CCNP Period 6-7

MPLS-LDP

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**Purpose:**

The Purpose of this lab was to familiar ourselves with a protocol which is widely used in ISP and LAN Networks. As also to prepare us for the upcoming CCNP test which this specific protocol is being testing in the certification test.

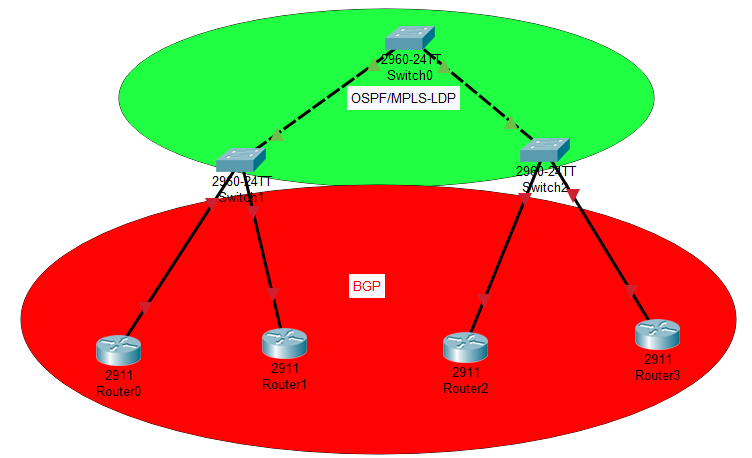
**Background:**

MPLS is a widely used Protocol and is implemented in places such as Internet Service Providers or shortened as ISPs, or in internal networks for a faster reliable way of transferring data and traffic. MPLS or Multiprotocol Label Switching has many benefits for the networks and ISPs. In the real world, ISP use MPLS for WAN Routing so the hosts who use their services don’t need to, they also work on a much simpler scale which makes it so that less network engineers need to be on staff. MPLS can handle pretty much any type of traffic including voice and video. There are also many types of other protocols and commands that enable MPLS to be used on a much broader scale, such as built-in QoS (Which we didn’t do this lab) capabilities for improvement in traffic speeds and bandwidth management. And on most commercial level businesses, they include Service level agreements. How MPLS LDP works is by generating a label, which can be statically set or automatically depending on what you want. After setting those label values on the routers, they will advertise it and create neighbors such as how OSPF or EIGRP would work. By doing this, they use these labels instead of IP addresses for a faster, more efficient data transfer. When the packets are being transferred between 2 MPLS LDP interfaces, it will slap a label onto the packet when it is being sent out and when it reaches the next hop interface, it assigns a new label for sending out to the next hop if it’s a MPLS LDP interface.

**Lab Setup:**

When we setup MPLS, some groups were able to use fiber cables. But for our lab we used 3 Switches with gig ports, and 4 2901 Routers attached to it. On the Switches, we ran OSPF to connect the gig Ethernet ports and BGP to connect the 2 outer switches to the 4 routers.

**Topology:**



**Specific commands:**

MPLS IP: Enables MPLS on device/interface

Mpls ldp router-id lo0 force Makes the lo0 interface the routers mpls ldp ip

Mpls label protocol ldp Enables ldp on the device

Mpls label range 200 299 Statically assigns a label to device and ports.

Do sh mpls ldp nei Confirms correct mpls ldp setup

Do sh mpls ldp bind Shows the label bindings

Do sh mpls for Confirms correct label bindings.

***R3 Show commands and Configurations:***

*R3#traceroute 1.1.1.1*

*Type escape sequence to abort.*

*Tracing the route to 1.1.1.1*

*VRF info: (vrf in name/id, vrf out name/id)*

*1 192.168.4.1 0 msec 4 msec 4 msec*

*2 172.16.20.1 [AS 100] [MPLS: Label 206 Exp 0] 0 msec 4 msec 0 msec*

*3 172.16.10.1 [AS 100] [MPLS: Label 205 Exp 0] 0 msec 0 msec 0 msec*

*4 192.168.1.2 [AS 100] 4 msec \* 0 msec*

*Router B2:*

*RB2#show ip route*

*Codes: L - local, C - connected, S - static, 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*

*i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2*

*ia - IS-IS inter area, \* - candidate default, U - per-user static route*

*o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP*

*+ - replicated route, % - next hop override*

*Gateway of last resort is 192.168.4.1 to network 0.0.0.0*

*B\* 0.0.0.0/0 [20/0] via 192.168.4.1, 00:38:55*

*1.0.0.0/32 is subnetted, 1 subnets*

*B 1.1.1.1 [20/0] via 192.168.4.1, 00:32:20*

*2.0.0.0/32 is subnetted, 1 subnets*

*B 2.2.2.2 [20/0] via 192.168.4.1, 00:31:49*

*3.0.0.0/32 is subnetted, 1 subnets*

*B 3.3.3.3 [20/0] via 192.168.4.1, 00:31:49*

*4.0.0.0/32 is subnetted, 1 subnets*

*C 4.4.4.4 is directly connected, Loopback0*

*B 192.168.1.0/24 [20/0] via 192.168.4.1, 00:38:55*

*B 192.168.2.0/24 [20/0] via 192.168.4.1, 00:38:55*

*B 192.168.3.0/24 [20/0] via 192.168.4.1, 00:38:55*

*192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks*

*C 192.168.4.0/24 is directly connected, GigabitEthernet0/0*

*L 192.168.4.2/32 is directly connected, GigabitEthernet0/0*

*R3#show run*

*hostname RB2*

*interface Loopback0*

*ip address 4.4.4.4 255.255.255.255*

*interface GigabitEthernet0/0*

*ip address 192.168.4.2 255.255.255.0*

*duplex auto*

*speed auto*

*router bgp 4*

*bgp log-neighbor-changes*

*network 4.4.4.4 mask 255.255.255.255*

*network 192.168.4.0*

*neighbor 192.168.4.1 remote-as 100*

*end*

***R2 Show Commands and Configurations:***

*RA2#show ip route*

*Codes: L - local, C - connected, S - static, 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*

*i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2*

*ia - IS-IS inter area, \* - candidate default, U - per-user static route*

*o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP*

*+ - replicated route, % - next hop override*

*Gateway of last resort is 192.168.3.1 to network 0.0.0.0*

*B\* 0.0.0.0/0 [20/0] via 192.168.3.1, 00:38:00*

*1.0.0.0/32 is subnetted, 1 subnets*

*B 1.1.1.1 [20/0] via 192.168.3.1, 00:31:25*

*2.0.0.0/32 is subnetted, 1 subnets*

*B 2.2.2.2 [20/0] via 192.168.3.1, 00:30:54*

*3.0.0.0/32 is subnetted, 1 subnets*

*C 3.3.3.3 is directly connected, Loopback0*

*4.0.0.0/32 is subnetted, 1 subnets*

*B 4.4.4.4 [20/0] via 192.168.3.1, 00:30:54*

*B 192.168.1.0/24 [20/0] via 192.168.3.1, 00:38:00*

*B 192.168.2.0/24 [20/0] via 192.168.3.1, 00:38:00*

*192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks*

*C 192.168.3.0/24 is directly connected, GigabitEthernet0/0*

*L 192.168.3.2/32 is directly connected, GigabitEthernet0/0*

*B 192.168.4.0/24 [20/0] via 192.168.3.1, 00:38:00*

*R2#show run*

*hostname R2*

*interface Loopback0*

*ip address 3.3.3.3 255.255.255.255*

*interface GigabitEthernet0/0*

*ip address 192.168.3.2 255.255.255.0*

*duplex auto*

*speed auto*

*router bgp 3*

*bgp log-neighbor-changes*

*network 3.3.3.3 mask 255.255.255.255*

*network 192.168.3.0*

*neighbor 192.168.3.1 remote-as 100*

*end*

***R3 Show commands and Configurations:***

*R3#show ip route*

*Codes: L - local, C - connected, S - static, 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*

*i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2*

*ia - IS-IS inter area, \* - candidate default, U - per-user static route*

*o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP*

*+ - replicated route, % - next hop override*

*Gateway of last resort is 192.168.2.1 to network 0.0.0.0*

*B\* 0.0.0.0/0 [20/0] via 192.168.2.1, 00:37:23*

*1.0.0.0/32 is subnetted, 1 subnets*

*B 1.1.1.1 [20/0] via 192.168.2.1, 00:30:15*

*2.0.0.0/32 is subnetted, 1 subnets*

*C 2.2.2.2 is directly connected, Loopback0*

*3.0.0.0/32 is subnetted, 1 subnets*

*B 3.3.3.3 [20/0] via 192.168.2.1, 00:29:45*

*4.0.0.0/32 is subnetted, 1 subnets*

*B 4.4.4.4 [20/0] via 192.168.2.1, 00:29:14*

*B 192.168.1.0/24 [20/0] via 192.168.2.1, 00:37:23*

*192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks*

*C 192.168.2.0/24 is directly connected, GigabitEthernet0/0*

*L 192.168.2.2/32 is directly connected, GigabitEthernet0/0*

*B 192.168.3.0/24 [20/0] via 192.168.2.1, 00:36:51*

*B 192.168.4.0/24 [20/0] via 192.168.2.1, 00:36:51*

*RB1#show run*

*hostname R3*

*interface Loopback0*

*ip address 2.2.2.2 255.255.255.255*

*ip broadcast-address 2.2.2.2*

*interface GigabitEthernet0/0*

*ip address 192.168.2.2 255.255.255.0*

*ip broadcast-address 192.168.2.0*

*duplex auto*

*speed auto*

*router bgp 2*

*bgp log-neighbor-changes*

*network 2.2.2.2 mask 255.255.255.255*

*network 192.168.2.0*

*neighbor 192.168.2.1 remote-as 100*

*end*

***R1 Show Commands and Configurations:***

*RA1#show ip route*

*Codes: L - local, C - connected, S - static, 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*

*i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2*

*ia - IS-IS inter area, \* - candidate default, U - per-user static route*

*o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP*

*+ - replicated route, % - next hop override*

*Gateway of last resort is 192.168.1.1 to network 0.0.0.0*

*B\* 0.0.0.0/0 [20/0] via 192.168.1.1, 00:36:29*

*1.0.0.0/32 is subnetted, 1 subnets*

*C 1.1.1.1 is directly connected, Loopback0*

*2.0.0.0/32 is subnetted, 1 subnets*

*B 2.2.2.2 [20/0] via 192.168.1.1, 00:28:51*

*3.0.0.0/32 is subnetted, 1 subnets*

*B 3.3.3.3 [20/0] via 192.168.1.1, 00:28:51*

*4.0.0.0/32 is subnetted, 1 subnets*

*B 4.4.4.4 [20/0] via 192.168.1.1, 00:28:20*

*192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks*

*C 192.168.1.0/24 is directly connected, GigabitEthernet0/0*

*L 192.168.1.2/32 is directly connected, GigabitEthernet0/0*

*B 192.168.2.0/24 [20/0] via 192.168.1.1, 00:36:29*

*B 192.168.3.0/24 [20/0] via 192.168.1.1, 00:35:56*

*B 192.168.4.0/24 [20/0] via 192.168.1.1, 00:35:56*

*R1#show run*

*hostname R1*

*interface Loopback0*

*ip address 1.1.1.1 255.255.255.255*

*interface GigabitEthernet0/0*

*ip address 192.168.1.2 255.255.255.0*

*duplex auto*

*speed auto*

*router bgp 1*

*bgp log-neighbor-changes*

*network 1.1.1.1 mask 255.255.255.255*

*network 192.168.1.0*

*neighbor 192.168.1.1 remote-as 100*

*end*

***Switch 3 Show Commands and Configurations:***

*S3#show mpls ldp bind*

*lib entry: 1.1.1.1/32, rev 20*

*local binding: label: 205*

*remote binding: lsr: 20.20.20.20:0, label: 206*

*lib entry: 2.2.2.2/32, rev 22*

*local binding: label: 206*

*remote binding: lsr: 20.20.20.20:0, label: 207*

*lib entry: 3.3.3.3/32, rev 24*

*local binding: label: 207*

*remote binding: lsr: 20.20.20.20:0, label: 208*

*lib entry: 4.4.4.4/32, rev 26*

*local binding: label: 208*

*remote binding: lsr: 20.20.20.20:0, label: 209*

*lib entry: 10.10.10.10/32, rev 2*

*local binding: label: 200*

*remote binding: lsr: 20.20.20.20:0, label: 200*

*lib entry: 20.20.20.20/32, rev 4*

*local binding: label: 201*

*remote binding: lsr: 20.20.20.20:0, label: imp-null*

*lib entry: 30.30.30.30/32, rev 6*

*local binding: label: imp-null*

*remote binding: lsr: 20.20.20.20:0, label: 203*

*lib entry: 172.16.10.0/24, rev 8*

*local binding: label: 202*

*remote binding: lsr: 20.20.20.20:0, label: imp-null*

*lib entry: 172.16.20.0/24, rev 10*

*local binding: label: imp-null*

*remote binding: lsr: 20.20.20.20:0, label: imp-null*

*lib entry: 192.168.1.0/24, rev 12*

*local binding: label: 203*

*remote binding: lsr: 20.20.20.20:0, label: 201*

*lib entry: 192.168.2.0/24, rev 14*

*local binding: label: 204*

*remote binding: lsr: 20.20.20.20:0, label: 202*

*lib entry: 192.168.3.0/24, rev 18*

*local binding: label: imp-null*

*remote binding: lsr: 20.20.20.20:0, label: 205*

*lib entry: 192.168.4.0/24, rev 16*

*local binding: label: imp-null*

*remote binding: lsr: 20.20.20.20:0, label: 204*

*S3#show mpls ldp neigh*

*Peer LDP Ident: 20.20.20.20:0; Local LDP Ident 30.30.30.30:0*

*TCP connection: 20.20.20.20.646 - 30.30.30.30.53728*

*State: Oper; Msgs sent/rcvd: 58/57; Downstream*

*Up time: 00:35:50*

*LDP discovery sources:*

*GigabitEthernet1/1/1, Src IP addr: 172.16.20.1*

*Addresses bound to peer LDP Ident:*

*20.20.20.20 172.16.10.2 172.16.20.1*

*S3#show mpls forw*

*Local Outgoing Prefix Bytes Label Outgoing Next Hop*

*Label Label or Tunnel Id Switched interface*

*200 200 10.10.10.10/32 0 Gi1/1/1 172.16.20.1*

*201 Pop Label 20.20.20.20/32 0 Gi1/1/1 172.16.20.1*

*202 Pop Label 172.16.10.0/24 0 Gi1/1/1 172.16.20.1*

*203 201 192.168.1.0/24 0 Gi1/1/1 172.16.20.1*

*204 202 192.168.2.0/24 0 Gi1/1/1 172.16.20.1*

*205 206 1.1.1.1/32 0 Gi1/1/1 172.16.20.1*

*206 207 2.2.2.2/32 0 Gi1/1/1 172.16.20.1*

*207 No Label 3.3.3.3/32 0 Fa1/0/1 192.168.3.2*

*208 No Label 4.4.4.4/32 610 Fa1/0/2 192.168.4.2*

*S3#show ip route*

*Codes: L - local, C - connected, S - static, 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*

*i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2*

*ia - IS-IS inter area, \* - candidate default, U - per-user static route*

*o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP*

*+ - replicated route, % - next hop override*

*Gateway of last resort is not set*

*1.0.0.0/32 is subnetted, 1 subnets*

*O E2 1.1.1.1 [110/1] via 172.16.20.1, 00:27:44, GigabitEthernet1/1/1*

*2.0.0.0/32 is subnetted, 1 subnets*

*O E2 2.2.2.2 [110/1] via 172.16.20.1, 00:27:14, GigabitEthernet1/1/1*

*3.0.0.0/32 is subnetted, 1 subnets*

*B 3.3.3.3 [20/0] via 192.168.3.2, 00:27:14*

*4.0.0.0/32 is subnetted, 1 subnets*

*B 4.4.4.4 [20/0] via 192.168.4.2, 00:27:14*

*10.0.0.0/32 is subnetted, 1 subnets*

*O 10.10.10.10 [110/3] via 172.16.20.1, 00:35:32, GigabitEthernet1/1/1*

*20.0.0.0/32 is subnetted, 1 subnets*

*O 20.20.20.20 [110/2] via 172.16.20.1, 00:35:32, GigabitEthernet1/1/1*

*S3#show run*

*hostname S3*

*no aaa new-model*

*system mtu routing 1500*

*ip routing*

*no ip domain-lookup*

*vtp domain CCNP*

*vtp mode transparent*

*mpls label range 200 299*

*mpls label protocol ldp*

*spanning-tree mode pvst*

*spanning-tree extend system-id*

*interface Loopback0*

*ip address 30.30.30.30 255.255.255.255*

*interface FastEthernet1/0/1*

*no switchport*

*ip address 192.168.3.1 255.255.255.0*

*interface FastEthernet1/0/2*

*no switchport*

*ip address 192.168.4.1 255.255.255.0*

*interface GigabitEthernet1/1/1*

*no switchport*

*ip address 172.16.20.2 255.255.255.0*

*speed auto 1000*

*mpls label protocol ldp*

*mpls ip*

*interface GigabitEthernet1/1/2*

*no switchport*

*ip address 172.16.20.1 255.255.255.0*

*speed auto 1000*

*mpls label protocol ldp*

*mpls ip*

*router ospf 1*

*redistribute bgp 100 subnets*

*network 30.30.30.30 0.0.0.0 area 0*

*network 172.16.20.0 0.0.0.255 area 0*

*router bgp 100*

*bgp log-neighbor-changes*

*network 192.168.3.0*

*network 192.168.4.0*

*neighbor 10.10.10.10 remote-as 100*

*neighbor 10.10.10.10 update-source Loopback0*

*neighbor 192.168.3.2 remote-as 3*

*neighbor 192.168.3.2 default-originate*

*neighbor 192.168.4.2 remote-as 4*

*neighbor 192.168.4.2 default-originate*

*no auto-summary*

*mpls ldp router-id Loopback0 force*

*monitor session 1 source interface Fa1/0/1 - 2*

*monitor session 1 source interface Gi1/1/1*

*monitor session 1 destination interface Fa1/0/3*

*end*

***S2 Show commands and Congigurations:***

*S2#show mpls ldp bind*

*lib entry: 1.1.1.1/32, rev 20*

*local binding: label: 206*

*remote binding: lsr: 10.10.10.10:0, label: 205*

*remote binding: lsr: 30.30.30.30:0, label: 205*

*lib entry: 2.2.2.2/32, rev 22*

*local binding: label: 207*

*remote binding: lsr: 30.30.30.30:0, label: 206*

*remote binding: lsr: 10.10.10.10:0, label: 206*

*lib entry: 3.3.3.3/32, rev 24*

*local binding: label: 208*

*remote binding: lsr: 30.30.30.30:0, label: 207*

*remote binding: lsr: 10.10.10.10:0, label: 207*

*lib entry: 4.4.4.4/32, rev 26*

*local binding: label: 209*

*remote binding: lsr: 30.30.30.30:0, label: 208*

*remote binding: lsr: 10.10.10.10:0, label: 208*

*lib entry: 10.10.10.10/32, rev 2*

*local binding: label: 200*

*remote binding: lsr: 10.10.10.10:0, label: imp-null*

*remote binding: lsr: 30.30.30.30:0, label: 200*

*lib entry: 20.20.20.20/32, rev 4*

*local binding: label: imp-null*

*remote binding: lsr: 10.10.10.10:0, label: 200*

*remote binding: lsr: 30.30.30.30:0, label: 201*

*lib entry: 30.30.30.30/32, rev 14*

*local binding: label: 203*

*remote binding: lsr: 30.30.30.30:0, label: imp-null*

*remote binding: lsr: 10.10.10.10:0, label: 202*

*lib entry: 172.16.10.0/24, rev 6*

*local binding: label: imp-null*

*remote binding: lsr: 10.10.10.10:0, label: imp-null*

*remote binding: lsr: 30.30.30.30:0, label: 202*

*lib entry: 172.16.20.0/24, rev 8*

*local binding: label: imp-null*

*remote binding: lsr: 10.10.10.10:0, label: 201*

*remote binding: lsr: 30.30.30.30:0, label: imp-null*

*lib entry: 192.168.1.0/24, rev 10*

*local binding: label: 201*

*remote binding: lsr: 10.10.10.10:0, label: imp-null*

*remote binding: lsr: 30.30.30.30:0, label: 203*

*lib entry: 192.168.2.0/24, rev 12*

*local binding: label: 202*

*remote binding: lsr: 10.10.10.10:0, label: imp-null*

*remote binding: lsr: 30.30.30.30:0, label: 204*

*lib entry: 192.168.3.0/24, rev 18*

*local binding: label: 205*

*remote binding: lsr: 10.10.10.10:0, label: 204*

*remote binding: lsr: 30.30.30.30:0, label: imp-null*

*lib entry: 192.168.4.0/24, rev 16*

*local binding: label: 204*

*remote binding: lsr: 30.30.30.30:0, label: imp-null*

*remote binding: lsr: 10.10.10.10:0, label: 203*

*S2#show mpls ldp neigh*

*Peer LDP Ident: 10.10.10.10:0; Local LDP Ident 20.20.20.20:0*

*TCP connection: 10.10.10.10.646 - 20.20.20.20.47613*

*State: Oper; Msgs sent/rcvd: 55/55; Downstream*

*Up time: 00:34:21*

*LDP discovery sources:*

*GigabitEthernet1/1/1, Src IP addr: 172.16.10.1*

*Addresses bound to peer LDP Ident:*

*10.10.10.10 192.168.1.1 192.168.2.1 172.16.10.1*

*Peer LDP Ident: 30.30.30.30:0; Local LDP Ident 20.20.20.20:0*

*TCP connection: 30.30.30.30.53728 - 20.20.20.20.646*

*State: Oper; Msgs sent/rcvd: 55/56; Downstream*

*Up time: 00:34:06*

*LDP discovery sources:*

*GigabitEthernet1/1/2, Src IP addr: 172.16.20.2*

*Addresses bound to peer LDP Ident:*

*30.30.30.30 192.168.4.1 172.16.20.2 192.168.3.1*

*S2#show mpls forw*

*Local Outgoing Prefix Bytes Label Outgoing Next Hop*

*Label Label or Tunnel Id Switched interface*

*200 Pop Label 10.10.10.10/32 5747 Gi1/1/1 172.16.10.1*

*201 Pop Label 192.168.1.0/24 590 Gi1/1/1 172.16.10.1*

*202 Pop Label 192.168.2.0/24 590 Gi1/1/1 172.16.10.1*

*203 Pop Label 30.30.30.30/32 5824 Gi1/1/2 172.16.20.2*

*204 Pop Label 192.168.4.0/24 590 Gi1/1/2 172.16.20.2*

*205 Pop Label 192.168.3.0/24 0 Gi1/1/2 172.16.20.2*

*206 205 1.1.1.1/32 0 Gi1/1/1 172.16.10.1*

*207 206 2.2.2.2/32 0 Gi1/1/1 172.16.10.1*

*208 207 3.3.3.3/32 0 Gi1/1/2 172.16.20.2*

*209 208 4.4.4.4/32 610 Gi1/1/2 172.16.20.2*

*S2#show ip route*

*Codes: L - local, C - connected, S - static, 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*

*i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2*

*ia - IS-IS inter area, \* - candidate default, U - per-user static route*

*o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP*

*+ - replicated route, % - next hop override*

*Gateway of last resort is not set*

*1.0.0.0/32 is subnetted, 1 subnets*

*O E2 1.1.1.1 [110/1] via 172.16.10.1, 00:26:01, GigabitEthernet1/1/1*

*2.0.0.0/32 is subnetted, 1 subnets*

*O E2 2.2.2.2 [110/1] via 172.16.10.1, 00:25:30, GigabitEthernet1/1/1*

*3.0.0.0/32 is subnetted, 1 subnets*

*O E2 3.3.3.3 [110/1] via 172.16.20.2, 00:25:30, GigabitEthernet1/1/2*

*4.0.0.0/32 is subnetted, 1 subnets*

*O E2 4.4.4.4 [110/1] via 172.16.20.2, 00:25:30, GigabitEthernet1/1/2*

*10.0.0.0/32 is subnetted, 1 subnets*

*O 10.10.10.10 [110/2] via 172.16.10.1, 00:34:04, GigabitEthernet1/1/1*

*20.0.0.0/32 is subnetted, 1 subnets*

*C 20.20.20.20 is directly connected, Loopback0*

*30.0.0.0/32 is subnetted, 1 subnets*

*O 30.30.30.30 [110/2] via 172.16.20.2, 00:33:48, GigabitEthernet1/1/2*

*172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks*

*C 172.16.10.0/24 is directly connected, GigabitEthernet1/1/1*

*L 172.16.10.2/32 is directly connected, GigabitEthernet1/1/1*

*C 172.16.20.0/24 is directly connected, GigabitEthernet1/1/2*

*L 172.16.20.1/32 is directly connected, GigabitEthernet1/1/2*

*O E2 192.168.1.0/24 [110/1] via 172.16.10.1, 00:34:04, GigabitEthernet1/1/1*

*O E2 192.168.2.0/24 [110/1] via 172.16.10.1, 00:34:04, GigabitEthernet1/1/1*

*O E2 192.168.3.0/24 [110/1] via 172.16.20.2, 00:33:33, GigabitEthernet1/1/2*

*O E2 192.168.4.0/24 [110/1] via 172.16.20.2, 00:33:45, GigabitEthernet1/1/2*

*S2#show run*

*hostname S2*

*no aaa new-model*

*system mtu routing 1500*

*ip routing*

*mpls label range 200 299*

*mpls label protocol ldp*

*spanning-tree mode pvst*

*spanning-tree extend system-id*

*interface Loopback0*

*ip address 20.20.20.20 255.255.255.255*

*interface GigabitEthernet1/1/1*

*no switchport*

*ip address 172.16.10.2 255.255.255.0*

*speed auto 1000*

*mpls label protocol ldp*

*mpls ip*

*interface GigabitEthernet1/1/2*

*no switchport*

*ip address 172.16.20.1 255.255.255.0*

*speed auto 1000*

*mpls label protocol ldp*

*mpls ip*

*router ospf 1*

*network 20.20.20.20 0.0.0.0 area 0*

*network 172.16.10.0 0.0.0.255 area 0*

*network 172.16.20.0 0.0.0.255 area 0*

*mpls ldp router-id Loopback0 force*

*monitor session 1 source interface Gi1/1/1 - 2*

*monitor session 1 destination interface Fa1/0/3*

*end*

***Switch 1 show commands and configurations:***

*S1#show mpls ldp bind*

*lib entry: 1.1.1.1/32, rev 20*

*local binding: label: 205*

*remote binding: lsr: 20.20.20.20:0, label: 206*

*lib entry: 2.2.2.2/32, rev 22*

*local binding: label: 206*

*remote binding: lsr: 20.20.20.20:0, label: 207*

*lib entry: 3.3.3.3/32, rev 24*

*local binding: label: 207*

*remote binding: lsr: 20.20.20.20:0, label: 208*

*lib entry: 4.4.4.4/32, rev 26*

*local binding: label: 208*

*remote binding: lsr: 20.20.20.20:0, label: 209*

*lib entry: 10.10.10.10/32, rev 2*

*local binding: label: imp-null*

*remote binding: lsr: 20.20.20.20:0, label: 200*

*lib entry: 20.20.20.20/32, rev 10*

*local binding: label: 200*

*remote binding: lsr: 20.20.20.20:0, label: imp-null*

*lib entry: 30.30.30.30/32, rev 15*

*local binding: label: 202*

*remote binding: lsr: 20.20.20.20:0, label: 203*

*lib entry: 172.16.10.0/24, rev 4*

*local binding: label: imp-null*

*remote binding: lsr: 20.20.20.20:0, label: imp-null*

*lib entry: 172.16.20.0/24, rev 12*

*local binding: label: 201*

*remote binding: lsr: 20.20.20.20:0, label: imp-null*

*lib entry: 192.168.1.0/24, rev 6*

*local binding: label: imp-null*

*remote binding: lsr: 20.20.20.20:0, label: 201*

*lib entry: 192.168.2.0/24, rev 8*

*local binding: label: imp-null*

*remote binding: lsr: 20.20.20.20:0, label: 202*

*lib entry: 192.168.3.0/24, rev 18*

*local binding: label: 204*

*remote binding: lsr: 20.20.20.20:0, label: 205*

*lib entry: 192.168.4.0/24, rev 16*

*local binding: label: 203*

*remote binding: lsr: 20.20.20.20:0, label: 204*

*S1#show mpls ldp neigh*

*Peer LDP Ident: 20.20.20.20:0; Local LDP Ident 10.10.10.10:0*

*TCP connection: 20.20.20.20.47613 - 10.10.10.10.646*

*State: Oper; Msgs sent/rcvd: 53/53; Downstream*

*Up time: 00:32:50*

*LDP discovery sources:*

*GigabitEthernet1/1/1, Src IP addr: 172.16.10.2*

*Addresses bound to peer LDP Ident:*

*20.20.20.20 172.16.10.2 172.16.20.1*

*S1#show mpls forw*

*Local Outgoing Prefix Bytes Label Outgoing Next Hop*

*Label Label or Tunnel Id Switched interface*

*200 Pop Label 20.20.20.20/32 0 Gi1/1/1 172.16.10.2*

*201 Pop Label 172.16.20.0/24 0 Gi1/1/1 172.16.10.2*

*202 203 30.30.30.30/32 0 Gi1/1/1 172.16.10.2*

*203 204 192.168.4.0/24 0 Gi1/1/1 172.16.10.2*

*204 205 192.168.3.0/24 0 Gi1/1/1 172.16.10.2*

*205 No Label 1.1.1.1/32 0 Fa1/0/1 192.168.1.2*

*206 No Label 2.2.2.2/32 0 Fa1/0/2 192.168.2.2*

*207 208 3.3.3.3/32 0 Gi1/1/1 172.16.10.2*

*208 209 4.4.4.4/32 0 Gi1/1/1 172.16.10.2*

*S1#show ip route*

*Codes: L - local, C - connected, S - static, 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*

*i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2*

*ia - IS-IS inter area, \* - candidate default, U - per-user static route*

*o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP*

*+ - replicated route, % - next hop override*

*Gateway of last resort is not set*

*1.0.0.0/32 is subnetted, 1 subnets*

*B 1.1.1.1 [20/0] via 192.168.1.2, 00:24:26*

*2.0.0.0/32 is subnetted, 1 subnets*

*B 2.2.2.2 [20/0] via 192.168.2.2, 00:23:55*

*3.0.0.0/32 is subnetted, 1 subnets*

*O E2 3.3.3.3 [110/1] via 172.16.10.2, 00:23:55, GigabitEthernet1/1/1*

*4.0.0.0/32 is subnetted, 1 subnets*

*O E2 4.4.4.4 [110/1] via 172.16.10.2, 00:23:55, GigabitEthernet1/1/1*

*10.0.0.0/32 is subnetted, 1 subnets*

*C 10.10.10.10 is directly connected, Loopback0*

*20.0.0.0/32 is subnetted, 1 subnets*

*O 20.20.20.20 [110/2] via 172.16.10.2, 00:32:29, GigabitEthernet1/1/1*

*30.0.0.0/32 is subnetted, 1 subnets*

*O 30.30.30.30 [110/3] via 172.16.10.2, 00:32:03, GigabitEthernet1/1/1*

*172.16.0.0/16 is variably subnetted, 3 subnets, 2 masks*

*C 172.16.10.0/24 is directly connected, GigabitEthernet1/1/1*

*L 172.16.10.1/32 is directly connected, GigabitEthernet1/1/1*

*O 172.16.20.0/24*

*[110/2] via 172.16.10.2, 00:32:13, GigabitEthernet1/1/1*

*192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks*

*C 192.168.1.0/24 is directly connected, FastEthernet1/0/1*

*L 192.168.1.1/32 is directly connected, FastEthernet1/0/1*

*192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks*

*C 192.168.2.0/24 is directly connected, FastEthernet1/0/2*

*L 192.168.2.1/32 is directly connected, FastEthernet1/0/2*

*O E2 192.168.3.0/24 [110/1] via 172.16.10.2, 00:31:58, GigabitEthernet1/1/1*

*O E2 192.168.4.0/24 [110/1] via 172.16.10.2, 00:32:03, GigabitEthernet1/1/1*

*hostname S1*

*no aaa new-model*

*system mtu routing 1500*

*ip routing*

*spanning-tree mode pvst*

*spanning-tree extend system-id*

*interface Loopback0*

*ip address 10.10.10.10 255.255.255.255*

*interface FastEthernet1/0/1*

*no switchport*

*ip address 192.168.1.1 255.255.255.0*

*interface FastEthernet1/0/2*

*no switchport*

*ip address 192.168.2.1 255.255.255.0*

*interface GigabitEthernet1/1/1*

*no switchport*

*ip address 172.16.10.1 255.255.255.0*

*speed auto 1000*

*mpls label protocol ldp*

*mpls ip*

*router ospf 1*

*redistribute bgp 100 subnets*

*network 10.10.10.10 0.0.0.0 area 0*

*network 172.16.10.0 0.0.0.255 area 0*

*router bgp 100*

*bgp log-neighbor-changes*

*network 192.168.1.0*

*network 192.168.2.0*

*neighbor 30.30.30.30 remote-as 100*

*neighbor 30.30.30.30 update-source Loopback0*

*neighbor 192.168.1.2 remote-as 1*

*neighbor 192.168.1.2 default-originate*

*neighbor 192.168.2.2 remote-as 2*

*neighbor 192.168.2.2 default-originate*

*no auto-summary*

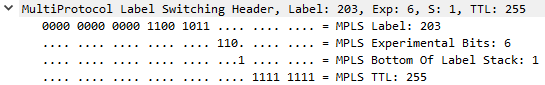
*mpls ldp router-id Loopback0 force*

*monitor session 1 source interface Fa1/0/1 - 2*

*monitor session 1 source interface Gi1/1/1*

*monitor session 1 destination interface Fa1/0/3*

*end*

****

**Problems:**

I ran into a few problems during this lab, first was that I didn’t realize that I was missing a router to my loopback interface in my ospf 1 network commands, because when I made lo0 the router id, the ldp didn’t know how to get there to make neighbors, but after adding it, it fixed itself. I also tried with ospf and eigrp but in the end bgp and ospf did the trick.

**Conclusion:**

This is going to be useful for going into the CCNP certification test and for future reference. This one took a bit longer then I thought it would. Although im not sure how much im going to be using MPLS in the future, I hope I remember how to do it.