Cisco Systems

# MPLS Configuration on Cisco IOS Software

A complete configuration manual for MPLS, MPLS VPNs, MPLS TE, QoS, Any Transport over MPLS (AToM), and VPLS

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**Example 5-36** *Final Configuration for the PE Routers*

```
hostname PE1-AS1
!
ip cef
!
ip vrf Cust_A
 rd 1:100
 route-target export 1:100
 route-target import 1:100
!
ip vrf Cust_B
 rd 1:200
 route-target export 1:200
 route-target import 1:200
!
interface Loopback0
 ip address 10.10.10.101 255.255.255.255
!
interface Serial0/0
 description connected to P1-AS1
 ip address 10.10.10.1 255.255.255.252
 mpls ip
!
interface Serial1/0
 description connected to CE1-A
 ip vrf forwarding Cust_A
 ip address 172.16.1.1 255.255.255.252
!
interface Serial2/0
 description connected to CE1-B
 ip vrf forwarding Cust_B
 ip address 192.168.1.1 255.255.255.252
!
router eigrp 1
 auto-summary
 !
 address-family ipv4 vrf Cust_B
 redistribute bgp 1 metric 1000 100 255 1 1500
 network 192.168.1.0
 no auto-summary
 autonomous-system 201
 exit-address-family
 !
 address-family ipv4 vrf Cust_A
 redistribute bgp 1 metric 1000 100 255 1 1500
 network 172.16.0.0
 no auto-summary
 autonomous-system 101
 exit-address-family
!
router ospf 1
 router-id 10.10.10.101
 network 10.0.0.0 0.255.255.255 area 0
```

**Example 5-36** *Final Configuration for the PE Routers (Continued)*

```
!
router bgp 1
 no synchronization
 neighbor 10.10.10.102 remote-as 1
 neighbor 10.10.10.102 update-source Loopback0
 no auto-summary
 !
 address-family vpnv4
 neighbor 10.10.10.102 activate
 neighbor 10.10.10.102 send-community extended
 exit-address-family
 !
 address-family ipv4 vrf Cust_B
 redistribute eigrp 201
 no auto-summary
 no synchronization
 exit-address-family
 !
 address-family ipv4 vrf Cust_A
 redistribute eigrp 101
 no auto-summary
 no synchronization
 exit-address-family
```

```
hostname PE2-AS1
!
ip cef
!
ip vrf Cust_A
 rd 1:100
 route-target export 1:100
 route-target import 1:100
!
ip vrf Cust_B
 rd 1:200
 route-target export 1:200
 route-target import 1:200
!
interface Loopback0
 ip address 10.10.10.102 255.255.255.255
!
interface Serial0/0
 description connected to P1-AS1
 ip address 10.10.10.5 255.255.255.252
 mpls ip
!
interface Serial1/0
 description connected to CE2-A
 ip vrf forwarding Cust_A
 ip address 172.16.2.1 255.255.255.252
!
```

*continues*

**Example 5-36** *Final Configuration for the PE Routers (Continued)*

```
interface Serial2/0
 description connected to CE2-B
 ip vrf forwarding Cust_B
 ip address 192.168.2.1 255.255.255.252
!
router eigrp 1
 auto-summary
 !
 address-family ipv4 vrf Cust_B
 redistribute bgp 1 metric 1000 100 255 1 1500
 network 192.168.2.0
 no auto-summary
 autonomous-system 202
 exit-address-family
 !
 address-family ipv4 vrf Cust_A
 redistribute bgp 1 metric 1000 100 255 1 1500
 network 172.16.0.0
 no auto-summary
 autonomous-system 101
 exit-address-family
!
router ospf 1
 router-id 10.10.10.102
 network 10.0.0.0 0.255.255.255 area 0
!
router bgp 1
 no synchronization
 neighbor 10.10.10.101 remote-as 1
 neighbor 10.10.10.101 update-source Loopback0
 no auto-summary
 !
 address-family vpnv4
 neighbor 10.10.10.101 activate
 neighbor 10.10.10.101 send-community extended
 exit-address-family
 !
 address-family ipv4 vrf Cust_B
 redistribute eigrp 202
 no auto-summary
 no synchronization
 exit-address-family
 !
 address-family ipv4 vrf Cust_A
 redistribute eigrp 101
 no auto-summary
 no synchronization
 exit-address-family
```

## Final Configuration for CE Routers

Example 5-37 shows the final configurations for the CE routers for Customer A (CE1-A and CE2-A) and Customer B (CE1-B and CE2-B).

**Example 5-37** *Final Configurations for CE1-A, CE2-A, CE1-B, and CE2-B*

```
hostname CE1-A
!
interface Ethernet0/0
 description VPN-A Site 1 network
 ip address 172.16.10.1 255.255.255.0
!
interface Serial1/0
 description connected to PE1-AS1
 ip address 172.16.1.2 255.255.255.252
!
router eigrp 101
 network 172.16.0.0
 no auto-summary
```

```
hostname CE2-A
!
interface Ethernet0/0
 description VPN-A Site 2 network
 ip address 172.16.20.1 255.255.255.0
!
interface Serial1/0
 description connected to PE2-AS1
 ip address 172.16.2.2 255.255.255.252
!
router eigrp 101
 network 172.16.0.0
 no auto-summary
```

```
hostname CE1-B
!
interface Ethernet0/0
 description VPN-B Site1 network
 ip address 192.168.10.1 255.255.255.0
!
interface Serial1/0
 description connected to PE1-AS1
 ip address 192.168.1.2 255.255.255.252
!
router eigrp 201
 network 192.168.1.0
 network 192.168.10.0
 no auto-summary
```

```
hostname CE2-B
!
interface Ethernet0/0
 description VPN-B Site2 network
 ip address 192.168.20.1 255.255.255.0
```

*continues*

**Example 5-37** *Final Configurations for CE1-A, CE2-A, CE1-B, and CE2-B (Continued)*

```
!
interface Serial1/0
 description connected to PE2-AS1
 ip address 192.168.2.2 255.255.255.252
!
router eigrp 202
 network 192.168.2.0
 network 192.168.20.0
 no auto-summary
```

## Verify Basic EIGRP PE-CE Routing

The steps to verify EIGRP PE-CE routing are as follows:

**Step 1** **Verify EIGRP neighbor relationship**—Example 5-38 shows the output on the PE1-AS1 and PE2-AS1.

**Example 5-38** *Verify EIGRP Neighbor Relationship*

```
PE1-AS1#show ip eigrp vrf Cust_A neighbors
IP-EIGRP neighbors for process 101
H   Address          Interface      Hold Uptime   SRTT   RTO  Q  Seq Type
                                    (sec)         (ms)       Cnt Num
0   172.16.1.2             Se1/0    14  00:38:47  68    408  0  3
```

```
PE1-AS1#show ip eigrp vrf Cust_B neighbors
IP-EIGRP neighbors for process 201
H   Address         Interface       Hold Uptime   SRTT   RTO  Q  Seq Type
                                    (sec)         (ms)       Cnt Num
0   192.168.1.2     Se2/0             11 00:38:54   81   486  0  4
```

**Step 2** **Verify EIGRP route propagation for Cust_B**—Use the following sequence of steps to verify route propagation for Cust_B network 192.168.20.0 and 182.168.99.0.

Example 5-39 shows that PE2-AS1 receives 192.168.20.0 (metric 2195456) as an internal route.

**Example 5-39** *Cust_B Routing Table on PE2-AS1*

```
PE2-AS1#show ip route vrf Cust_B eigrp
D EX 192.168.99.0/24 [170/3097600] via 192.168.2.2, 00:14:20, Serial2/0
D    192.168.20.0/24 [90/1787392] via 192.168.2.2, 00:14:20, Serial2/0
```

The EIGRP metric for 192.168.20.0 is copied into these attributes when the EIGRP route is redistributed into MP-BGP, as shown in Example 5-40. The command **show ip bgp vpnv4 all 192.168.20.0** shows the extended BGP attributes that are attached to the route.

**Example 5-40** *BGP VPNv4 Information for 192.168.20.0 on PE2-AS1*

```
PE2-AS1#show ip bgp vpnv4 vrf Cust_B 192.168.20.0
BGP routing table entry for 1:200:192.168.20.0/24, version 20
Paths: (1 available, best #1, table Cust_B)
  Advertised to update-groups:
     1
  Local
    192.168.2.2 (via Cust_B) from 0.0.0.0 (10.10.10.102)
     Origin incomplete, metric 1787392, localpref 100, weight 32768, valid, sourced,
       best
      Extended Community: RT:1:200
        Cost:pre-bestpath:128:1787392 (default-2145696255) 0x8800:32768:0
        0x8801:202:537600 0x8802:65281:1249792 0x8803:65281:1500,
      mpls labels in/out 23/nolabel
```

PE1-AS1 redistributing back from MP-BGP into EIGRP uses this information to reconstruct the original EIGRP routing update. Example 5-41 shows that the EIGRP metric for 192.168.20.0 is preserved when crossing an MP-BGP domain by using the BGP extended community attributes.

**Example 5-41** *BGP VPNv4 Information for 192.168.20.0 on PE1-AS1*

```
PE1-AS1#show ip bgp vpnv4 vrf Cust_B 192.168.20.0
BGP routing table entry for 1:200:192.168.20.0/24, version 20
Paths: (1 available, best #1, table Cust_B)
  Not advertised to any peer
  Local
    10.10.10.102 (metric 97) from 10.10.10.102 (10.10.10.102)
      Origin incomplete, metric 1787392, localpref 100, valid, internal, best
      Extended Community: RT:1:200
        Cost:pre-bestpath:128:1787392 (default-2145696255) 0x8800:32768:0
        0x8801:202:537600 0x8802:65281:1249792 0x8803:65281:1500,
      mpls labels in/out nolabel/23
```

For Customer B, the two EIGRP AS numbers are different (201 on PE1-AS1 and 202 on PE2-AS1); therefore, normal redistribution rules apply. External EIGRP routes (D EX) are created when the 192.168.20.0 is redistributed into EIGRP from MP-BGP updates received on PE1-AS1 from PE2-AS1. Example 5-42 shows the EIGRP routing table on CE1-B.

**Example 5-42** *EIGRP Routing Table on CE1-B*

```
CE1-B#show ip route eigrp
D EX 192.168.20.0/24 [170/3097600] via 192.168.1.1, 00:33:07, Serial1/0
     192.168.2.0/30 is subnetted, 1 subnets
D EX    192.168.2.0 [170/3097600] via 192.168.1.1, 00:39:28, Serial1/0
```

**Step 3** **Verify EIGRP route propagation for Cust_A**—Use the following sequence of steps to verify route propagation for Cust_A network 172.16.20.0/24 and 209.165.201.0/27.