MPLS L3VPN

➢ ISP Backbone Configurations

1. IGP IS-IS
2. MPLS LDP
3. MP-BGP
4. VRF

1- IGP IS-IS [PE01-P01-RR-P02-PE02]

PE01
| ```
router isis
net 49.0001.0001.0001.0001.00
metric-style wide
passive-interface Loopback0
!
interface Loopback0
ip router isis
!
interface Ethernet0/3
ip router isis
!
interface Serial1/0
ip router isis
isis metric 50
``` |

P01
| ```
router isis
net 49.0001.0002.0002.0002.00
metric-style wide
passive-interface Loopback0
!
interface Loopback0
ip router isis
!
interface Ethernet0/0
ip router isis
!
interface Ethernet0/1
ip router isis
!
interface Serial1/0
ip router isis
isis metric 50
``` |

RR
| ```
router isis
net 49.0001.0099.0099.0099.00
metric-style wide
passive-interface Loopback0
!
interface Loopback0
ip router isis
!
interface Ethernet0/1
ip router isis
!
interface Ethernet0/2
ip router isis
``` |

P02

```
router isis
net 49.0001.0003.0003.0003.00
metric-style wide
passive-interface Loopback0
!
interface Loopback0
ip router isis
!
interface Ethernet0/0
ip router isis
!
interface Ethernet0/1
ip router isis
!
interface Ethernet0/2
ip router isis
```

PE02

```
router isis
net 49.0001.0004.0004.0004.00
metric-style wide
passive-interface Loopback0
!
interface Loopback0
ip router isis
!
interface Ethernet0/2
ip router isis
!
interface Ethernet0/3
ip router isis
```

2- MPLS LDP [PE01-P01-RR-P02-PE02]

PE01

```
ip cef
mpls ip
mpls label protocol ldp
mpls ldp router-id Loopback0
mpls label range 1000 1999
!
interface Ethernet0/3
mpls ip
!
interface Serial1/0
mpls ip
```

P01

```
ip cef
mpls ip
mpls label protocol ldp
mpls ldp router-id Loopback0
mpls label range 2000 2999
!
interface Ethernet0/0
mpls ip
!
interface Ethernet0/1
mpls ip
!
interface Serial1/0
mpls ip
```

RR

```
ip cef
mpls ip
mpls label protocol ldp
mpls ldp router-id Loopback0
mpls label range 9000 9999
!
interface Ethernet0/1
mpls ip
!
interface Ethernet0/2
mpls ip
```

P02

```
ip cef
mpls ip
mpls label protocol ldp
mpls ldp router-id Loopback0
mpls label range 3000 3999
!
interface Ethernet0/0
mpls ip
!
interface Ethernet0/1
mpls ip
!
interface Ethernet0/2
mpls ip
```

PE02

```
ip cef
mpls ip
mpls label protocol ldp
mpls ldp router-id Loopback0
mpls label range 4000 4999
!
interface Ethernet0/2
mpls ip
!
interface Ethernet0/3
mpls ip
```

3- MP-BGP [PE01-RR-PE02]

PE01

```
router bgp 1453
 bgp router-id 1.1.1.1
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 99.99.99.99 remote-as 1453
 neighbor 99.99.99.99 update-source Loopback0
 !
 address-family ipv4
  neighbor 99.99.99.99 activate
 exit-address-family
 !
 address-family vpnv4
  neighbor 99.99.99.99 activate
  neighbor 99.99.99.99 send-community extended
exit-address-family
```

RR

```
router bgp 1453
 bgp router-id 99.99.99.99
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 1.1.1.1 remote-as 1453
 neighbor 1.1.1.1 update-source Loopback0
 neighbor 4.4.4.4 remote-as 1453
 neighbor 4.4.4.4 update-source Loopback0
 !
 address-family ipv4
  neighbor 1.1.1.1 activate
  neighbor 1.1.1.1 route-reflector-client
  neighbor 4.4.4.4 activate
  neighbor 4.4.4.4 route-reflector-client
 exit-address-family
 !
 address-family vpnv4
  neighbor 1.1.1.1 activate
  neighbor 1.1.1.1 send-community extended
  neighbor 1.1.1.1 route-reflector-client
  neighbor 4.4.4.4 activate
  neighbor 4.4.4.4 send-community extended
  neighbor 4.4.4.4 route-reflector-client
 exit-address-family
```

PE02

```
router bgp 1453
 bgp router-id 4.4.4.4
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 99.99.99.99 remote-as 1453
 neighbor 99.99.99.99 update-source Loopback0
 !
 address-family ipv4
  neighbor 99.99.99.99 activate
 exit-address-family
 !
 address-family vpnv4
  neighbor 99.99.99.99 activate
  neighbor 99.99.99.99 send-community extended
 exit-address-family
```

4- VRF [PE01-PE02]

PE01

```
vrf definition VPN-10
 rd 10:10
 !
 address-family ipv4
  route-target export 10:10
  route-target import 10:10
 exit-address-family
!
vrf definition VPN-20
 rd 20:20
 !
 address-family ipv4
  route-target export 20:20
  route-target import 20:20
 exit-address-family
!
interface Ethernet0/0
 vrf forwarding VPN-10
 ip address 192.168.111.1 255.255.255.0
!
interface Ethernet0/1
 vrf forwarding VPN-20
 ip address 192.168.121.1 255.255.255.0
```

PE02

```
vrf definition VPN-10
 rd 10:10
 !
 address-family ipv4
  route-target export 10:10
  route-target import 10:10
 exit-address-family
!
vrf definition VPN-20
 rd 20:20
 !
 address-family ipv4
  route-target export 20:20
  route-target import 20:20
 exit-address-family
!
interface Ethernet0/0
 vrf forwarding VPN-10
 ip address 192.168.112.4 255.255.255.0
!
interface Ethernet0/1
 vrf forwarding VPN-20
 ip address 192.168.122.4 255.255.255.0
```

> ➤ PE-CE Configurations

1. VPN-10 → PE01-CE11 [OSPF]
2. VPN-10 → PE02-CE12 [EIGRP]
3. VPN-20 → PE01-CE21 [STATIC]
4. VPN-20 → PE02-CE22 [BGP]

1- VPN-10 → PE01-CE11 [OSPF]

PE01
| ```
ip prefix-list VPN-10-LINK seq 5 permit 192.168.111.0/24
!
ip prefix-list VPN-20-LINK seq 5 permit 192.168.121.0/24
!
route-map INTERLINK-DENY deny 10
 match ip address prefix-list VPN-10-LINK VPN-20-LINK
!
route-map INTERLINK-DENY permit 20
!
router ospf 10 vrf VPN-10
 redistribute bgp 1453 subnets
 network 192.168.111.1 0.0.0.0 area 0
!
router bgp 1453
!
 address-family ipv4 vrf VPN-10
  redistribute ospf 10 match internal external 1 external 2 route-map INTERLINK-DENY
 exit-address-family
``` |

CE11
| ```
router ospf 1
 network 10.10.10.11 0.0.0.0 area 0
 network 192.168.111.11 0.0.0.0 area 0
``` |

2- VPN-10 → PE02-CE12 [EIGRP]

PE02

```
ip prefix-list VPN-10-LINK seq 5 permit 192.168.112.0/24
!
ip prefix-list VPN-20-LINK seq 5 permit 192.168.122.0/24
!
route-map INTERLINK-DENY deny 10
 match ip address prefix-list VPN-10-LINK VPN-20-LINK
!
route-map INTERLINK-DENY permit 20
!
router eigrp CISCO
 !
 address-family ipv4 unicast vrf VPN-10 autonomous-system 10
  !
  topology base
   redistribute bgp 1453 metric 10000 10 255 1 1500
  exit-af-topology
  network 192.168.112.4 0.0.0.0
 exit-address-family
!
router bgp 1453
!
 address-family ipv4 vrf VPN-10
  redistribute eigrp 10 route-map INTERLINK-DENY
 exit-address-family
```

CE12

```
router eigrp 10
 network 10.10.12.12 0.0.0.0
 network 192.168.112.12 0.0.0.0
```

3- VPN-20 → PE01-CE21 [STATIC]

PE01

```
ip route vrf VPN-20 10.10.10.0 255.255.255.0 192.168.121.21
!
router bgp 1453
!
 address-family ipv4 vrf VPN-20
  redistribute static route-map INTERLINK-DENY
 exit-address-family
```

CE21

```
ip route 0.0.0.0 0.0.0.0 192.168.121.1
```

4- VPN-20 → PE02-CE22 [BGP]

PE02

```
router bgp 1453
!
address-family ipv4 vrf VPN-20
  neighbor 192.168.122.22 remote-as 65000
  neighbor 192.168.122.22 activate
exit-address-family
```

CE22

```
router bgp 65000
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 192.168.122.4 remote-as 1453
 !
 address-family ipv4
  network 10.10.22.0 mask 255.255.255.0
  neighbor 192.168.122.4 activate
 exit-address-family
```

MPLS L2VPN ATOM

PE01

```
pseudowire-class ETH-2-PPP
 encapsulation mpls
 interworking ip
!
interface Serial1/1
no ip address
xconnect 4.4.4.4 30 encapsulation mpls pw-class ETH-2-PPP
```

PE02

```
pseudowire-class ETH-2-PPP
 encapsulation mpls
 interworking ip
!
interface Ethernet1/1
 no ip address
 xconnect 1.1.1.1 30 encapsulation mpls pw-class ETH-2-PPP
```

CE31

```
router ospf 1
network 0.0.0.0 255.255.255.255 area 0
```

CE32

```
interface Ethernet0/0
ip ospf network point-to-point
!
router ospf 1
network 0.0.0.0 255.255.255.255 area 0
```

MPLS L2VPN EoMPLS

PE01
interface Ethernet0/2 no ip address xconnect 4.4.4.4 40 encapsulation mpls

PE02
interface Ethernet1/0 no ip address xconnect 1.1.1.1 40 encapsulation mpls

CE41,CE42
router ospf 1 network 0.0.0.0 255.255.255.255 area 0

verifications
show mpls ldp neighbor show mpls l2transport binding show mpls l2transport summary show mpls l2transport vc show xconnect all