MPLS Layer–3 VPN

MPLS L3 VPN

- 192.168.0.1/32 — CE-RED-01 — Gi0/0
- Default Route 192.168.200.0/30
- 192.168.1.1/32 — CE-GREEN-01 — Gi0/0 — Static 192.168.201.0/30
- OSPF - 528 192.168.202.0/30 — CE-BLUE-01 — 192.168.2.11/32
- Underlying OSPF PID - 1500 / MP-BGP - 65535
- PE-01 — Gi3, Gi2, Gi1, Gi4, Gi5 — QFP
- 10.24.0.0/30 — Gi0/0/1 / 10.24.255.0/30 — Gi0/0/0
- P-01 — SP MPLS Domain — Gi0/0/0/2, Gi0/0/0/3
- 10.24.0.252/30 / 10.24.255.252/30
- RED - 65535:2 / GREEN - 65535:7 / BLUE - 65535:11
- CE-RED-02 — Gi0/0 — VLAN VLAN-10 192.168.200.252/30 VLAN-11 192.168.200.248/30
- PE-02 — Gi6, Gi1, Gi2, Gi3, Gi4 — QFP
- 192.168.1.2/32 — CE-GREEN-02 — Gi0/0 — Static 192.168.201.252/30
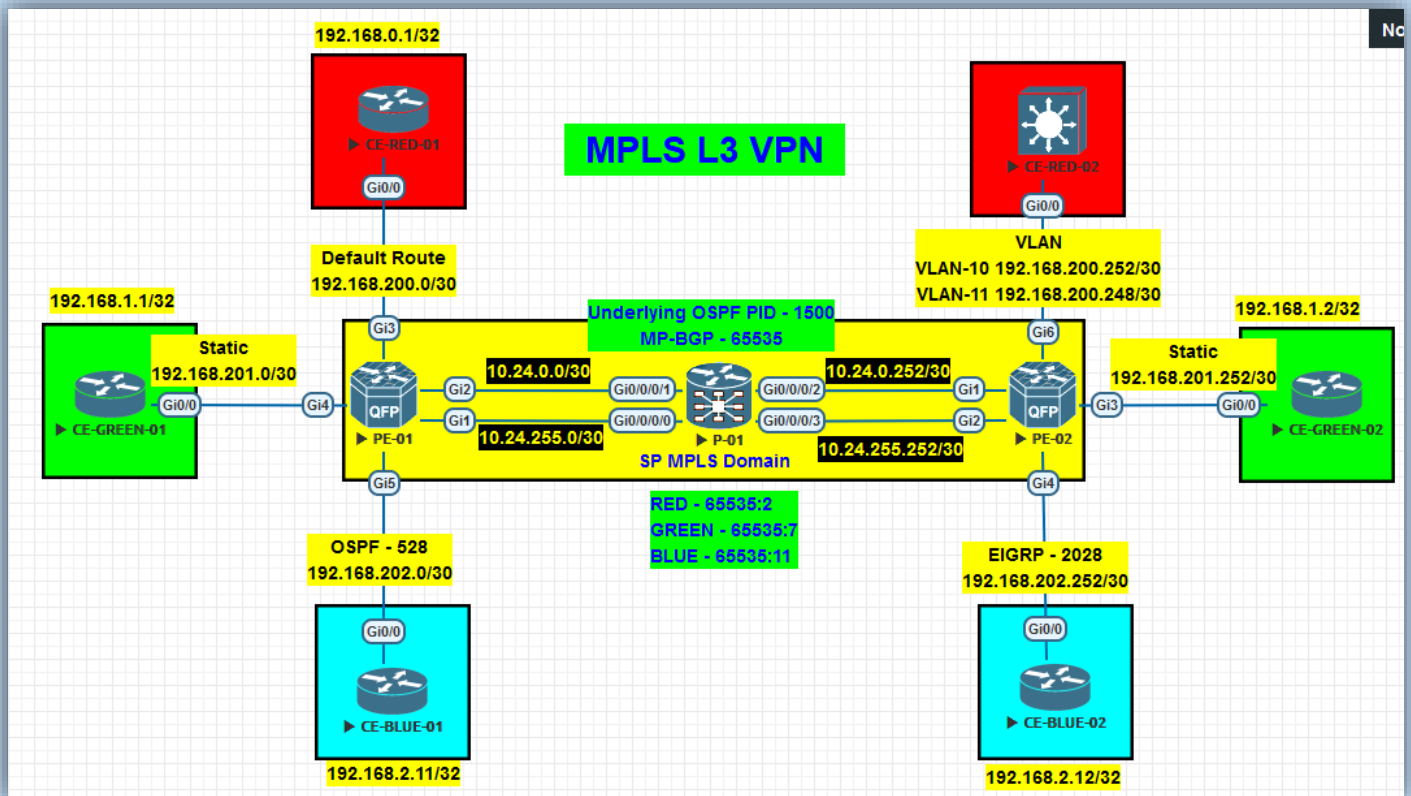- EIGRP - 2028 192.168.202.252/30 — CE-BLUE-02 — Gi0/0 — 192.168.2.12/32

Lab Requirements

1. Run **OSPF** as underlying protocol in Service Provider.
2. Enable **MPLS** in Service Provider.
3. Run **MP–BGP** for route exchange within **VRF**s.
4. Use **OSPF** as PE–CE routing protocol between **CE–BLUE–01** and **PE–01**.
5. Use **EIGRP** as PE-CE routing protocol between **CE–BLUE–02** and **PE–02**.
6. Use **Static Route** as PE–CE routing protocol between **CE–GREEN–01** and **PE–01**, **CE–GREEN–02** and **PE–02**.
7. Use **Default Route** as PE–CE routing protocol between **CE–RED–01** and **PE–01**.
8. Use **Default Route** and **VLAN** as PE–CE routing protocol between **CE–RED–02** and **PE–02**.

OSPF Configuration As Underlying Protocol In Service Provider

<u>PE-01</u>

```
router ospf 1500
 router-id 10.106.0.1
 auto-cost reference-bandwidth 1000
 passive-interface default
 no passive-interface GigabitEthernet1
 no passive-interface GigabitEthernet2
 network 10.24.0.2 0.0.0.0 area 0
 network 10.24.255.2 0.0.0.0 area 0
 network 10.106.0.1 0.0.0.0 area 0
!
```

<u>PE-02</u>

```
router ospf 1500
 router-id 10.106.0.2
 auto-cost reference-bandwidth 1000
 passive-interface default
 no passive-interface GigabitEthernet1
 no passive-interface GigabitEthernet2
 network 10.24.0.254 0.0.0.0 area 0
 network 10.24.255.254 0.0.0.0 area 0
 network 10.106.0.2 0.0.0.0 area 0
!
```

<u>P-01</u>

```
router ospf 1500
 router-id 10.106.0.254
 network point-to-point
 passive enable
 dead-interval 11
 hello-interval 2
 auto-cost reference-bandwidth 1000
```

```
  area 0
   interface Loopback0
   !
   interface GigabitEthernet0/0/0/0
    passive disable
   !
   interface GigabitEthernet0/0/0/1
    passive disable
   !
   interface GigabitEthernet0/0/0/2
    passive disable
   !
   interface GigabitEthernet0/0/0/3
    passive disable
   !
  !
!
```

MP-BGP Configuration In Service Provider

PE-01

```
router bgp 65535
 bgp router-id 10.106.0.1
 neighbor 10.106.0.254 remote-as 65535
 neighbor 10.106.0.254 password 7 1234567890
 neighbor 10.106.0.254 update-source Loopback0
 !
 address-family ipv4
  neighbor 10.106.0.254 activate
 exit-address-family
 !
 address-family vpnv4
```

```
  neighbor 10.106.0.254 activate
  neighbor 10.106.0.254 send-community extended
 exit-address-family
 !
 address-family ipv4 vrf BLUE
  redistribute ospf 528 match internal external 1 external 2
 exit-address-family
 !
 address-family ipv4 vrf GREEN
  redistribute static
 exit-address-family
 !
 address-family ipv4 vrf RED
  redistribute static
  default-information originate
 exit-address-family
 !
```

PE-02
```
router bgp 65535
 bgp router-id 10.106.0.2
 bgp log-neighbor-changes
 neighbor 10.106.0.254 remote-as 65535
 neighbor 10.106.0.254 password 7 1234567890
 neighbor 10.106.0.254 update-source Loopback0
 !
 address-family ipv4
  neighbor 10.106.0.254 activate
 exit-address-family
 !
 address-family vpnv4
  neighbor 10.106.0.254 activate
```

```
  neighbor 10.106.0.254 send-community extended
 exit-address-family
 !
 address-family ipv4 vrf BLUE
  redistribute eigrp 2028
 exit-address-family
 !
 address-family ipv4 vrf GREEN
  redistribute static
 exit-address-family
 !
 address-family ipv4 vrf RED
  redistribute connected
 exit-address-family
!
```

P-01

```
router bgp 65535
 bgp router-id 10.106.0.254
 address-family ipv4 unicast
 !
 address-family vpnv4 unicast
 !
 neighbor-group IBGP-RR
  remote-as 65535
  password encrypted 1234567890
  update-source Loopback0
  address-family ipv4 unicast
   route-reflector-client
  !
  address-family vpnv4 unicast
   route-reflector-client
```

```
 !
 !
 neighbor 10.106.0.1
  use neighbor-group IBGP-RR
  description PE-01
 !
 neighbor 10.106.0.2
  use neighbor-group IBGP-RR
  description PE-02
 !
!
```

VRF Configurations In PEs

PE-01

```
ip vrf BLUE
 rd 65535:11
 route-target export 65535:11
 route-target import 65535:11
!
ip vrf GREEN
 rd 65535:7
 route-target export 65535:7
 route-target import 65535:7
!
ip vrf RED
 rd 65535:2
 route-target export 65535:2
 route-target import 65535:2
!
```

PE-02

```
ip vrf BLUE
```

```
 rd 65535:11
 route-target export 65535:11
 route-target import 65535:11
!
ip vrf GREEN
 rd 65535:7
 route-target export 65535:7
 route-target import 65535:7
!
ip vrf RED
 rd 65535:2
 route-target export 65535:2
 route-target import 65535:2
!
```

PE-CE Routing Between CE-RED-01 And PE-01

PE-01

```
interface GigabitEthernet3
 ip vrf forwarding RED
 ip address 192.168.200.1 255.255.255.252
!
ip route vrf RED 0.0.0.0 0.0.0.0 192.168.200.2
!
```

CE-RED-01

```
interface Loopback0
 ip address 192.168.0.1 255.255.255.255
!
interface GigabitEthernet0/0
 ip address 192.168.200.2 255.255.255.252
!
ip route 0.0.0.0 0.0.0.0 192.168.200.1
```

!

PE–02

interface **GigabitEthernet6.10**

 encapsulation dot1Q **10**

 ip vrf forwarding **RED**

 ip address 192.168.200.253 255.255.255.252

!

interface **GigabitEthernet6.11**

 encapsulation dot1Q **11**

 ip vrf forwarding **RED**

 ip address 192.168.200.249 255.255.255.252

!

CE–RED–02

interface **Vlan10**

 ip address 192.168.200.254 255.255.255.252

!

interface **Vlan11**

 ip address 192.168.200.250 255.255.255.252

!

ip route 0.0.0.0 0.0.0.0 192.168.200.253

ip route 0.0.0.0 0.0.0.0 192.168.200.249

!

interface **GigabitEthernet0/0**

 switchport trunk allowed vlan **10,11**

 switchport trunk encapsulation dot1q

 switchport mode trunk

!

PE–CE Routing Between CE–GREEN–01 And PE–01

<u>PE–01</u>

interface **GigabitEthernet4**

 ip vrf forwarding **GREEN**

 ip address 192.168.201.1 255.255.255.252

!

ip route vrf **GREEN** 192.168.1.1 255.255.255.255 192.168.201.2

!

<u>CE–GREEN–01</u>

interface **GigabitEthernet0/0**

 ip address 192.168.201.2 255.255.255.252

!

interface **Loopback0**

 ip address 192.168.1.1 255.255.255.255

!

ip route 192.168.1.2 255.255.255.255 192.168.201.1

!

PE–CE Routing Between CE–GREEN–02 And PE–02

<u>PE–02</u>

interface **GigabitEthernet3**

 ip vrf forwarding **GREEN**

 ip address 192.168.201.253 255.255.255.252

!

ip route vrf **GREEN** 192.168.1.2 255.255.255.255 192.168.201.254

!

<u>CE–GREEN–02</u>

interface **GigabitEthernet0/0**

 ip address 192.168.201.254 255.255.255.252

!

interface **Loopback0**

```
ip address 192.168.1.2 255.255.255.255
!
ip route 192.168.1.1 255.255.255.255 192.168.201.253
!
```

PE-CE Routing Between CE-BLUE-01 And PE-01

PE-01

```
interface GigabitEthernet5
 ip vrf forwarding BLUE
 ip address 192.168.202.1 255.255.255.252
 ip ospf network point-to-point
 ip ospf dead-interval 11
 ip ospf hello-interval 2
!
router ospf 528 vrf BLUE
 router-id 192.168.202.1
 auto-cost reference-bandwidth 1000
 redistribute bgp 65535 subnets
 passive-interface default
 no passive-interface GigabitEthernet5
 network 192.168.202.1 0.0.0.0 area 0
!
```

CE-BLUE-01

```
interface Loopback0
 ip address 192.168.2.11 255.255.255.255
!
interface GigabitEthernet0/0
 ip address 192.168.202.2 255.255.255.252
 ip ospf network point-to-point
 ip ospf dead-interval 11
 ip ospf hello-interval 2
```

```
!
router ospf 528
 router-id 192.168.202.2
 auto-cost reference-bandwidth 1000
 passive-interface default
 no passive-interface GigabitEthernet0/0
 network 192.168.2.11 0.0.0.0 area 0
 network 192.168.202.2 0.0.0.0 area 0
!
```

PE-CE Routing Between CE-BLUE-02 And PE-02

PE-02

```
interface GigabitEthernet4
 ip vrf forwarding BLUE
 ip address 192.168.202.253 255.255.255.252
!
router eigrp 2028
 address-family ipv4 vrf BLUE autonomous-system 2028
  redistribute bgp 65535 metric 1000000 1 1 1 1500
  network 192.168.202.253 0.0.0.0
  eigrp router-id 192.168.202.253
 exit-address-family
!
```

CE-BLUE-02

```
interface Loopback0
 ip address 192.168.2.12 255.255.255.255
!
interface GigabitEthernet0/0
 ip address 192.168.202.254 255.255.255.252
!
router eigrp 2028
```

```
 network 192.168.2.12 0.0.0.0
 network 192.168.202.254 0.0.0.0
 eigrp router-id 192.168.202.254
!
```