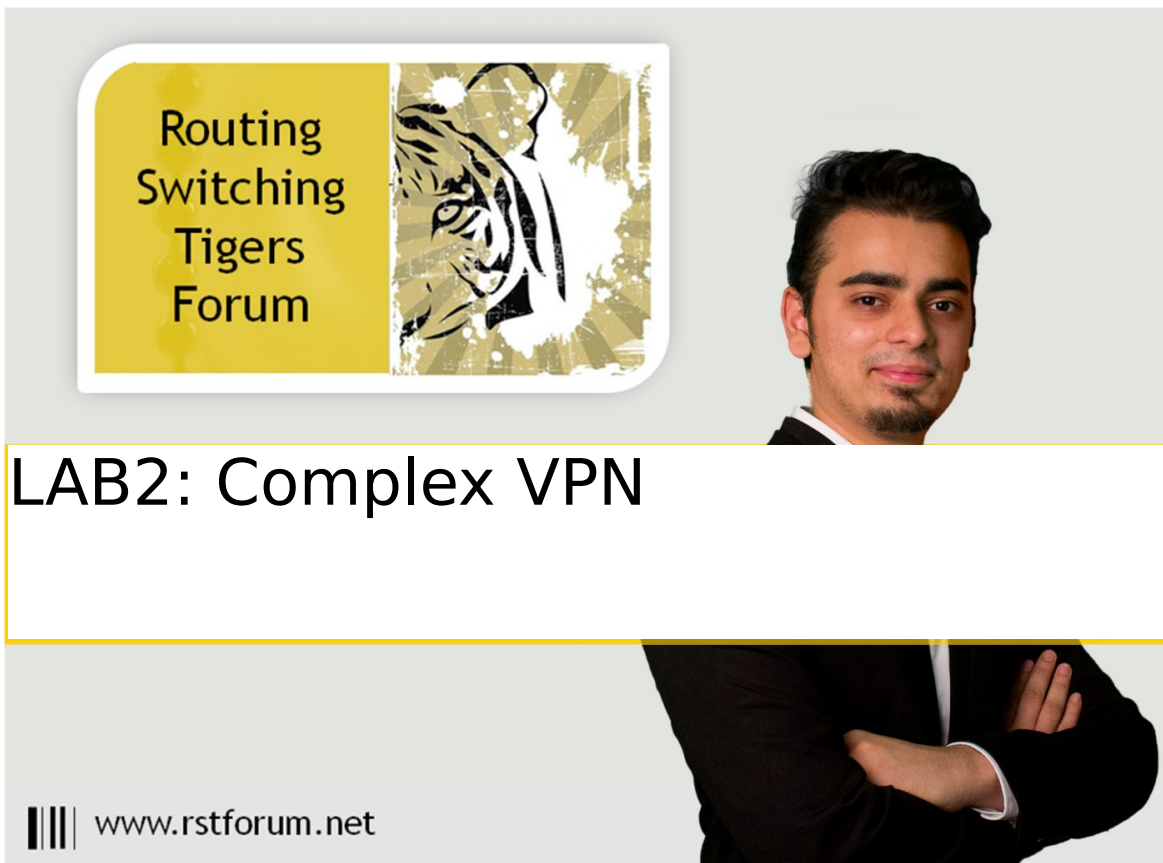# LAB2: MPLS

Disclaimer

This Configuration Guide is designed to assist members to enhance their skills in respective technology area. While every effort has been made to ensure that all material is as complete and accurate as possible, the enclosed material is presented on an "as is" basis. Neither the authors nor Forum assume any liability or responsibility to any person or entity with respect to loss or damages incurred from the information contained in this guide. This Lab Guide was developed by RSTForum. Any similarities between material presented in this configuration guide and any other material is completely coincidental.
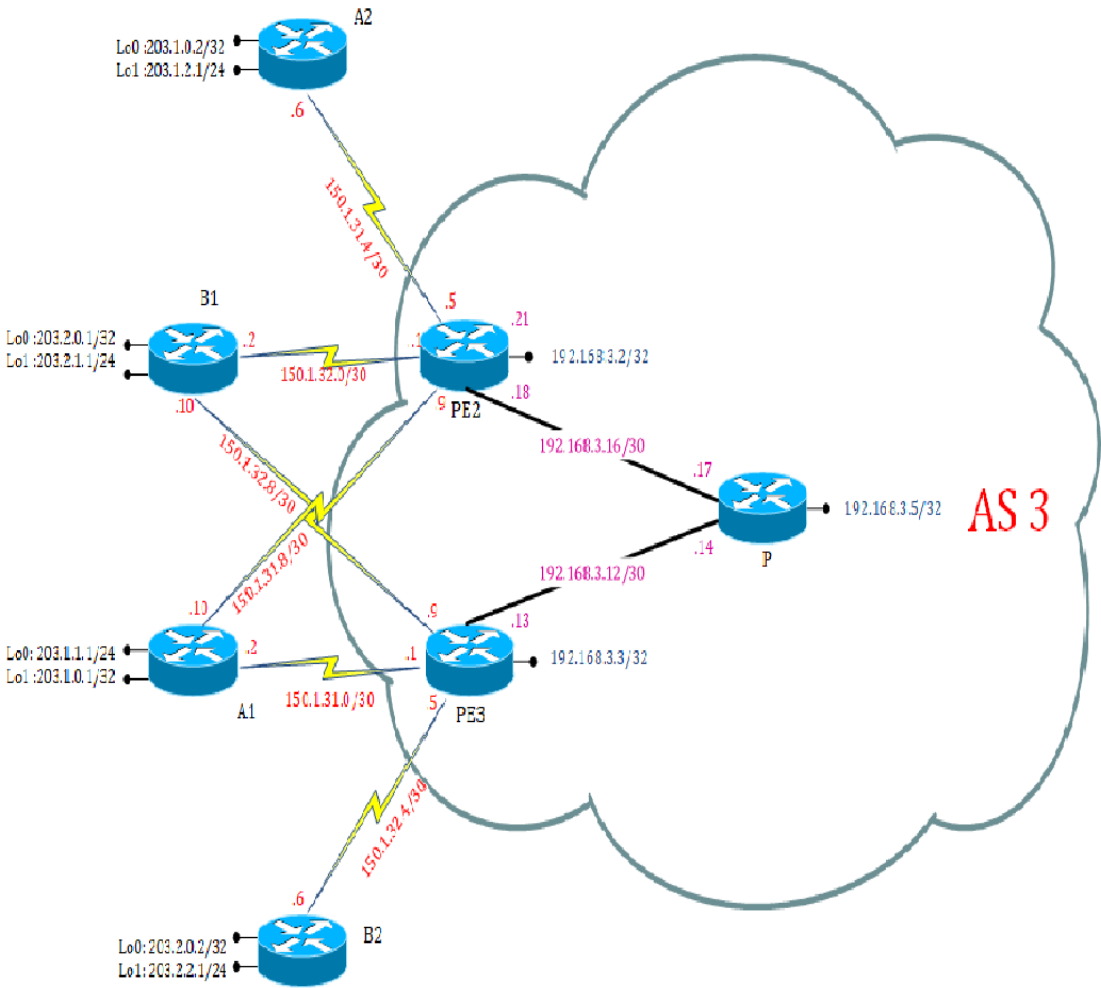
Routing
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LAB2: Complex VPN

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LAB 2: Diagram

Note: This Lab was developed on Cisco IOS Version15.2(4) M1 ADVENTERPRISEK9-M.

LAB 2: Complex MPLS VPN with OSPF on CE-PE routers

Task 1: Basic configuration on (CE) customer-edge routers.

A1:
interface Loopback0
 ip address 203.1.1.1 255.255.255.0
 exit
interface Loopback1
 ip address 203.1.0.1 255.255.255.255
 exit
interface Serial1/1
 description "Link to PE3"
 ip address 150.1.31.2 255.255.255.252
 no shutdown
 exit
interface Serial1/2
 description "Link to PE2"
 ip address 150.1.31.10 255.255.255.252
 no shutdown
 exit
router ospf 3
 network 150.1.31.0 255.255.255.0 area 0
 network 203.1.0.0 255.255.0.0 area 0
 exit

A2:
interface Loopback0
 ip address 203.1.0.2 255.255.255.255
 exit
interface Loopback1
 ip address 203.1.2.1 255.255.255.0
 exit
interface Serial1/0
 description "Link to PE2"
 ip address 150.1.31.6 255.255.255.252
 no shutdown
 exit
router ospf 3
 network 150.1.0.0 255.255.0.0 area 0

network 203.1.0.0 255.255.0.0 area 0
exit

B1:
interface Loopback0
 ip address 203.2.0.1 255.255.255.255
 exit
interface Loopback1
 ip address 203.2.1.1 255.255.255.0
 exit
interface Serial1/0
 description "Link to PE3"
 ip address 150.1.32.10 255.255.255.252
 no shutdown
 exit
interface Serial1/1
 description "Link to PE2"
 ip address 150.1.32.2 255.255.255.252
 no shutdown
 exit
 router ospf 4
 network 150.1.0.0 255.255.0.0 area 0
 network 203.2.0.0 255.255.0.0 area 0
 exit

B2:
interface Loopback0
 ip address 203.2.0.2 255.255.255.255
 exit
interface Loopback1
 ip address 203.2.2.1 255.255.255.0
 exit
interface Serial1/2
 description "Link to PE3"
 ip address 150.1.32.6 255.255.255.252
 no shutdown
 exit
router ospf 4
 network 203.2.0.0 255.255.0.0 area 0
 network 150.1.0.0 255.255.0.0 area 0
 exit

Task 2: Basic configuration of OSPF and MPLS setup on all PE and P routers.

```
PE2:
ip cef
mpls label protocol ldp
no mpls ip propagate-ttl
interface Loopback0
 ip address 192.168.3.2 255.255.255.255
 exit
interface Ethernet0/0
 description "Link to P"
 ip address 192.168.3.18 255.255.255.252
 no shutdown
 mpls ip
 exit
interface Serial1/0
 description "Link to A2"
  ip address 150.1.31.5 255.255.255.252
 no shutdown
 exit
interface Serial1/1
 description "Link to B1"
  ip address 150.1.32.1 255.255.255.252
  no shutdown
  exit
interface Serial1/2
 description "Link to A1"
  ip address 150.1.31.9 255.255.255.252
  no shutdown
 exit
router ospf 64
 network 192.168.0.0 255.255.0.0 area 0
 exit

PE3:
ip cef
mpls label protocol ldp
no mpls ip propagate-ttl
interface Loopback0
 ip address 192.168.3.3 255.255.255.255
 exit
interface Ethernet0/1
```

```
description "link to P"
ip address 192.168.3.13 255.255.255.252
no shutdown
mpls ip
interface Serial1/0
description "link to B1"
ip address 150.1.32.9 255.255.255.252
no shutdown
exit
interface Serial1/1
description "Link to A1"
 ip address 150.1.31.1 255.255.255.252
 no shutdown
 exit
interface Serial1/2
description "link to B2"
ip address 150.1.32.5 255.255.255.252
no shutdown
exit
router ospf 64
 network 192.168.0.0 255.255.0.0 area 0
 exit

P:
ip cef
mpls label protocol ldp
no mpls ip propagate-ttl
interface Loopback0
 ip address 192.168.3.5 255.255.255.255
 exit
interface Ethernet0/0
 description "Link to PE2"
ip address 192.168.3.17 255.255.255.252
no shutdown
 mpls ip
 exit
interface Ethernet0/1
 description "Link to PE3"
ip address 192.168.3.14 255.255.255.252
 no shutdown
 mpls ip
 exit

router ospf 64
```

network 192.168.0.0 255.255.0.0 area 0
exit

Task 3: Configure Multi-protocol BGP between provider-edge (PE) routers.

Step1: Enable BGP and activate VPNv4 BGP sessions on all PE routers in your Service Provider backbone.

```
PE2:
router bgp 3
 bgp log-neighbor-changes
 neighbor 192.168.3.3 remote-as 3
 neighbor 192.168.3.3 update-source Loopback0
 address-family ipv4
 no auto-summary
 no synchronization
 neighbor 192.168.3.3 activate
 network 192.168.3.2 mask 255.255.255.255
 exit-address-family
  address-family vpnv4
  neighbor 192.168.3.3 activate
  neighbor 192.168.3.3 send-community extended
 exit-address-family
 exit

PE3:
router bgp 3
 bgp log-neighbor-changes
 neighbor 192.168.3.2 remote-as 3
 neighbor 192.168.3.2 update-source Loopback0
  address-family ipv4
  network 192.168.3.3 mask 255.255.255.255
  neighbor 192.168.3.2 activate
 exit-address-family
 address-family vpnv4
  neighbor 192.168.3.2 activate
  neighbor 192.168.3.2 send-community extended
 exit-address-family
 exit
```

Task 3: Create the virtual private network (VRF) on provider edge.

PE2:
ip vrf a
 rd 3:1
 route-target both 3:1
 exit
ip vrf a_central
 rd 3:11
 route-target both 3:1
 route-target both 3:30
 exit
ip vrf b_central
 rd 3:21
 route-target both 3:2
 route-target both 3:30
 exit

PE3:
ip vrf a_central
 rd 3:11
 route-target both 3:1
 route-target both 3:30
 exit
ip vrf b
 rd 3:2
 route-target both 3:2
 exit
ip vrf b_central
 rd 3:21
 route-target both 3:2
 route-target both 3:30
 exit

Task 4: Create VRFs on A1, A2, B1, B2's interfaces between PE-CE links.

Note: "ip vrf forwarding name" command removes the ip address from interface, so ip address need to be re-configured.

PE2:
interface Serial1/0
 ip vrf forwarding a
 ip address 150.1.31.5 255.255.255.252
 exit
interface Serial1/1
 ip vrf forwarding b_central
 ip address 150.1.32.1 255.255.255.252
 exit
interface Serial1/2
 ip vrf forwarding a_central
 ip address 150.1.31.9 255.255.255.252
 exit

PE3:
interface Serial1/0
 ip vrf forwarding b_central
 ip address 150.1.32.9 255.255.255.252
 exit
interface Serial1/1
 ip vrf forwarding a_central
 ip address 150.1.31.1 255.255.255.252
 exit
interface Serial1/2
 ip vrf forwarding b
 ip address 150.1.32.5 255.255.255.252
 exit

Task 5: Configure BGP on CE router.

A1:
```
router bgp 3
 bgp log-neighbor-changes
 redistribute connected
 neighbor 150.1.31.1 remote-as 3
 neighbor 150.1.31.1 allowas-in
 neighbor 150.1.31.9 remote-as 3
 neighbor 150.1.31.9 allowas-in
 exit
```

A2:
```
router bgp 2
 bgp log-neighbor-changes
 redistribute connected
 neighbor 150.1.31.5 remote-as 3
 neighbor 150.1.31.5 allowas-in
 exit
```

B1:
```
router bgp 4
 bgp log-neighbor-changes
 redistribute connected
 neighbor 150.1.32.1 remote-as 3
 neighbor 150.1.32.1 allowas-in
 neighbor 150.1.32.9 remote-as 3
 neighbor 150.1.32.9 allowas-in
 exit
```

B2:
```
router bgp 4
 bgp log-neighbor-changes
 redistribute connected
 neighbor 150.1.32.5 remote-as 3
 neighbor 150.1.32.5 allowas-in
 exit
```

Task 6: Configure new VRFs for A1 and B1 re-establish BGP routing

PE2:

```
router bgp 3
address-family ipv4 vrf a
  neighbor 150.1.31.6 remote-as 2
  neighbor 150.1.31.6 activate
  neighbor 150.1.31.6 as-override
 exit-address-family
  address-family ipv4 vrf a_central
  neighbor 150.1.31.10 remote-as 2
  neighbor 150.1.31.10 activate
  neighbor 150.1.31.10 as-override
 exit-address-family
  address-family ipv4 vrf b_central
  neighbor 150.1.32.2 remote-as 4
  neighbor 150.1.32.2 activate
  neighbor 150.1.32.2 as-override
 exit-address-family
 exit
```

PE3:

```
router bgp 3
address-family ipv4 vrf a_central
  neighbor 150.1.31.2 remote-as 2
  neighbor 150.1.31.2 activate
  neighbor 150.1.31.2 as-override
 exit-address-family
  address-family ipv4 vrf b
  neighbor 150.1.32.6 remote-as 4
  neighbor 150.1.32.6 activate
  neighbor 150.1.32.6 as-override
 exit-address-family
  address-family ipv4 vrf b_central
  neighbor 150.1.32.10 remote-as 4
  neighbor 150.1.32.10 activate
  neighbor 150.1.32.10 as-override
 exit-address-family
 exit
```

Verification:

A1#ping 203.2.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.2.0.2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

A1#ping 203.2.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.2.2.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

A1#ping 203.2.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.2.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/16/17
ms

A1#ping 203.2.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.2.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/16/17
ms

A1#ping 203.1.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.1.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 14/16/17
ms

A1#ping 203.1.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.1.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 14/16/17
ms

```
B1#ping 203.1.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.1.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 14/16/17
ms

B1#ping 203.1.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.1.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/16/17
ms

B1#ping 203.1.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.1.0.2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

B1#ping 203.1.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.1.2.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

B1#ping 203.2.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.2.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 17/19/28
ms

B1#ping 203.2.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.2.2.1, timeout is 2 seconds:
```

!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 13/16/17
ms