Chapter 7

Verifying the Physical Layer

This chapter describes how to investigate a problem at the physical layer of a Multiprotocol Label Switching (MPLS) network. (See Table 13.)

Table 13: Checklist for Verifying the Physical Layer

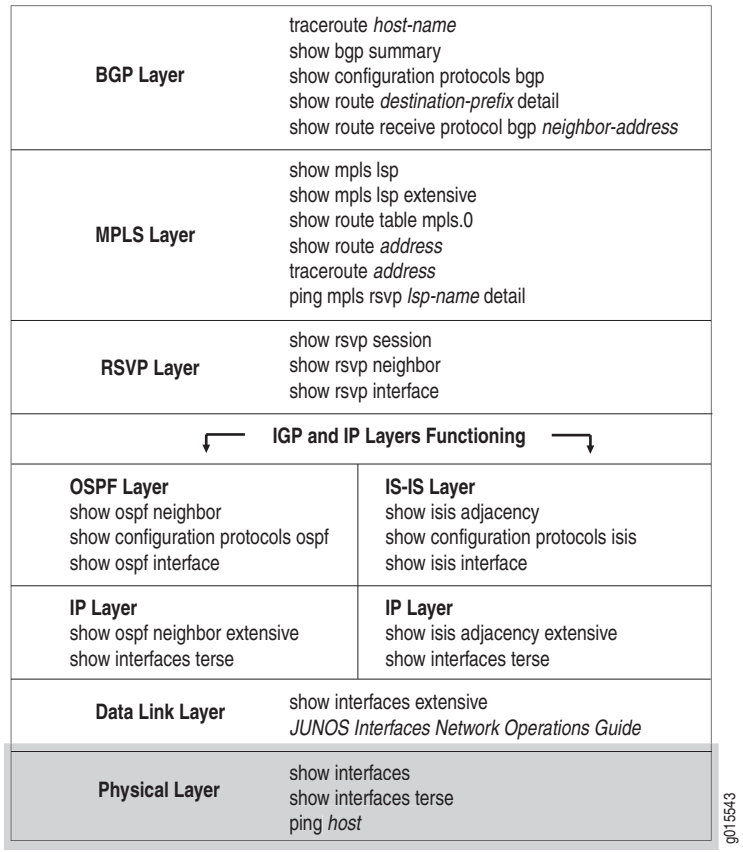
Verifying the Physical Layer Tasks	Command or Action
Verifying the Physical Layer on page 94	
1. Verify the LSP on page 96	show mpls lsp extensive
2. Verify Router Connection on page 97	ping *host*
3. Verify Interfaces on page 98	show interfaces terse show configuration interfaces *type-fpc/pic/port*
4. Take Appropriate Action on page 98	The following sequence of commands addresses the specific problem described in this section: [edit interfaces *type-fpc/pic/port*] set family mpls show commit
5. Verify the LSP Again on page 99	show mpls lsp extensive

Verifying the Physical Layer

Purpose After you have configured the LSP, issued the show mpls lsp extensive command, and determined that there is an error, you can start investigating the problem at the physical layer of the network.

Figure 10 illustrates the physical layer of the layered MPLS model.

Figure 10: Verifying the Physical Layer

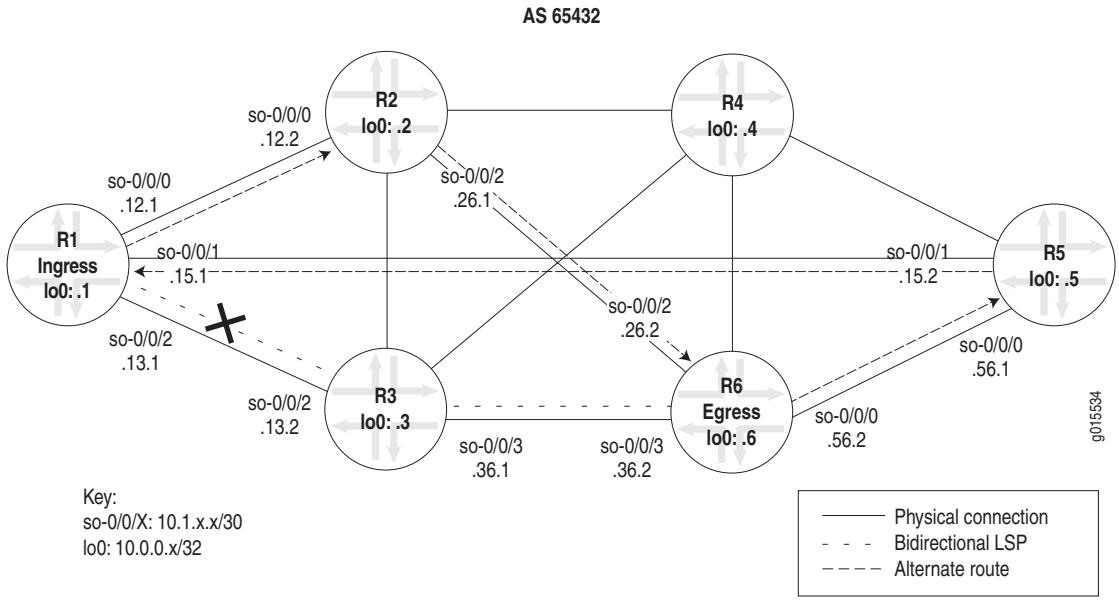


With this layer, you must ensure that the routers are connected, and that the interfaces are up and configured correctly on the ingress, egress, and transit routers.

If the network is not functioning at this layer, the label-switched path (LSP) does not work as configured.

Figure 11 illustrates the MPLS network and the problem described in this chapter.

Figure 11: MPLS Network Broken at the Physical Layer



The network shown in Figure 11 is a fully meshed configuration where every directly connected interface can receive and send packets to every other similar interface. The LSP in this network is configured to run from ingress router R1, through transit router R3, to egress router R6. In addition, a reverse LSP is configured to run from R6 through R3 to R1, creating bidirectional traffic.

However, in this example, traffic does not use the configured LSP. Instead traffic uses the alternate route from R1 through R2 to R6, and in the reverse direction, from R6 through R5 to R1.

When you become aware of a situation where an alternate route is used rather than the configured LSP, verify that the physical layer is functioning correctly. You might find that routers are not connected, or that interfaces are not up and configured correctly on the ingress, egress, or transit routers.

The cross shown in Figure 11 indicates where the LSP is broken because of a configuration error on ingress router R1.

Steps To Take To check the physical layer, follow these steps:

1. Verify the LSP on page 96
2. Verify Router Connection on page 97
3. Verify Interfaces on page 98
4. Take Appropriate Action on page 98
5. Verify the LSP Again on page 99

Step 1: Verify the LSP

Purpose Typically, you use the show mpls lsp extensive command to verify the LSP. However, for quick verification of the LSP state, use the show mpls lsp command. If the LSP is down, use the extensive option (show mpls lsp extensive) as a follow-up. If your network has numerous LSPs, you might consider specifying the name of the LSP, using the name option (show mpls lsp name *name* or show mpls lsp name *name* extensive).

Action To determine whether the LSP is up, enter the following command from the ingress router:

user@ingress-router> **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)
 10.1.12.2 S 10.1.26.2 S
    Received RRO (ProtectionFlag 1=Available 2=InUse 4=B/W 8=Node
10=SoftPreempt):
          10.1.12.2 10.1.26.2
   99 Sep 18 14:19:04 CSPF: computation result accepted
   98 Sep 18 14:19:04 CSPF: link down/deleted
10.1.13.1(R1.00/10.0.0.1)->10.1.13.2(R3.00/10.0.0.3)
   97 Sep 18 14:19:01 Record Route:  10.1.12.2 10.1.26.2
   96 Sep 18 14:19:01 Up
   95 Sep 18 14:19:01 Clear Call
   94 Sep 18 14:19:01 CSPF: computation result accepted
   93 Sep 18 14:19:01 MPLS label allocation failure
   92 Sep 18 14:19:01 Down
   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
   [...Output truncated...]
  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:  144, 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) 67333 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 from ingress router R1 shows that the LSP is using an alternate path rather than the configured path. The configured path for the LSP is R1 through R3 to R6, and for the reverse LSP, R6 through R3 to R1. The alternate path used by the LSP is R1 through R2 to R6, and for the reverse LSP, R6 through R5 to R1.

Step 2: Verify Router Connection

Action To determine that the routers are connected, enter the following command from the ingress and transit routers:

user@host> **ping** *host*

Sample Output

```
user@R1> ping 10.0.0.3 count 3
PING 10.0.0.3 (10.0.0.3): 56 data bytes
64 bytes from 10.0.0.3: icmp_seq=0 ttl=254 time=0.859 ms
64 bytes from 10.0.0.3: icmp_seq=1 ttl=254 time=0.746 ms
64 bytes from 10.0.0.3: icmp_seq=2 ttl=254 time=0.776 ms

--- 10.0.0.3 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.746/0.794/0.859/0.048 ms

user@R3> ping 10.0.0.6 count 3
PING 10.0.0.6 (10.0.0.6): 56 data bytes
64 bytes from 10.0.0.6: icmp_seq=0 ttl=255 time=0.968 ms
64 bytes from 10.0.0.6: icmp_seq=1 ttl=255 time=3.221 ms
64 bytes from 10.0.0.6: icmp_seq=2 ttl=255 time=0.749 ms

--- 10.0.0.6 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.749/1.646/3.221/1.117 ms
```

What It Means The sample output shows that ingress router R1 is receiving packets from transit router R3, and that the transit router is receiving packets from the egress router. Therefore, the routers in the LSP are connected.

Step 3: Verify Interfaces

Action To determine that the relevant interfaces are up and configured correctly, enter the following commands from the ingress, transit, and egress routers:

```
user@host> show interfaces terse
user@host> show configuration interfaces type-fpc/pic/port
```

Sample Output

```
user@R1> show interfaces so* 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  <<< family mpls is missing
so-0/0/3                up    down

user@R1> show configuration interfaces so-0/0/2
unit 0 {
    family inet {
        address 10.1.13.1/30;
    }
    family iso; <<< family mpls is missing
}
```

What It Means The sample output shows that interface so-0/0/2.0 on the ingress router does not have the family mpls statement configured at the [edit interfaces *type-fpc/pic/port*] hierarchy level, indicating that the interface is incorrectly configured to support the LSP. The LSP is configured correctly at the [edit protocols mpls] hierarchy level.

The output from the transit and egress routers (not shown) shows that the interfaces on those routers are configured correctly.

Step 4: Take Appropriate Action

Purpose Depending on the error you encountered in your investigation, you must take the appropriate action to correct the problem. In the example below, the family mpls statement, which was missing, is included in the configuration of ingress router R1.

Action To correct the error in this example, enter the following commands:

```
[edit interfaces type-fpc/pic/port]
user@R1# set family mpls
user@R1# show
user@R1# commit
```

Sample Output

```
[edit interfaces so-0/0/2 unit 0]
user@R1# set family mpls

[edit interfaces so-0/0/2 unit 0]
user@R1# show
family inet {
    address 10.1.13.1/30;
}
family iso;
family mpls;

[edit interfaces so-0/0/2 unit 0]
user@R1# commit
commit complete
```

What It Means The sample output from ingress router R1 shows that the family mpls statement is configured correctly for interface so-0/0/2.0, and that the LSP is now functioning as originally configured.

Step 5: Verify the LSP Again

Action To verify that the LSP is up and traversing the network as expected, enter the following command:

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

Sample Output 1

```
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
   112 Sep 21 16:27:33 Record Route:  10.1.13.2 10.1.36.2
   111 Sep 21 16:27:33 Up
   110 Sep 21 16:27:33 CSPF: computation result accepted
   109 Sep 21 16:27:33 CSPF: link down/deleted
10.1.12.1(R1.00/10.0.0.1)->10.1.12.2(R2.00/10.0.0.2)
   108 Sep 21 16:27:33 CSPF: link down/deleted
10.1.15.1(R1.00/10.0.0.1)->10.1.15.2(R5.00/10.0.0.5)
   [Output truncated...]
  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:  149, Since: Tue Sep 21 16:29:43 2004
```

```
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 39024 protocol 0
  PATH rcvfrom: 10.1.13.2 (so-0/0/2.0) 7 pkts
  Adspec: received MTU 1500
  PATH sentto: localclient
  RESV rcvfrom: localclient
  Record route: 10.1.36.2 10.1.13.2 <self>
Total 1 displayed, Up 1, Down 0

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

Sample Output 2

```
[edit protocols mpls]
user@R1# show
label-switched-path R1-to-R6 {
    to 10.0.0.6;
}
interface fxp0.0 {
    disable;
}
inactive: interface so-0/0/0.0;
inactive: interface so-0/0/1.0;
interface so-0/0/2.0;
```

What It Means

Sample Output 1 from ingress router R1 shows that the LSP is now traversing the network along the expected path, from R1 through R3 to R6, and the reverse LSP, from R6 through R3 to R1.

Sample Output 2 from ingress router R1 shows that the LSP is forced to take the intended path because MPLS is deactivated on R1 interfaces so-0/0/0.0 and so-0/0/1.0. If these interfaces were not deactivated, even though the configuration is now correct, the LSP would still traverse the network through the alternate path.