Chapter 3

Determining the LSP State

This chapter describes how to display the status and statistics of the Multiprotocol Label Switching (MPLS) protocol running on all routers in a network. You can use a variety of operational mode commands to determine status and statistics information useful in diagnosing problem situations. (See Table 7.)

Table 7: Checklist for Determining the LSP State

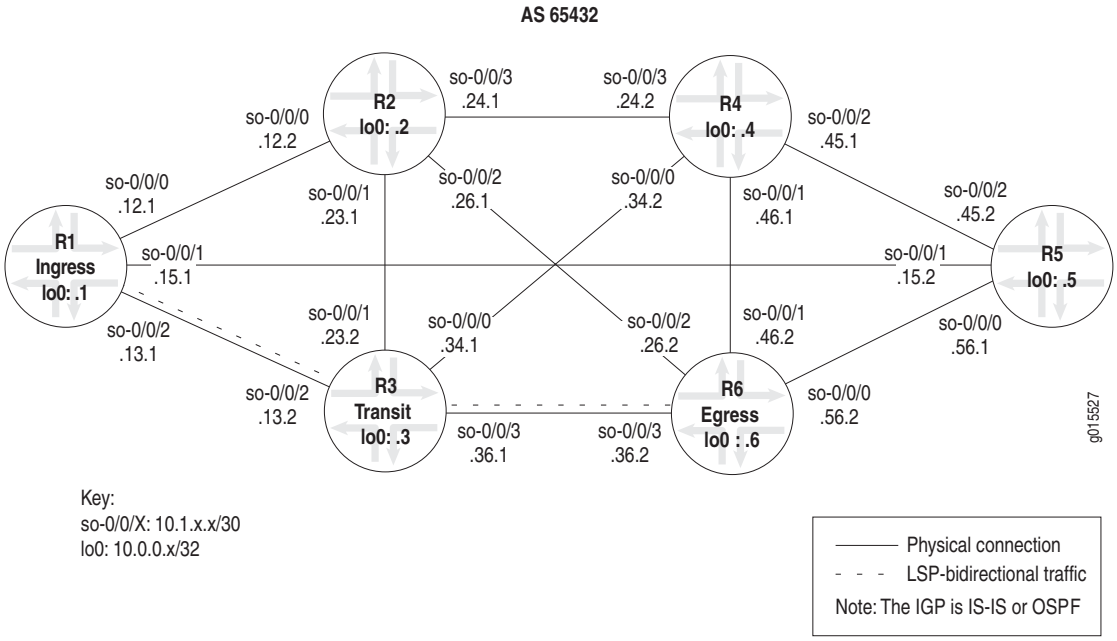
Determining the LSP State Tasks	Command or Action
Determining LSP Status on page 60	
1. Check the Status of the LSP on page 60	show mpls lsp
2. Display Extensive Status About the LSP on page 61	show mpls lsp extensive
Determining LSP Statistics on page 66	show rsvp session detail

Determining LSP Status

Purpose Display detailed information about Resource Reservation Protocol (RSVP) objects and the label-switched path (LSP) history to pinpoint a problem with the LSP.

Figure 6 illustrates the network topology used in this chapter. For more details about the router configurations in this network, see “Configuring MPLS on a Network” on page 3.

Figure 6: MPLS Network Topology



Steps To Take To determine the LSP state, follow these steps:

1. Check the Status of the LSP on page 60
2. Display Extensive Status About the LSP on page 61

Step 1: Check the Status of the LSP

Action To determine the LSP status, on the ingress router, enter the following JUNOS command-line interface (CLI) operational mode command:

user@host> **show mpls lsp**

Sample Output

```
user@R1> show mpls lsp
Ingress LSP: 1 sessions
To              From            State Rt ActivePath       P     LSPname
10.0.0.6        10.0.0.1        Up     1                  *     R1-to-R6
Total 1 displayed, Up 1, Down 0
```

```
Egress LSP: 1 sessions
To              From            State Rt Style Labelin Labelout LSPname
10.0.0.1        10.0.0.6        Up     0 1 FF       3        - R6-to-R1
Total 1 displayed, Up 1, Down 0

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

What It Means The sample output is from the ingress router (R1), and shows ingress, egress, and transit LSP information. Ingress information is for the sessions that originate from this router, egress information is for sessions that terminate on this router, and transit information is for sessions that transit through this router.

There is one ingress route from R1 (10.0.0.1) to R6 (10.0.0.6). This route is currently up, and is an active route installed in the routing table (Rt). The LSP R1-to-R6 is the primary path (P) as opposed to the secondary path, and is indicated by an asterisk (*). The route to R6 does not contain a named path (ActivePath).

There is one egress LSP from R6 to R1. The State is up, with no routes installed in the routing table. RSVP reservation style (Style) consists of two parts. The first is the number of active reservations (1). The second is the reservation style, which is FF (fixed filter). The reservation style can be FF, SE (shared explicit), or WF (wildcard filter). There are three incoming labels (Labelin) and no labels going out (Labelout) for this LSP.

There are no transit LSPs.

For more information on checking the LSP state, see "Working with the Layered MPLS Troubleshooting Model" on page 85.

Step 2: Display Extensive Status About the LSP

Purpose Display extensive information about LSPs, including all past state history and the reasons why an LSP might have failed.

Action To display extensive information about LSPs, on the ingress router, enter the following JUNOS CLI operational mode command:

```
user@host> show mpls lsp extensive
```

Sample Output

```
user@R1> show mpls lsp extensive
Ingress LSP: 1 sessions

10.0.0.6
  From: 10.0.0.1, State: Up, ActiveRoute: 1, LSPname: R1-to-R6
  ActivePath:  (primary)
  LoadBalance: Random
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
 *Primary                    State: Up
    Computed ERO (S [L] denotes strict [loose] hops): (CSPF metric: 20)
 10.1.13.2 S 10.1.36.2 S
    Received RRO (ProtectionFlag 1=Available 2=InUse 4=B/W 8=Node
10=SoftPreempt):
          10.1.13.2 10.1.36.2
   91 Aug 17 12:22:52 Selected as active path
   90 Aug 17 12:22:52 Record Route:  10.1.13.2 10.1.36.2
   89 Aug 17 12:22:52 Up
   88 Aug 17 12:22:52 Originate Call
```

```
   87 Aug 17 12:22:52 CSPF: computation result accepted
   86 Aug 17 12:22:23 CSPF failed: no route toward 10.0.0.6[13920 times]
   85 Aug 12 19:12:51 Clear Call
   84 Aug 12 19:12:50 10.1.56.2: MPLS label allocation failure
   83 Aug 12 19:12:47 Deselected as active
   82 Aug 12 19:12:47 10.1.56.2: MPLS label allocation failure
   81 Aug 12 19:12:47 ResvTear received
   80 Aug 12 19:12:47 Down
   79 Aug 12 19:12:31 10.1.56.2: MPLS label allocation failure[4 times]
   78 Aug 12 19:09:58 Selected as active path
   77 Aug 12 19:09:58 Record Route:  10.1.15.2 10.1.56.2
   76 Aug 12 19:09:58 Up
   75 Aug 12 19:09:57 Originate Call
   74 Aug 12 19:09:57 CSPF: computation result accepted
   73 Aug 12 19:09:29 CSPF failed: no route toward 10.0.0.6[11 times]
   72 Aug 12 19:04:36 Clear Call
   71 Aug 12 19:04:23 Deselected as active
   70 Aug 12 19:04:23 ResvTear received
   69 Aug 12 19:04:23 Down
   68 Aug 12 19:04:23 CSPF failed: no route toward 10.0.0.6
   67 Aug 12 19:04:23 10.1.15.2: Session preempted
   66 Aug 12 16:45:35 Record Route:  10.1.15.2 10.1.56.2
   65 Aug 12 16:45:35 Up
   64 Aug 12 16:45:35 Clear Call
   63 Aug 12 16:45:35 CSPF: computation result accepted
   62 Aug 12 16:45:35 ResvTear received
   61 Aug 12 16:45:35 Down
   60 Aug 12 16:45:35 10.1.13.2: Session preempted
   59 Aug 12 14:50:52 Selected as active path
   58 Aug 12 14:50:52 Record Route:  10.1.13.2 10.1.36.2
   57 Aug 12 14:50:52 Up
   56 Aug 12 14:50:52 Originate Call
   55 Aug 12 14:50:52 CSPF: computation result accepted
   54 Aug 12 14:50:23 CSPF failed: no route toward 10.0.0.6[7 times]
   53 Aug 12 14:47:22 Deselected as active
   52 Aug 12 14:47:22 CSPF failed: no route toward 10.0.0.6
   51 Aug 12 14:47:22 Clear Call
   50 Aug 12 14:47:22 CSPF: link down/deleted
10.1.12.1(R1.00/10.0.0.1)->10.1.12.2(R2.00/10.0.0.2)
   49 Aug 12 14:47:22 CSPF: link down/deleted
10.1.15.1(R1.00/10.0.0.1)->10.1.15.2(R5.00/10.0.0.5)
   48 Aug 12 14:47:22 10.1.15.1: MPLS label allocation failure
   47 Aug 12 14:47:22 Clear Call
   46 Aug 12 14:47:22 CSPF: computation result accepted
   45 Aug 12 14:47:22 10.1.12.1: MPLS label allocation failure
   44 Aug 12 14:47:22 MPLS label allocation failure
   43 Aug 12 14:47:22 Down
   42 Jul 23 11:27:21 Selected as active path
  Created: Sat Jul 10 18:18:44 2004
Total 1 displayed, Up 1, Down 0

Egress LSP: 1 sessions

10.0.0.1
  From: 10.0.0.6, LSPstate: Up, ActiveRoute: 0
  LSPname: R6-to-R1, LSPpath: Primary
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: -
  Resv style: 1 FF, Label in: 3, Label out: -
  Time left:  141, Since: Tue Aug 17 12:23:14 2004
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 39024 protocol 0
  PATH rcvfrom: 10.1.15.2 (so-0/0/1.0) 130 pkts
```

```
  Adspec: received MTU 1500
  PATH sentto: localclient
  RESV rcvfrom: localclient
  Record route: 10.1.56.2 10.1.15.2 <self>
Total 1 displayed, Up 1, Down 0

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

What It Means The sample output is from the ingress router (R1), and shows ingress, egress, and transit LSP information in detail, including all past state history and the reasons why an LSP failed. Ingress information is for sessions that originate from this router, egress information is for sessions that terminate on this router, and transit information is for sessions that transit through this router.

There is one ingress route from R1 (10.0.0.1) to R6 (10.0.0.6). This route is currently up (State), with one route actively using the LSP, R1-to-R6. The LSP active path is the primary path. Even if the LSP does not contain a primary or secondary keyword, the router still treats the LSP as a primary LSP, indicating that if the LSP fails, the router will attempt to signal inactive LSPs at 30-second intervals, by default.

Load balancing is Random, which is the default, indicating that when selecting the physical path for an LSP, the router randomly selects among equal-cost paths that have an equal hop count. Other options that you can configure are Least-fill and Most-fill. Least-fill places the LSP over the least utilized link of the equal-cost paths with equal hop count. Most-fill places the LSP over the most utilized link of the equal-cost paths sharing an equal hop count. Utilization is based on the percentage of available bandwidth.

The Encoding type field shows Generalized MPLS (GMPLS) signaling parameters (Packet), indicating IPv4. The Switching type is Packet, and the Generalized Payload Identifier (GPID) is IPv4.

The primary path is the active path, as indicated by an asterisk (*). The state of the LSP is Up.

The Explicit Route Object (ERO) includes the Constrained Shortest Path First (CSPF) cost (20) for the physical path that the LSP follows. The presence of the CSPF metric indicates that this is a CSPF LSP. The absence of the CSPF metric indicates a no-CSPF LSP.

The field 10.1.13.2 S indicates the actual ERO. The RSVP signaling messages went to 10.1.13.2 strictly (as a next hop) and finished at 10.1.36.2 strictly. All ERO addresses are strict hops when the LSP is a CSPF LSP. Loose hops can only display in a no-CSPF LSP.

The received Record Route Object (RRO) has the following protection flags:

- 0x01—Local protection available. The link downstream of this node is protected by a local repair mechanism. This flag can only be set if the Local protection flag was set in the SESSION_ATTRIBUTE object of the corresponding path message.
- 0x02—Local protection in use. A local repair mechanism is in use to maintain this tunnel (usually because of an outage of the link it was routed over previously).
- 0x04— Bandwidth protection. The downstream router has a backup path providing the same bandwidth guarantee as the protected LSP for the protected section.
- 0x08—Node protection. The downstream router has a backup path providing protection against link and node failure on the corresponding path section. If the downstream router can set up only a link-protection backup path, the "Local protection available" bit is set but the "Node protection" bit is cleared.
- 0x10—Preemption pending. The preempting node sets this flag if a pending preemption is in progress for the traffic engineered LSP. This indicates to the ingress label edge router (LER) of this LSP that it should be rerouted.

For more information on protection flags, see the *JUNOS Routing Protocols and Policies Command Reference.*

The field 10.1.13.2.10.1.36.2 is the actual received record route (RRO). Note that the addresses in the RRO field match those in the ERO field. This is the normal case for CSPF LSPs. If the RRO and ERO addresses do not match for a CSPF LSP, the LSP has to reroute or detour.

The lines numbered 91 through 42 contain the 49 most recent entries to the history log. Each line is time stamped. The most recent entries have the largest log history number and are at the top of the log, indicating that line 91 is the most recent history log entry. When you read the log, start with the oldest entry (42) to the most recent (91).

The history log was started on July 10, and displays the following sequence of activities: an LSP was selected as active, was found to be down, MPLS label allocation failed several times, was deleted several times, was preempted because of an ResvTear, was deselected as active, and was cleared. In the end, the router computed a CSPF ERO, signaled the call, the LSP came up with the listed RRO (line 90), and was listed as active.

For more information on error messages, see the *JUNOS MPLS Network Operations Guide Log Reference.*

The total number of ingress LSPs displayed is 1, with 1 up and 0 down. The number in the Up field plus the number in the Down field should equal the total.

There is one egress LSP session from R6 to R1. The State is up, with no routes installed in the routing table. RSVP reservation style (Style) consists of two parts. The first is the number of active reservations (1). The second is the reservation style, which is FF (fixed filter). The reservation style can be FF, SE (shared explicit), or WF (wildcard filter). There are three incoming labels (Labelin) and no labels going out (Labelout) for this LSP.

There are no transit LSPs.

For more information on checking the LSP state, see “Working with the Layered MPLS Troubleshooting Model” on page 85.

Determining LSP Statistics

Purpose Display detailed information about RSVP objects to assist the diagnosis of an LSP problem.

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

```
user@host> show rsvp session detail
```

Sample Output

```
user@R1> show rsvp session detail
Ingress RSVP: 1 sessions

10.0.0.6
  From: 10.0.0.1, LSPstate: Up, ActiveRoute: 1
  LSPname: R1-to-R6, LSPpath: Primary
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 100064
  Resv style: 1 FF, Label in: -, Label out: 100064
  Time left:    -, Since: Tue Aug 17 12:22:52 2004
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 12 receiver 44251 protocol 0
  PATH rcvfrom: localclient
  Adspec: sent MTU 1500
  PATH sentto: 10.1.13.2 (so-0/0/2.0) 182 pkts
  RESV rcvfrom: 10.1.13.2 (so-0/0/2.0) 159 pkts
  Explct route: 10.1.13.2 10.1.36.2
  Record route: <self> 10.1.13.2 10.1.36.2
Total 1 displayed, Up 1, Down 0

Egress RSVP: 1 sessions

10.0.0.1
  From: 10.0.0.6, LSPstate: Up, ActiveRoute: 0
  LSPname: R6-to-R1, LSPpath: Primary
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: -
  Resv style: 1 FF, Label in: 3, Label out: -
  Time left:  135, Since: Tue Aug 17 12:23:14 2004
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 39024 protocol 0
  PATH rcvfrom: 10.1.15.2 (so-0/0/1.0) 158 pkts
  Adspec: received MTU 1500
  PATH sentto: localclient
  RESV rcvfrom: localclient
  Record route: 10.1.56.2 10.1.15.2 <self>
Total 1 displayed, Up 1, Down 0

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

What It Means The sample output shows that there is one ingress and one egress RSVP session. The ingress session has a source address of 10.0.0.1 (R1), and the session is up, with one active route. The LSP name is R1-to-R6 and it is the primary path for the LSP.

The recovery label (100064) is sent by a graceful restart router to its neighbor to recover a forwarding state. It is probably the old label that the router advertised before it went down.

This session is using the fixed filter (FF) reservation style (Resv style). Since this is an ingress router, there is no inbound label. The outbound label (provided by the next downstream router) is 100064.

The Time Left field provides the number of seconds remaining in the RSVP session, and the Tspec object provides information about the controlled load rate (rate) and maximum burst size (peak), an infinite value (Infbps) for the guaranteed delivery option, and the indication that packets smaller than 20 bytes are treated as 20 bytes, while packets larger than 1500 bytes are treated as 1500 bytes.

The port number is the IPv4 tunnel ID, while the sender/receiver port number is the LSP ID. The IPv4 tunnel ID is unique for the life of the LSP, while the sender/receiver LSP ID can change, for example, with an SE style reservation.

The PATH rcvfrom field includes the source of the path message. Since this is the ingress router, the local client originated the path message.

The PATH sentto field includes the path message destination (10.1.13.2) and outgoing interface (so-0/0/2.0). The RESV rcvfrom field includes both the source of the Resv message received (10.1.13.2) and the incoming interface (so-0/0/2.0).

The RSVP explicit route and the route record values are identical: 10.1.13.2 and 10.1.36.2. In most cases, the explicit route and the record route values are identical. Differences indicate that some path rerouting has occurred, typically during Fast-Reroute.

The Total fields indicate the total number of ingress, egress, and transit RSVP sessions, with the total being equal to the sum of the up and down sessions. In this example, there is one ingress session, one egress session, and no transit RSVP sessions.