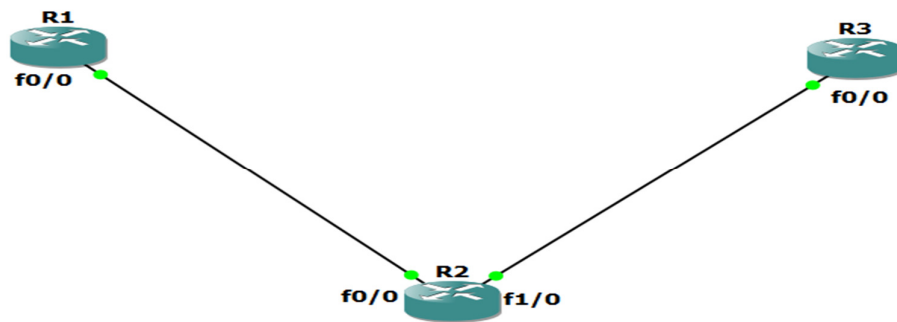


**Topology:****Step -1:** IP addressing of MPLS Core and OSPF.

First bring 3 routers into your topology R1, R2, R3 position them as below. We are going to address the routers and configure ospf to ensure loopback to loopback connectivity between R1 and R3.

**R1:**

```

*Apr 29 10:28:17.803: %LINK-5-CHANGED: Interface FastEthernet5/0, changed state to administratively down
R1#
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#int lo0
R1(config-if)#ip add 1.1.1.1 255.255.255.255
R1(config-if)#ip ospf 1 area 0
R1(config-if)#int f0/0
R1(config-if)#ip add 10.0.0.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#ip ospf 1 area 0
*Apr 29 10:30:34.751: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
R1(config-if)#ip ospf 1 area 0
R1(config-if)#
*Apr 29 10:30:37.111: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Apr 29 10:30:38.111: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R1(config-if)#
*Apr 29 10:33:40.355: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on FastEthernet0/0 from LOADING to FULL, Loading Done
  
```

**R2:**

```

*Apr 29 10:28:17.803: %LINK-5-CHANGED: Interface FastEthernet5/0, changed state to administratively down
R2#
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#int lo0
R2(config-if)#ip add 2.2.2.2 255.255.255.255
R2(config-if)#ip ospf 1 area 0
R2(config-if)#int f0/0
R2(config-if)#ip add 10.0.0.2 255.255.255.0
R2(config-if)#no shut
R2(config-if)#ip ospf 1 area 0
R2(config-if)#int f1/0
R2(config-if)#ip add 10.0.1.2 255.255.255.0
R2(config-if)#no shut
R2(config-if)#ip ospf 1 area 0
*Apr 29 10:33:35.371: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
R2(config-if)#ip ospf 1 area 0
*Apr 29 10:33:37.723: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Apr 29 10:33:37.883: %LINK-3-UPDOWN: Interface FastEthernet1/0, changed state to up
*Apr 29 10:33:38.723: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R2(config-if)#ip ospf 1 area 0
*Apr 29 10:33:38.883: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up
R2(config-if)#ip ospf 1 area 0
*Apr 29 10:33:40.787: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on FastEthernet0/0 from LOADING to FULL, Loading Done
R2(config-if)#ip ospf 1 area 0
R2(config-if)#
*Apr 29 10:35:20.407: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on FastEthernet1/0 from LOADING to FULL, Loading Done
R2(config-if)#
R2(config-if)#exit
R2(config)#exit
R2#
  
```

**R3:**

```
*Apr 29 10:28:17.775: %LINK-5-CHANGED: Interface FastEthernet5/0, changed state
to administratively down
R3#
R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#int lo0
R3(config-if)#ip add 3.3.3.3 255.255.255.255
R3(config-if)#ip ospf 1 area 0
R3(config-if)#int f0/0
R3(config-if)#ip add 10.0.1.3 255.255.255.0
R3(config-if)#no shut
R3(config-if)#ip ospf 1 area 0
*Apr 29 10:35:15.815: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
R3(config-if)#ip ospf 1 area 0
R3(config-if)#
*Apr 29 10:35:18.179: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Apr 29 10:35:19.179: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R3(config-if)#
*Apr 29 10:35:20.259: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on FastEthernet0/0 from LOADING to FULL, Loading Done
R3(config-if)#
R3(config-if)#exit
R3(config)#exit
R3#
```

To check full ip connectivity between R1, R2, R3 can ping between the loopbacks of R1 and R3.

```
R1#
R1#
*Apr 29 10:35:46.203: %SYS-5-CONFIG_I: Configured from console by console
R1#ping 3.3.3.3 source lo0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, timeout is 2 seconds:
Packet sent with a source address of 1.1.1.1
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/59/64 ms
R1#
```

**Step – 2: Configure LDP on all the interfaces in the MPLS Core.**

In order to run MPLS you need to enable it, there are two ways to do this. At each interface enter the mpls ip command. Under the ospf process use the mpls ldp autoconfig command.

**R1:**

```
R1#
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#mpls ldp autoconfig
R1(config-router)#
*Apr 29 10:38:13.803: %PARSE_RC-3-PRC_INVALID_BLOCK_PTR:
R1(config-router)#
*Apr 29 10:39:51.183: %LDP-5-NBRCHG: LDP Neighbor 2.2.2.2:0 (1) is UP
R1(config-router)#
R1(config-router)#exit
R1(config)#exit
R1#
R1#
```

**R2:**

```
R2#
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#mpls ldp autoconfig
R2(config-router)#
*Apr 29 10:39:51.371: %PARSE_RC-3-PRC_INVALID_BLOCK_PTR:
*Apr 29 10:39:51.387: %PARSE_RC-3-PRC_INVALID_BLOCK_PTR:
R2(config-router)#
*Apr 29 10:39:51.591: %LDP-5-NBRCHG: LDP Neighbor 1.1.1.1:0 (1) is UP
R2(config-router)#
*Apr 29 10:40:44.955: %LDP-5-NBRCHG: LDP Neighbor 3.3.3.3:0 (2) is UP
R2(config-router)#exit
R2(config)#exit
R2#
R2#
```

**R3:**

```

R3#
*Apr 29 10:40:28.647: %SYS-5-CONFIG_I: Configured from console by console
R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#router ospf 1
R3(config-router)#mpls ldp autoconfig
R3(config-router)#
*Apr 29 10:40:44.527: %PARSE_RC-3-PRC_INVALID_BLOCK_PTR:
R3(config-router)#
*Apr 29 10:40:44.747: %LDP-5-NBRCHG: LDP Neighbor 2.2.2.2:0 (1) is UP
R3(config-router)#exit
R3(config)#

```

**R2:**

You should see log messages coming up showing the LDP neighbors are up.

To verify the mpls interfaces the command is very simple – sh mpls interface.

This is done on R2 and you can see that both interfaces are running mpls and using LDP.

```

R2#
*Apr 29 10:42:12.199: %SYS-5-CONFIG_I: Configured from console by console
R2#sh mpls interface

```

Interface	IP	Tunnel	BGP	Static	Operational
FastEthernet0/0	Yes (ldp)	No	No	No	Yes
FastEthernet1/0	Yes (ldp)	No	No	No	Yes

```

R2#

```

```

R2#
R2#sh mpls ldp neigh
  Peer LDP Ident: 1.1.1.1:0; Local LDP Ident 2.2.2.2:0
    TCP connection: 1.1.1.1.646 - 2.2.2.2.54977
    State: Oper; Msgs sent/rcvd: 11/11; Downstream
    Up time: 00:02:56
    LDP discovery sources:
      FastEthernet0/0, Src IP addr: 10.0.0.1
    Addresses bound to peer LDP Ident:
      10.0.0.1      1.1.1.1
  Peer LDP Ident: 3.3.3.3:0; Local LDP Ident 2.2.2.2:0
    TCP connection: 3.3.3.3.39793 - 2.2.2.2.646
    State: Oper; Msgs sent/rcvd: 10/10; Downstream
    Up time: 00:02:02
    LDP discovery sources:
      FastEthernet1/0, Src IP addr: 10.0.1.3
    Addresses bound to peer LDP Ident:
      10.0.1.3      3.3.3.3
R2#

```

One more verification to confirm LDP is running ok is to do a trace between R1 and R3 and verify if you get MPLS Labels show up in the trace.

```

R1#
*Apr 29 10:43:41.287: %SYS-5-CONFIG_I: Configured from console by console
R1#trace 3.3.3.3
Type escape sequence to abort.
Tracing the route to 3.3.3.3
VRF info: (vrf in name/id, vrf out name/id)
  1 10.0.0.2 [MPLS: Label 17 Exp 0] 32 msec 32 msec
  2 10.0.1.3 52 msec 60 msec 56 msec
R1#

```

**Step – 3: MPLS BGP Configuration between R1 and R3.**

Need to establish a Multi-Protocol BGP session between R1 and R3 this is done by configuring the vpnv4 address family as below.

**R1:**

```

R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#router bgp 1
R1(config-router)#neighbor 3.3.3.3 remote-as 1
R1(config-router)#neighbor 3.3.3.3 update-source Loopback0
R1(config-router)#no auto-summary
R1(config-router)#address-family vpnv4
R1(config-router-af)#neighbor 3.3.3.3 activate
R1(config-router-af)#
*Apr 29 10:46:22.419: %BGP-3-NOTIFICATION: received from neighbor 3.3.3.3 active 2/8 (no supported AFI/SAFI) 3 bytes 000000
R1(config-router-af)#
*Apr 29 10:46:22.423: %BGP-5-NBR_RESET: Neighbor 3.3.3.3 active reset (BGP Notification received)
*Apr 29 10:46:22.427: %BGP-5-ADJCHANGE: neighbor 3.3.3.3 active Down BGP Notification received
*Apr 29 10:46:22.427: %BGP_SESSION-5-ADJCHANGE: neighbor 3.3.3.3 VPNv4 Unicast topology base removed from session BGP Notification received
*Apr 29 10:46:22.427: %BGP_SESSION-5-ADJCHANGE: neighbor 3.3.3.3 IPv4 Unicast topology base removed from session BGP Notification received
R1(config-router-af)#
*Apr 29 10:46:27.411: %BGP-5-NBR_RESET: Neighbor 3.3.3.3 passive reset (BGP Notification sent)
*Apr 29 10:46:27.415: %BGP-5-ADJCHANGE: neighbor 3.3.3.3 passive Down AFI/SAFI not supported
R1(config-router-af)#
*Apr 29 10:46:35.735: %BGP-5-ADJCHANGE: neighbor 3.3.3.3 Up
R1(config-router-af)#exit
R1(config-router)#exit
R1(config)#exit
R1#

```

**R3:**

```

R3(config)#
R3(config)#router bgp 1
R3(config-router)#neighbor 1.1.1.1 remote-as 1
R3(config-router)#neighbor 1.1.1.1 update-source Loopback0
R3(config-router)#no auto-summary
R3(config-router)#address-family vpnv4
R3(config-router-af)#neighbor 1.1.1.1 activate
R3(config-router-af)#
*Apr 29 10:46:22.759: %BGP-3-NOTIFICATION: received from neighbor 1.1.1.1 active 2/8 (no supported AFI/SAFI) 3 bytes 000000
R3(config-router-af)#
*Apr 29 10:46:22.763: %BGP-5-NBR_RESET: Neighbor 1.1.1.1 active reset (BGP Notification received)
*Apr 29 10:46:22.763: %BGP-5-ADJCHANGE: neighbor 1.1.1.1 active Down BGP Notification received
*Apr 29 10:46:22.763: %BGP_SESSION-5-ADJCHANGE: neighbor 1.1.1.1 VPNv4 Unicast topology base removed from session BGP Notification received
*Apr 29 10:46:22.763: %BGP_SESSION-5-ADJCHANGE: neighbor 1.1.1.1 IPv4 Unicast topology base removed from session BGP Notification received
R3(config-router-af)#
*Apr 29 10:46:27.755: %BGP-5-NBR_RESET: Neighbor 1.1.1.1 passive reset (BGP Notification sent)
*Apr 29 10:46:27.755: %BGP-5-ADJCHANGE: neighbor 1.1.1.1 passive Down AFI/SAFI not supported

```

To verify the BGP session between R1 and R3 issue the command `sh bgp vpnv4 unicast all summary`.

```

R1#
R1#sh bgp vpnv4 unicast all summary
BGP router identifier 1.1.1.1, local AS number 1
BGP table version is 1, main routing table version 1

Neighbor      V      AS MsgRcvd MsgSent  TblVer  InQ  OutQ Up/Down  State/PfxRcd
3.3.3.3       4        1      5      5        1    0    0 00:00:53      0
R1#

```

\*\*\*\*\*END\*\*\*\*\*