MPLS Troubleshooting

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Introduction

This document describes how to troubleshoot Multiprotocol Label Switching (MPLS).

Prerequisites

Requirements

Readers of this document should have knowledge of this topic:

- MPLS basics

Components Used

This document is based on the Configuring Basic MPLS Using OSPF sample configuration and presumes that you have configured these elements:

- IP address and a routing protocol such as Open Shortest Path First Protocol (OSPF Protocol) or Intermediate System–to–Intermediate System Protocol (IS–IS Protocol)
- Cisco Express Forwarding (CEF) or distributed CEF switching on all routers
- General MPLS or tag switching on all routers
- MPLS or tag switching on all required interfaces

If you have doubts about which hardware or Cisco IOS® Software releases support MPLS, refer to the Software Advisor.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

Troubleshoot Procedures

This section contains several MPLS troubleshoot procedures.

Verify That Routing Protocol Runs

Issue the **show ip protocols** command in order to display the parameters and current state of the active routing protocol process:

```
Pomerol# show ip protocols
Routing Protocol is "ospf 1"
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Router ID 10.10.10.3
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Maximum path: 4  Routing for Networks:
        10.1.1.0 0.0.0.255 area 9
        10.10.10.0 0.0.0.255 area 9
Routing Information Sources:
        Gateway          Distance        Last Update
        10.10.10.2            110         10:41:55
        10.10.10.3            110         10:41:55
        10.10.10.1            110         10:41:55
        10.10.10.6            110         10:41:55
        10.10.10.4            110         10:41:55
        10.10.10.5            110         10:41:55
Distance: (default is 110)
```

Ensure that the protocol routes for the MPLS network and all neighbors are present. You can also issue the **show ip route** command in order to verify the routing table:

```
Pomerol# show ip route
Codes: C – connected, S – static, I – IGRP, R – RIP, M – mobile, B – BGP
       D – EIGRP, EX – EIGRP external, O – OSPF, IA – OSPF inter area
       N1 – OSPF NSSA external type 1, N2 – OSPF NSSA external type 2
       E1 – OSPF external type 1, E2 – OSPF external type 2, E – EGP
       i – ISIS, L1 – ISIS level-1, L2 – ISIS level-2, ia – ISIS inter area
       * – candidate default, U – per-user static route, o – ODR

Gateway of last resort is 10.200.28.1 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 13 subnets, 3 masks
C       10.1.1.8/30 is directly connected, Serial0/1.2
O       10.1.1.12/30 [110/390] via 10.1.1.5, 15:26:38, Serial0/1.1
O       10.10.10.2/32 [110/196] via 10.1.1.10, 15:26:38, Serial0/1.2
C       10.10.10.3/32 is directly connected, Loopback0
O       10.1.1.0/30 [110/390] via 10.1.1.5, 15:26:38, Serial0/1.1
                    [110/390] via 10.1.1.10, 15:26:38, Serial0/1.2
O       10.10.10.1/32 [110/196] via 10.1.1.5, 15:26:38, Serial0/1.1
O       10.10.10.6/32 [110/98] via 10.1.1.22, 15:26:38, Serial0/1.3
O       10.10.10.4/32 [110/391] via 10.1.1.5, 15:26:38, Serial0/1.1
C       10.1.1.4/30 is directly connected, Serial0/1.1
C       10.1.1.20/30 is directly connected, Serial0/1.3
```

If the routers or routes are not present, investigate the routing protocol process. Refer to the OSPF Support Page in order to investigate the routing protocol process.

Verify CEF Switching

Issue the **show ip cef summary** command in order to display specific entries in the Forwarding Information Base (FIB) with IP address information as a basis. This output shows `Normal` status:

```
Pomerol# show ip cef summary
IP CEF with switching (Table Version 131), flags=0x0, bits=8
  32 routes, 0 reresolve, 0 unresolved (0 old, 0 new)
  32 leaves, 18 nodes, 23004 bytes, 125 inserts, 93 invalidations
  1 load sharing elements, 336 bytes, 1 references
  universal per-destination load sharing algorithm, id B642EBCF
  1 CEF resets, 6 revisions of existing leaves
  6 in-place modifications
  refcounts:  4909 leaf, 4864 node
```

Issue the **show ip cef** and **show ip cef interface** commands in order to verify CEF status. If CEF has not been enabled, nothing appears:

```
Pomerol# show ip cef
%CEF not running
Prefix              Next Hop            Interface
```

Refer to the Cisco Express Forwarding Overview if you continue to have problems with the enablement of CEF.

Verify MPLS

Issue the **show mpls interfaces** command in order to ensure that MPLS is globally enabled. This command also verifies that a Label Distribution Protocol (LDP) runs on the requested interfaces:

```
Pomerol# show mpls interfaces
Interface           IP              Tunnel   Operational
(...)
Serial0/1.1         Yes (tdp)       Yes      Yes
Serial0/1.2         Yes             Yes      No
Serial0/1.3         Yes (tdp)       Yes      Yes
(...)
```

show mpls interfaces Command Output Field Descriptions	
Field	**Description**
IP	This field shows that MPLS IP is configured for an interface. The LDP appears in parentheses to the right of the IP status. The LDP is either: • Tag Distribution Protocol (TDP), which the Cisco Tag Switching architecture defines • LDP, as the Internet Engineering Task Force (IETF) defines in RFC 3036
Tunnel	This field indicates the capacity of traffic engineering on the interface.
Operational	This field shows the status of the LDP.

> **Note:** In the example output, the
> `Operational` field is down on Serial0/1.2
> because the interface is down.

Ping the Neighbors

An unlabeled connection must be up between each pair of router neighbors. The routing protocol and the LDP use the unlabeled connection to build the routing table and the label forwarding information base (LFIB).

```
Pomerol# ping 10.10.10.6

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.10.6, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/60 ms
```

Verify Label Distribution

Issue the **show tag−switching tdp discovery** command in order to display the discovered neighbors:

```
Pomerol# show tag-switching tdp discovery
Local TDP Identifier:
    10.10.10.3:0
Discovery Sources:
    Interfaces:
        Serial0/1.1 (tdp): xmit/recv
            TDP Id: 10.10.10.1:0
        Serial0/1.2 (tdp): xmit/recv
            TDP Id: 10.10.10.2:0
        Serial0/1.3 (tdp): xmit/recv
            TDP Id: 10.10.10.6:0
```

In the **show tag−switching tdp discovery** command output, the use of TDP binds labels with routes. If any of the presumed neighbors is not present and you cannot ping the presumed neighbor, a connectivity problem exists and the LDP cannot run. If LDP runs correctly, it assigns one label per forwarding equivalent class.

Note: If the router ID for the LDP cannot be reached from the global routing table, the neighbor relationship fails to establish.

Verify Label Bindings

Issue the **show tag−switching tdp bindings** command in order to ensure the assignment of labels to each destination. You can use commands such as the **show tag−switching forwarding−table {ip address | prefix} detail** command in order to verify the different routes and the labels associated with the routes.

The output that this section shows contains label bindings for 10.10.10.x/32 networks, which are the interfaces of each label switch router (LSR):

Note: There are multiple labels for each LSR. Each label corresponds to a different path.

```
Pomerol# show tag-switching tdp bindings
(...)
tib entry: 10.10.10.1/32, rev 31
        local binding:  tag: 18
        remote binding: tsr: 10.10.10.1:0, tag: imp-null
        remote binding: tsr: 10.10.10.2:0, tag: 18
        remote binding: tsr: 10.10.10.6:0, tag: 21
```

```
        tib entry: 10.10.10.2/32, rev 22
                local binding:  tag: 17
                remote binding: tsr: 10.10.10.2:0, tag: imp-null
                remote binding: tsr: 10.10.10.1:0, tag: 19
                remote binding: tsr: 10.10.10.6:0, tag: 22
        tib entry: 10.10.10.3/32, rev 2
                local binding:  tag: imp-null
                remote binding: tsr: 10.10.10.2:0, tag: 17
                remote binding: tsr: 10.10.10.1:0, tag: 20
                remote binding: tsr: 10.10.10.6:0, tag: 23
        tib entry: 10.10.10.4/32, rev 40
                local binding:  tag: 20
                remote binding: tsr: 10.10.10.1:0, tag: 16
                remote binding: tsr: 10.10.10.2:0, tag: 20
                remote binding: tsr: 10.10.10.6:0, tag: 24
        tib entry: 10.10.10.5/32, rev 44
                local binding:  tag: 22
                remote binding: tsr: 10.10.10.1:0, tag: 17
                remote binding: tsr: 10.10.10.2:0, tag: 22
                remote binding: tsr: 10.10.10.6:0, tag: 25
        tib entry: 10.10.10.6/32, rev 48
                local binding:  tag: 23
                remote binding: tsr: 10.10.10.6:0, tag: imp-null
                remote binding: tsr: 10.10.10.1:0, tag: 22
                remote binding: tsr: 10.10.10.2:0, tag: 24
        (...)


        Pomerol# show tag-switching forwarding-table 10.10.10.4 detail
        Local  Outgoing    Prefix              Bytes
        tag    Outgoing    Next Hoptag    tag or VC   or Tunnel Id    switched    interface
        20     16              10.10.10.4/32    0           Se0/1.1    point2point
                        MAC/Encaps=4/8, MTU=1500, Tag Stack{16}
                        48D18847 00010000
                        No output feature configured
                Per-packet load-sharing
```

Verify That Labels Are Set

Use the **debug mpls packet** command or the MPLS−aware **traceroute** command functionality in order to make sure that the labels are set.

```
        Pesaro# traceroute 10.10.10.4

        Type escape sequence to abort.
        Tracing the route to 10.10.10.4

                1 10.1.1.21 [MPLS: Label 20 Exp 0] 272 msec 268 msec 300 msec
                2 10.1.1.5 [MPLS: Label 16 Exp 0] 228 msec 228 msec 228 msec
                3 10.1.1.14 92 msec * 92 msec
```

Related Information

- **MPLS Support Page**
- **OSPF Support Page**
- **Technical Support & Documentation**