

MPLS Observation Lab – Basic LDP Label Binding

Objective

The purpose of this lab is to observe **LDP label binding**. This is an observation-focused lab. The learner should focus on the changes to the routing table, MPLS LDP binding table, and MPLS forwarding table.

Topology Overview

RTR1 and RTR2 are currently not configured for MPLS.

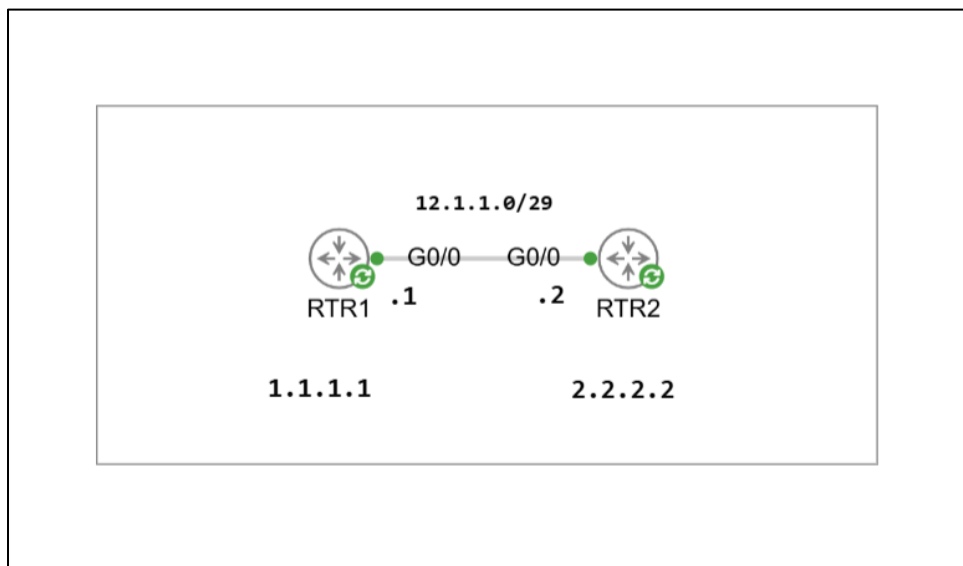


Figure 1 – Topology

Note: The MPLS label values shown throughout this lab may differ from the label values displayed on your routers. Focus on the relationship being demonstrated.

Task 1 – Observe LDP Label Binding and Forwarding Tables

- a. On RTR1, view the MPLS LDP bindings and MPLS forwarding table.

```
RTR1# show mpls ldp bindings
```

```
RTR1# show mpls forwarding-table
```

Observe

Both tables are empty. This is to be expected because MPLS has not yet been configured on the interfaces.

- b. View RTR1's routing table. On RTR1's Gi0/0, configure MPLS, then view the MPLS LDP bindings and MPLS forwarding table. Issue the commands to view the MPLS label range.

```
RTR1(config-if)# mpls ip
```

```
RTR1# show mpls label range  
RTR1(config)# mpls label range ?
```

Observe

The MPLS LDP binding table contains two entries. One entry for each of the prefixes in the routing table. The MPLS forwarding table is empty.

```
Gateway of last resort is not set  
  
  1.0.0.0/32 is subnetted, 1 subnets  
C       1.1.1.1 is directly connected, Loopback0  
  12.0.0.0/8 is variably subnetted, 2 subnets, 2 masks  
C       12.1.1.0/29 is directly connected, GigabitEthernet0/0  
L       12.1.1.1/32 is directly connected, GigabitEthernet0/0  
RTR1#
```

Figure 2 – RTR1 show ip route output

```
RTR1#show mpls ldp bindings
lib entry: 1.1.1.1/32, rev 2
  local binding: label: imp-null
lib entry: 12.1.1.0/29, rev 4
  local binding: label: imp-null
RTR1#
```

Figure 3 – RTR1 show mpls ldp bindings

```
RTR1#show mpls label range
Downstream Generic label region: Min/Max label: 16/100000
RTR1#
```

Figure 4 – RTR1 show mpls label range

```
RTR1(config)#mpls label range ?
<16-1048575> Minimum label value for dynamic label range
RTR1(config)#mpls label range
```

Figure 5 – RTR1 mpls label range ? output

Engineer Insight

Recall that enabling MPLS on an interface also enables the **Label Distribution Protocol (LDP)**. LDP is used between MPLS routers to exchange label binding information. MPLS routers generate, or bind, a local label for each prefix in their routing table and place the label binding information in the **MPLS LDP Binding Table**.

MPLS labels range from **0 to 1,048,575**, but values **0–15** are reserved for special purposes. On Cisco IOS, the default dynamic label range is **16–100,000**. For CCNP training, the important range to remember is the **reserved range of 0–15**.

RTR1's directly connected prefixes have a label value displayed as imp-null which stands for **Implicit Null**. The significance of imp-null will be explained and demonstrated in a future lab.

- c. On RTR1, configure a static route for 15.15.15.0/24 with a next hop of 12.1.1.2. View the routing, MPLS LDP bindings, and MPLS forwarding table.

Observe

There is a new entry in the LDP binding table for 15.15.15.0/24. Unlike the other two entries, the local binding is not imp-null. MPLS forwarding table has an entry for network 15.15.15.0/24.

```

Gateway of last resort is not set

    1.0.0.0/32 is subnetted, 1 subnets
C       1.1.1.1 is directly connected, Loopback0
    12.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       12.1.1.0/29 is directly connected, GigabitEthernet0/0
L       12.1.1.1/32 is directly connected, GigabitEthernet0/0
    15.0.0.0/24 is subnetted, 1 subnets
S       15.15.15.0 [1/0] via 12.1.1.2
RTR1#

```

Figure 6 – RTR1 show ip route output

```

RTR1#show mpls ldp bindings
lib entry: 1.1.1.1/32, rev 2
    local binding: label: imp-null
lib entry: 12.1.1.0/29, rev 4
    local binding: label: imp-null
lib entry: 15.15.15.0/24, rev 6
    local binding: label: 16
RTR1#

```

Figure 7 – RTR1 show mpls ldp bindings output

```

RTR1#show mpls forwarding-table
Local      Outgoing  Prefix      Bytes Label  Outgoing  Next Hop
Label      Label      or Tunnel Id  Switched     interface
16         No Label   15.15.15.0/24  0            Gi0/0     12.1.1.2
RTR1#

```

Figure 8 – RTR1 show mpls forwarding-table output

Question

- How are the entries for networks 1.1.1.1/32 and 12.1.1.0/29 different from the entry for network 15.15.15.0/24?

Engineer Insight

The difference between the prefixes is that 15.15.15.0/24 is not directly connected. The assigned label is displayed as a numerical value.

- On RTR1, remove the previous static route and configure a static route for 15.15.15.0/24 with a next hop of Gi0/0. View the MPLS LDP bindings and MPLS forwarding table.

Observe

The entry for 15.15.15.0/24 no longer displays a numerical label value. Instead, the local binding is shown as imp-null, like the other two entries. The entry in the MPLS forwarding table has been removed.

```
Gateway of last resort is not set

  1.0.0.0/32 is subnetted, 1 subnets
C    1.1.1.1 is directly connected, Loopback0
  12.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    12.1.1.0/29 is directly connected, GigabitEthernet0/0
L    12.1.1.1/32 is directly connected, GigabitEthernet0/0
  15.0.0.0/24 is subnetted, 1 subnets
S    15.15.15.0 is directly connected, GigabitEthernet0/0
RTR1#
```

Figure 9 – RTR1 show ip route output

```
RTR1#show mpls ldp bindings
lib entry: 1.1.1.1/32, rev 2
    local binding: label: imp-null
lib entry: 12.1.1.0/29, rev 4
    local binding: label: imp-null
lib entry: 15.15.15.0/24, rev 7
    local binding: label: imp-null
RTR1#
```

Figure 10 – RTR1 show mpls ldp bindings output

Engineer Insight

Configuring the static route to point to the directly connected interface instead of the neighbor's next-hop IP caused the prefix to appear directly connected. With the prefix directly connected, the information in the MPLS LDP binding and MPLS forwarding table changed to reflect this.

All prefixes, whether directly connected or learned from another router, appear in the MPLS LDP binding table. Think of it as a directory of label assignments. The MPLS forwarding table contains prefixes for which the router performs MPLS processing. Directly connected prefixes do not require an MPLS forwarding action on the local router, so they do not appear in its MPLS forwarding table.

Lab Summary

You observed that:

- Labels **0–15** are reserved.
- The MPLS binding table contains information about prefixes and their assigned labels.
- The MPLS forwarding table contains prefixes for prefixes that require an MPLS processing to be forwarded.