for seq 4, to interface 69, label 100064
Reply for seq 4, return code: Egress-ok
Request for seq 5, to interface 69, label 100064
Reply for seq 5, return code: Egress-ok

--- lsping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
```

What It Means

Sample Output 1 from egress router R6 shows that the IP address 127.0.0.1/32 is configured.

Sample Output 2 from ingress router R1 shows that an echo request is sent with a label (100064), indicating that the echo requests were sent over the LSP R1-to-R6.