

CCIE Lab Center

CLC - CCIE Service Provider v5.0: Practice Lab v1.0

CLC

Forum: <https://cciestudygroup.org>

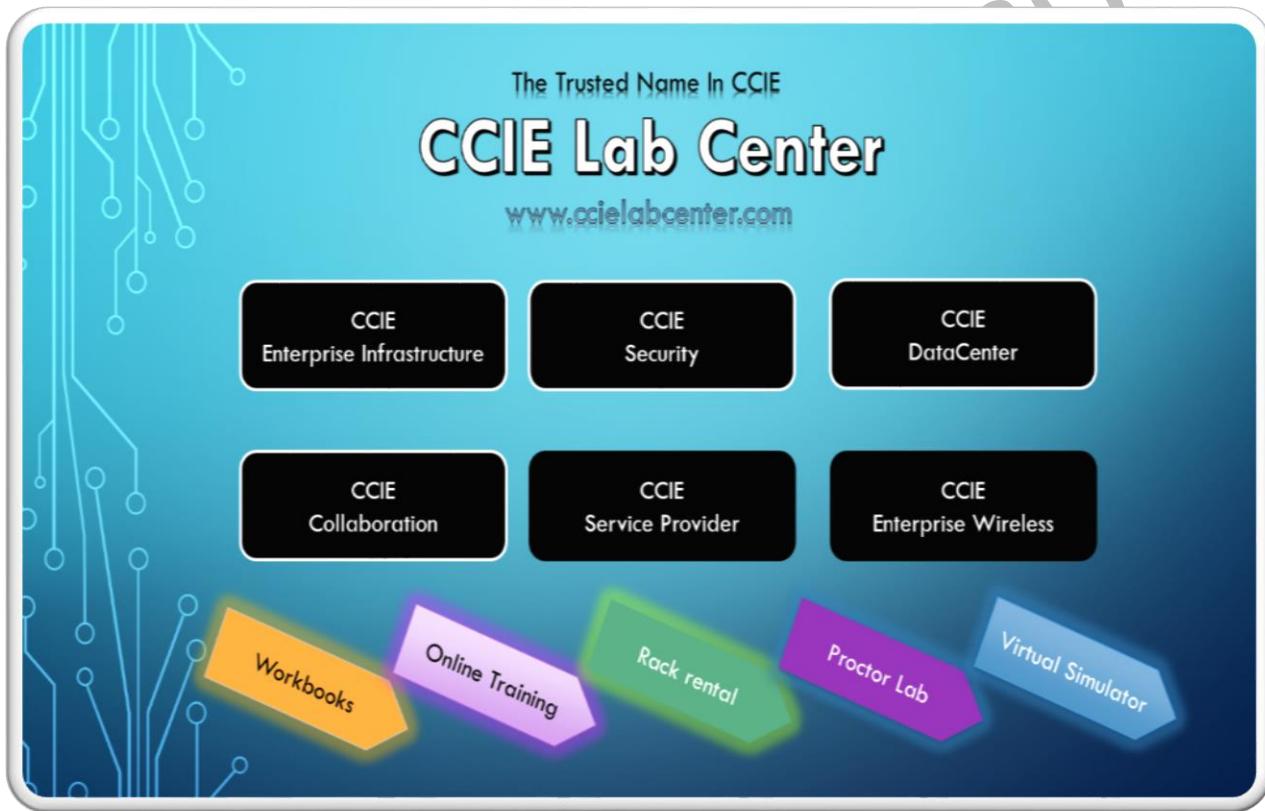
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CCIE Service Provider

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CCIE Service Provider Practice Lab v1.0



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Workbook Description

Author: CCIE Lab Center (CLC)

Focus: Practice

Level: Expert (CCIE)

Stream: CCIE Service Provider

Lab Version: Lab 1.0

Content: Topology, Questions, Solutions, Verifications, Initial/Pre-Configurations

Format: PDF

Protection: None

Price: ~~USD 50\$~~ Free

Note: This is a not for sale product.

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SECTION 1: Lab Details

SECTION 1.1: Lab Summary

1. Service Provider IGP Network.
2. Service Provider BGP Network.
3. Service Provider MP-BGP Network.
4. Service Provider PE-CE Network.
5. Service Provider Traffic Engineering.
6. Customer IGP Network.
7. Customer BGP Network.
8. Customer Traffic Engineering.
9. Customer Internet Service.

Lab Installation & Hardware Requirements

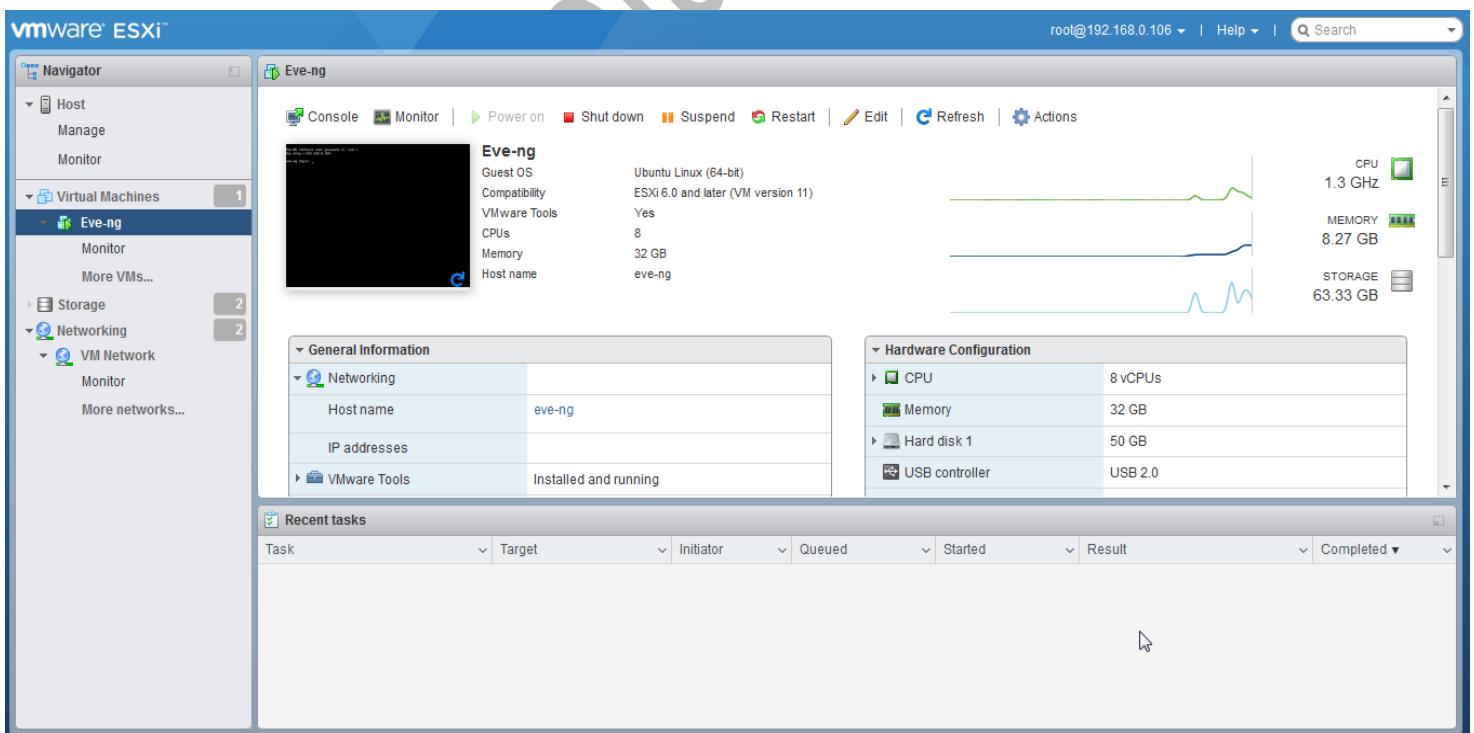
Lab Installed: VMware Esxi ---> Eve-ng Community Version --->

Hardware Requirement:

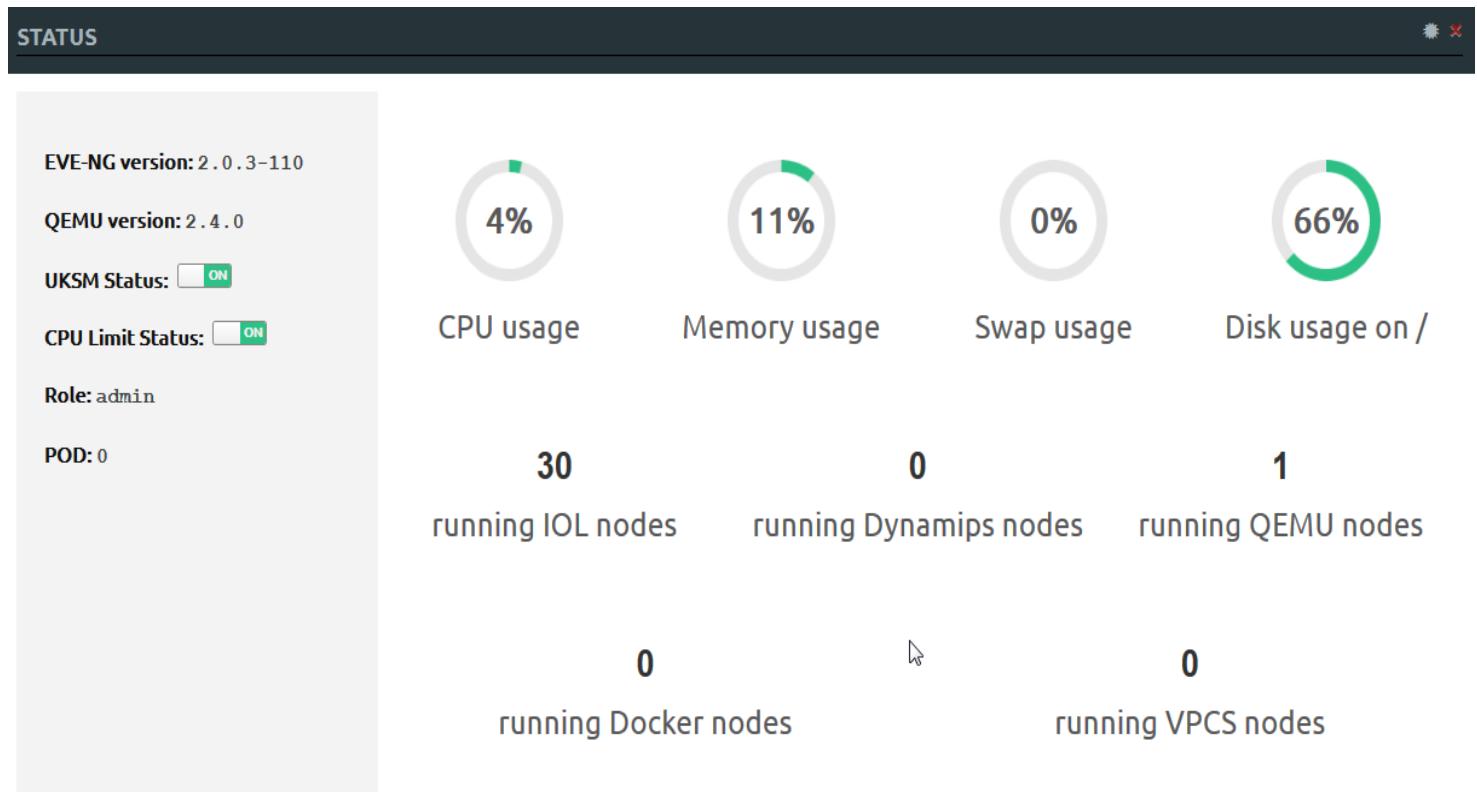
CPU: 4 Cores

RAM: 12 GB (Minimum 8 GB)

Storage: 100 GB



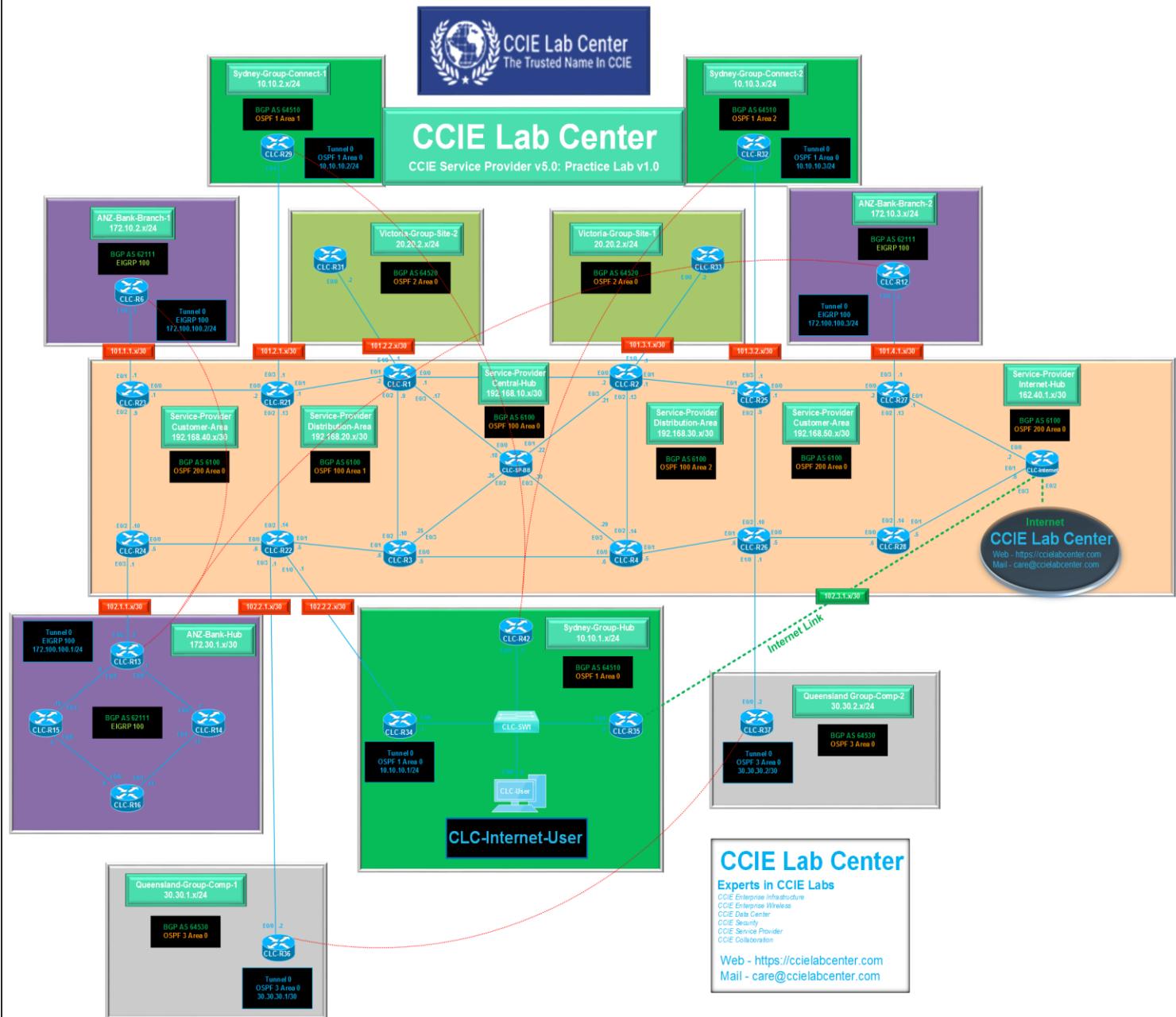
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SECTION 1.2: Lab Topology

CLC CCIE Service Provider Practice Lab 1: Topology



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SECTION 1.3: Lab Initial Configuration

CLC-SP-Backbone

```
hostname CLC-SP-Backbone

interface Loopback0
 ip address 100.255.255.255 255.255.255.255

interface Ethernet0/0
 ip address 192.168.10.18 255.255.255.252

interface Ethernet0/1
 ip address 192.168.10.22 255.255.255.252

interface Ethernet0/2
 ip address 192.168.10.26 255.255.255.252

interface Ethernet0/3
 ip address 192.168.10.30 255.255.255.252
```

CLC-R1

```
hostname CLC-R1

interface Loopback0
 ip address 100.1.1.1 255.255.255.255

interface Ethernet0/0
 ip address 192.168.10.1 255.255.255.252

interface Ethernet0/1
 ip address 192.168.20.1 255.255.255.252

interface Ethernet0/2
 ip address 192.168.10.9 255.255.255.252

interface Ethernet0/3
 ip address 192.168.10.17 255.255.255.252
```

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CLC-R2

hostname CLC-R2

interface Loopback0
ip address 100.2.2.2 255.255.255.255

interface Ethernet0/0
ip address 192.168.10.2 255.255.255.252

interface Ethernet0/1
ip address 192.168.30.1 255.255.255.252

interface Ethernet0/2
ip address 192.168.10.13 255.255.255.252

interface Ethernet0/3
ip address 192.168.10.21 255.255.255.252

CLC-R3

hostname CLC-R3

interface Loopback0
ip address 100.3.3.3 255.255.255.255

interface Ethernet0/0
ip address 192.168.10.5 255.255.255.252

interface Ethernet0/1
ip address 192.168.20.5 255.255.255.252

interface Ethernet0/2
ip address 192.168.10.10 255.255.255.252

interface Ethernet0/3
ip address 192.168.10.25 255.255.255.25

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CLC-R4

hostname CLC-R4

interface Loopback0

ip address 100.4.4.4 255.255.255.255

interface Ethernet0/0

ip address 192.168.10.6 255.255.255.252

interface Ethernet0/1

ip address 192.168.30.5 255.255.255.252

interface Ethernet0/2

ip address 192.168.10.14 255.255.255.252

interface Ethernet0/3

ip address 192.168.10.29 255.255.255.252

CLC-R6

hostname CLC-R6

interface Loopback0

ip address 6.6.6.6 255.255.255.255

interface Tunnel0

ip address 172.100.100.2 255.255.255.0

no ip redirects

ip nhrp authentication CLC

ip nhrp map multicast 102.1.1.2

ip nhrp map 172.100.100.1 102.1.1.2

ip nhrp network-id 123

ip nhrp nhs 172.100.100.1

tunnel source Ethernet0/0

tunnel mode gre multipoint

interface Ethernet0/0

description "Connected to R23 eth0/1"

ip address 101.1.1.2 255.255.255.252

interface Ethernet0/1

description "Connected to LAN"

ip address 172.10.2.1 255.255.255.0

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CLC-R12

```
hostname CLC-R12
```

```
interface Loopback0
ip address 12.12.12.12 255.255.255.255
```

```
interface Tunnel0
ip address 172.100.100.3 255.255.255.0
no ip redirects
ip nhrp authentication CLC
ip nhrp map multicast 102.1.1.2
ip nhrp map 172.100.100.1 102.1.1.2
ip nhrp network-id 123
ip nhrp nhs 172.100.100.1
tunnel source Ethernet0/0
tunnel mode gre multipoint
```

```
interface Ethernet0/0
description "Connected to R27 eth0/3"
ip address 101.4.1.2 255.255.255.252
```

```
interface Ethernet0/1
description "Connected to LAN"
ip address 172.10.3.1 255.255.255.0
```

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CLC-R13

hostname CLC-R13

interface Loopback0

ip address 13.13.13.13 255.255.255.255

interface Tunnel0

ip address 172.100.100.1 255.255.255.0

no ip redirects

no ip split-horizon eigrp 100

ip nhrp authentication CLC

ip nhrp map multicast dynamic

ip nhrp network-id 123

tunnel source Ethernet0/3

tunnel mode gre multipoint

interface Ethernet0/0

ip address 172.30.1.1 255.255.255.252

interface Ethernet0/1

ip address 172.30.1.9 255.255.255.252

interface Ethernet0/3

description "Connected to R24 eth0/3"

ip address 102.1.1.2 255.255.255.252

CLC-R14

hostname CLC-R14

interface Loopback0

ip address 14.14.14.14 255.255.255.255

interface Ethernet0/0

ip address 172.30.1.2 255.255.255.252

interface Ethernet0/1

ip address 172.30.1.13 255.255.255.252

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CLC-R15

hostname CLC-R15

interface Loopback0

ip address 15.15.15.15 255.255.255.255

interface Ethernet0/0

ip address 172.30.1.5 255.255.255.252

interface Ethernet0/1

ip address 172.30.1.10 255.255.255.252

CLC-R16

hostname CLC-R16

interface Loopback0

ip address 16.16.16.16 255.255.255.255

interface Ethernet0/0

ip address 172.30.1.6 255.255.255.252

interface Ethernet0/1

ip address 172.30.1.14 255.255.255.252

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CLC-R21

hostname CLC-R21

interface Loopback0

ip address 100.21.21.21 255.255.255.255

interface Ethernet0/0

ip address 192.168.40.2 255.255.255.252

interface Ethernet0/1

ip address 192.168.20.2 255.255.255.252

interface Ethernet0/2

ip address 192.168.40.13 255.255.255.252

interface Ethernet0/3

description "Connected to Sydney-Group-Connect-1 eth0/0"

ip address 101.2.1.1 255.255.255.252

interface Ethernet1/0

description "Connected to Victoria-Group-Site-2 eth0/0"

ip address 101.2.2.1 255.255.255.252

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CLC-R22

hostname CLC-R22

interface Loopback0

ip address 100.22.22.22 255.255.255.255

interface Ethernet0/0

ip address 192.168.40.6 255.255.255.252

interface Ethernet0/1

ip address 192.168.20.6 255.255.255.252

interface Ethernet0/2

ip address 192.168.40.14 255.255.255.252

interface Ethernet0/3

description "Connected to Queensland-Group-Comp-1 eth0/0"

ip address 102.2.1.1 255.255.255.252

interface Ethernet1/0

description "Connected to Sydney-Group-Hub eth0/1"

ip address 102.2.2.1 255.255.255.252

CLC-R23

hostname CLC-R23

interface Loopback0

ip address 100.23.23.23 255.255.255.255

interface Ethernet0/0

ip address 192.168.40.1 255.255.255.252

interface Ethernet0/1

description "Connected to ANZ-Bank-Branch-1 eth0/0"

ip address 101.1.1.1 255.255.255.252

interface Ethernet0/2

ip address 192.168.40.9 255.255.255.252

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CLC-R24

hostname CLC-R24

interface Loopback0
ip address 100.24.24.24 255.255.255.255

interface Ethernet0/0
ip address 192.168.40.5 255.255.255.252

interface Ethernet0/2
ip address 192.168.40.10 255.255.255.252

interface Ethernet0/3
description "Connected to ANZ-Bank-Hub eth0/3"
ip address 102.1.1.1 255.255.255.252

CLC-R25

hostname CLC-R25

interface Loopback0
ip address 100.25.25.25 255.255.255.255

interface Ethernet0/0
ip address 192.168.50.1 255.255.255.252

interface Ethernet0/1
ip address 192.168.30.2 255.255.255.252

interface Ethernet0/2
ip address 192.168.50.9 255.255.255.252

interface Ethernet0/3
description "Connected to Sydney-Group-Connect-2 eth0/0"
ip address 101.3.2.1 255.255.255.252

interface Ethernet1/0
description "Connected to Victoria-Group-Site-1 eth0/0"
ip address 101.3.1.1 255.255.255.252

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CLC-R26

```
hostname CLC-R26

interface Loopback0
 ip address 100.26.26.26 255.255.255.255

interface Ethernet0/0
 ip address 192.168.50.5 255.255.255.252
!
interface Ethernet0/1
 ip address 192.168.30.6 255.255.255.252

interface Ethernet0/2
 ip address 192.168.50.10 255.255.255.252

interface Ethernet1/0
 description "Connected to Queensland-Group-Comp-2 eth0/0"
 ip address 102.3.2.1 255.255.255.252
```

CLC-R27

```
hostname CLC-R27

interface Loopback0
 ip address 100.27.27.27 255.255.255.255

interface Ethernet0/0
 ip address 192.168.50.2 255.255.255.252

interface Ethernet0/1
 ip address 162.40.1.1 255.255.255.252

interface Ethernet0/2
 ip address 192.168.50.13 255.255.255.252

interface Ethernet0/3
 description "Connected to ANZ-Bank-Branch-2 eth0/0"
 ip address 101.4.1.1 255.255.255.252
```

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CLC-R28

hostname CLC-R28

interface Loopback0

ip address 100.28.28.28 255.255.255.255

interface Ethernet0/0

ip address 192.168.50.6 255.255.255.252

interface Ethernet0/1

ip address 162.40.1.5 255.255.255.252

interface Ethernet0/2

ip address 192.168.50.14 255.255.255.25

CLC-Internet

hostname CLC-Internet

interface Loopback0

ip address 162.100.100.100 255.255.255.255

interface Ethernet0/0

ip address 162.40.1.2 255.255.255.252

interface Ethernet0/1

ip address 162.40.1.6 255.255.255.252

interface Ethernet0/2

ip address dhcp

ip nat outside

interface Ethernet0/3

ip address 102.3.1.1 255.255.255.252

ip nat inside

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CLC-R29

```
hostname CLC-R29

interface Loopback0
ip address 29.29.29.29 255.255.255.255
!
interface Tunnel0
ip address 10.10.10.2 255.255.255.0
no ip redirects
ip nhrp authentication CLC
ip nhrp map multicast 102.2.2.2
ip nhrp map 10.10.10.1 102.2.2.2
ip nhrp network-id 123
ip nhrp nhs 10.10.10.1
ip ospf network point-to-multipoint
tunnel source Ethernet0/0
tunnel mode gre multipoint

interface Ethernet0/0
description "Connected to R21 eth0/3"
ip address 101.2.1.2 255.255.255.252

interface Ethernet0/1
description "Connected to LAN"
ip address 10.10.2.1 255.255.255.0
```

CLC-R31

```
hostname CLC-R31

interface Loopback0
ip address 31.31.31.31 255.255.255.255
!
interface Ethernet0/0
description "Connected to R21 eth1/0"
ip address 101.2.2.2 255.255.255.252
!
interface Ethernet0/1
description "Connected to LAN"
ip address 20.20.2.1 255.255.255.0
```

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CLC-R32

```
hostname CLC-R32
```

```
interface Loopback0
```

```
  ip address 32.32.32.32 255.255.255.255
```

```
interface Tunnel0
```

```
  ip address 10.10.10.3 255.255.255.0
```

```
  no ip redirects
```

```
  ip nhrp authentication CLC
```

```
  ip nhrp map multicast 102.2.2.2
```

```
  ip nhrp map 10.10.10.1 102.2.2.2
```

```
  ip nhrp network-id 123
```

```
  ip nhrp nhs 10.10.10.1
```

```
  ip ospf network point-to-multipoint
```

```
  tunnel source Ethernet0/0
```

```
  tunnel mode gre multipoint
```

```
interface Ethernet0/0
```

```
  description "Connected to R25 eth0/3"
```

```
  ip address 101.3.2.2 255.255.255.252
```

```
interface Ethernet0/1
```

```
  description "Connected to LAN"
```

```
  ip address 10.10.3.1 255.255.255.0
```

CLC-R33

```
hostname CLC-R33
```

```
interface Loopback0
```

```
  ip address 33.33.33.33 255.255.255.255
```

```
interface Ethernet0/0
```

```
  description "Connected to R25 eth1/0"
```

```
  ip address 101.3.1.2 255.255.255.252
```

```
interface Ethernet0/1
```

```
  description "Connected to LAN"
```

```
  ip address 20.20.1.1 255.255.255.0
```

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CLC-R34

hostname CLC-R34

interface Loopback0

ip address 34.34.34.34 255.255.255.255

interface Tunnel0

ip address 10.10.10.1 255.255.255.0

no ip redirects

ip nhrp authentication CLC

ip nhrp map multicast dynamic

ip nhrp network-id 123

ip ospf network point-to-multipoint

tunnel source Ethernet0/1

tunnel mode gre multipoint

interface Ethernet0/0

description "Connected to LAN"

ip address 10.10.1.1 255.255.255.0

interface Ethernet0/1

description "MPLS Connected to R22 eth1/0"

ip address 102.2.2.2 255.255.255.252

CLC-R35

hostname CLC-R35

interface Loopback0

ip address 35.35.35.35 255.255.255.255

interface Ethernet0/0

description "Connected to LAN"

ip address 10.10.1.2 255.255.255.0

interface Ethernet0/1

description " Internet-Link Connected to Internet eth0/3"

ip address 102.3.1.2 255.255.255.252

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CLC-R36

hostname CLC-R36

interface Loopback0

ip address 36.36.36.36 255.255.255.255

interface Tunnel0

ip address 30.30.30.1 255.255.255.252

no ip redirects

ip nhrp authentication CLC

ip nhrp map multicast 102.3.2.2

ip nhrp map 30.30.30.2 102.3.2.2

ip nhrp network-id 123

ip nhrp nhs 30.30.30.2

ip ospf network point-to-point

tunnel source Ethernet0/0

tunnel mode gre multipoint

interface Ethernet0/0

description "Connected to R22 eth0/3"

ip address 102.2.1.2 255.255.255.252

interface Ethernet0/1

description "Connected to LAN"

ip address 30.30.1.1 255.255.255.0

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CLC-R37

```
hostname CLC-R37
```

```
interface Loopback0
```

```
  ip address 37.37.37.37 255.255.255.255
```

```
interface Tunnel0
```

```
  ip address 30.30.30.2 255.255.255.252
```

```
  no ip redirects
```

```
  ip nhrp authentication CLC
```

```
  ip nhrp map multicast 102.2.1.2
```

```
  ip nhrp map 30.30.30.1 102.2.1.2
```

```
  ip nhrp network-id 123
```

```
  ip nhrp nhs 30.30.30.1
```

```
  ip ospf network point-to-point
```

```
  tunnel source Ethernet0/0
```

```
  tunnel mode gre multipoint
```

```
interface Ethernet0/0
```

```
  description "Connected to R26 eth1/0"
```

```
  ip address 102.3.2.2 255.255.255.252
```

```
interface Ethernet0/1
```

```
  description "Connected to LAN"
```

```
  ip address 30.30.2.1 255.255.255.0
```

CLC-R42

```
hostname CLC-R42
```

```
interface Loopback0
```

```
  ip address 42.42.42.42 255.255.255.255
```

```
interface Ethernet0/0
```

```
  ip address 10.10.1.3 255.255.255.0
```

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CLC-SW1

hostname CLC-SW1

interface Ethernet0/0
switchport access vlan 10
switchport mode access

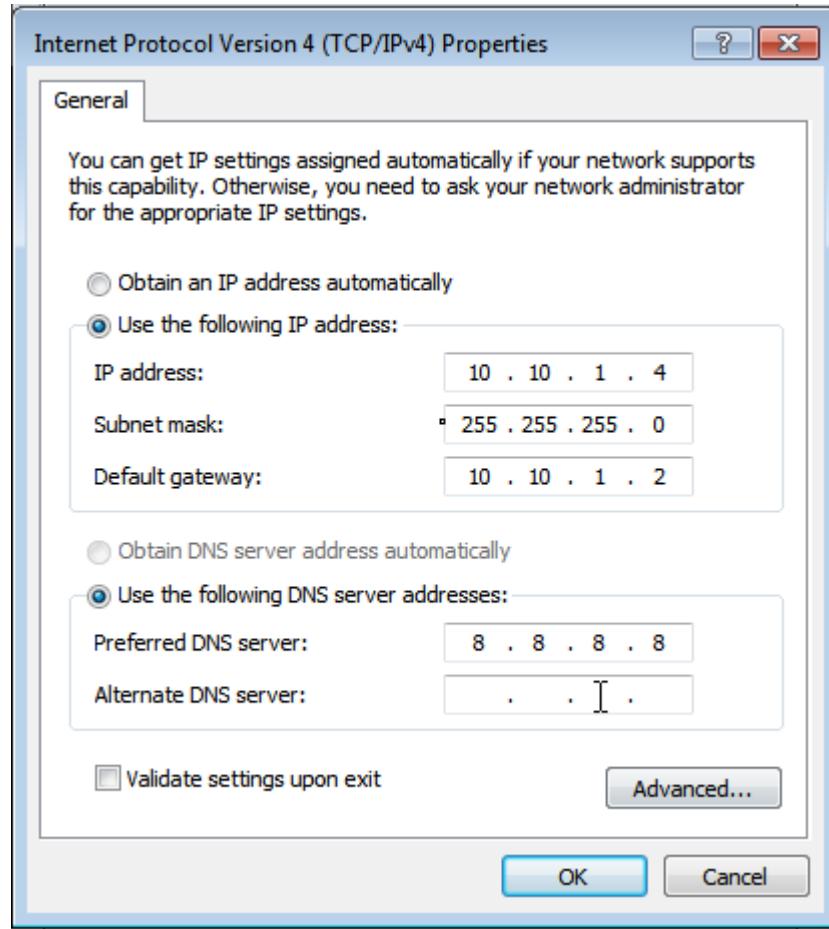
interface Ethernet0/1
switchport access vlan 10
switchport mode access

interface Ethernet0/2
switchport access vlan 10
switchport mode access

interface Ethernet0/3
switchport access vlan 10
switchport mode access

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CLC-Internet User



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SECTION 2: Service Provider IGP

SECTION 2.1: OSPF in Service Provider Central Hub

QUESTION

Configure Service Provider Central Hub (SPCH) site as per the following requirements:

1. Configure OSPF process id 100 Area 0 in SPCH as per the diagram
2. Set the router id to interface loopback 0 on all devices.
3. The interface loopback 0 at each router must be seen as an internal OSPF prefix by all other L3 devices.
4. Do not try to modify the default OSPF cost on any device.
5. Ensure that OSPF is not running on any interface that is facing another AS not in use.
6. You are allowed to advertise only specific networks in OSPF to accomplish this requirement.

Solution

On CLC-SP-Backbone

```
CLC-SP-Backbone(config)#router ospf 100
CLC-SP-Backbone(config-router)#router-id 100.255.255.255
CLC-SP-Backbone(config-router)#network 100.255.255.255 0.0.0.0 area 0
CLC-SP-Backbone(config-router)#network 192.168.10.18 0.0.0.0 area 0
CLC-SP-Backbone(config-router)#network 192.168.10.22 0.0.0.0 area 0
CLC-SP-Backbone(config-router)#network 192.168.10.26 0.0.0.0 area 0
CLC-SP-Backbone(config-router)#network 192.168.10.30 0.0.0.0 area 0
CLC-SP-Backbone(config-router)#exit
CLC-SP-Backbone(config)#
```

On CLC-R1

```
CLC-R1(config)#router ospf 100
CLC-R1(config-router)#router-id 100.1.1.1
CLC-R1(config-router)#network 100.1.1.1 0.0.0.0 area 0
CLC-R1(config-router)#network 192.168.10.1 0.0.0.0 area 0
CLC-R1(config-router)#network 192.168.10.9 0.0.0.0 area 0
```

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```
CLC-R1(config-router)#network 192.168.10.17 0.0.0.0 area 0
CLC-R1(config-router)#exit
CLC-R1(config)#
```

On CLC-R2

```
CLC-R2(config)#router ospf 100
CLC-R2(config-router)#router-id 100.2.2.2
CLC-R2(config-router)#network 100.2.2.2 0.0.0.0 area 0
CLC-R2(config-router)#network 192.168.10.2 0.0.0.0 area 0
CLC-R2(config-router)#network 192.168.10.13 0.0.0.0 area 0
CLC-R2(config-router)#network 192.168.10.21 0.0.0.0 area 0
CLC-R2(config-router)#exit
CLC-R2(config)#
```

On CLC-R3

```
CLC-R3(config)#router ospf 100
CLC-R3(config-router)#router-id 100.3.3.3
CLC-R3(config-router)#network 100.3.3.3 0.0.0.0 area 0
CLC-R3(config-router)#network 192.168.10.5 0.0.0.0 area 0
CLC-R3(config-router)#network 192.168.10.10 0.0.0.0 area 0
CLC-R3(config-router)#network 192.168.10.25 0.0.0.0 area 0
CLC-R3(config-router)#exit
CLC-R3(config)#
```

On CLC-R4

```
CLC-R4(config)#router ospf 100
CLC-R4(config-router)#router-id 100.4.4.4
CLC-R4(config-router)#network 100.4.4.4 0.0.0.0 area 0
CLC-R4(config-router)#network 192.168.10.6 0.0.0.0 area 0
CLC-R4(config-router)#network 192.168.10.14 0.0.0.0 area 0
CLC-R4(config-router)#network 192.168.10.29 0.0.0.0 area 0
CLC-R4(config-router)#exit
CLC-R4(config)#
```

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Verification

On CLC-SP-Backbone

```
CLC-SP-Backbone#show ip ospf neighbor

Neighbor ID      Pri   State          Dead Time    Address           Interface
100.4.4.4        1     FULL/BDR      00:00:38    192.168.10.29  Ethernet0/3
100.3.3.3        1     FULL/BDR      00:00:39    192.168.10.25  Ethernet0/2
100.2.2.2        1     FULL/BDR      00:00:39    192.168.10.21  Ethernet0/1
100.1.1.1        1     FULL/BDR      00:00:39    192.168.10.17  Ethernet0/0
CLC-SP-Backbone#
```

```
CLC-SP-Backbone#show ip route ospf

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
       a - application route
       + - replicated route, % - next hop override

Gateway of last resort is not set

      100.0.0.0/32 is subnetted, 5 subnets
O        100.1.1.1 [110/11] via 192.168.10.17, 00:10:31, Ethernet0/0
O        100.2.2.2 [110/11] via 192.168.10.21, 00:10:31, Ethernet0/1
O        100.3.3.3 [110/11] via 192.168.10.25, 00:10:31, Ethernet0/2
O        100.4.4.4 [110/11] via 192.168.10.29, 00:10:31, Ethernet0/3
      192.168.10.0/24 is variably subnetted, 12 subnets, 2 masks
O          192.168.10.0/30 [110/20] via 192.168.10.21, 00:10:31, Ethernet0/1
                           [110/20] via 192.168.10.17, 00:10:21, Ethernet0/0
O          192.168.10.4/30 [110/20] via 192.168.10.29, 00:10:31, Ethernet0/3
                           [110/20] via 192.168.10.25, 00:10:21, Ethernet0/2
O          192.168.10.8/30 [110/20] via 192.168.10.25, 00:10:31, Ethernet0/2
                           [110/20] via 192.168.10.17, 00:10:21, Ethernet0/0
O          192.168.10.12/30 [110/20] via 192.168.10.29, 00:10:31, Ethernet0/3
                           [110/20] via 192.168.10.21, 00:10:31, Ethernet0/1
CLC-SP-Backbone#
```

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On CLC-R1

```
CLC-R1#show ip ospf neighbor

Neighbor ID      Pri  State            Dead Time    Address          Interface
100.255.255.255   1    FULL/DR        00:00:38    192.168.10.18  Ethernet0/3
100.3.3.3         1    FULL/DR        00:00:38    192.168.10.10  Ethernet0/2
100.2.2.2         1    FULL/DR        00:00:37    192.168.10.2   Ethernet0/0
CLC-R1#
```

On CLC-R2

```
CLC-R2#show ip ospf neighbor

Neighbor ID      Pri  State            Dead Time    Address          Interface
100.255.255.255   1    FULL/DR        00:00:35    192.168.10.22  Ethernet0/3
100.4.4.4         1    FULL/DR        00:00:36    192.168.10.14  Ethernet0/2
100.1.1.1         1    FULL/BDR       00:00:37    192.168.10.1   Ethernet0/0
CLC-R2#
```

On CLC-R3

```
CLC-R3#show ip ospf neighbor

Neighbor ID      Pri  State            Dead Time    Address          Interface
100.255.255.255   1    FULL/DR        00:00:32    192.168.10.26  Ethernet0/3
100.1.1.1         1    FULL/BDR       00:00:34    192.168.10.9   Ethernet0/2
100.4.4.4         1    FULL/DR        00:00:38    192.168.10.6   Ethernet0/0
CLC-R3#
```

On CLC-R4

```
CLC-R4#show ip ospf neighbor

Neighbor ID      Pri  State            Dead Time    Address          Interface
100.255.255.255   1    FULL/DR        00:00:33    192.168.10.30  Ethernet0/3
100.2.2.2         1    FULL/BDR       00:00:35    192.168.10.13  Ethernet0/2
100.3.3.3         1    FULL/BDR       00:00:33    192.168.10.5   Ethernet0/0
CLC-R4#
```

CCIE Lab Center

SECTION 2.2: OSPF in Service Provider Customer Area

QUESTION

Configure Service Provider Customer Area (SPCA) site as per the following requirements:

1. Configure OSPF process id 200 Area 0 in SPCA as per the diagram
2. Set the router id to interface loopback 0 on all devices.
3. The interface loopback 0 at each router must be seen as an internal OSPF prefix by all other L3 devices.
4. Do not try to modify the default OSPF cost on any device.
5. Ensure that OSPF is not running on any interface that is facing another AS not in use.
6. You are allowed to advertise only specific networks in OSPF to accomplish this requirement.

Solution

On CLC-R21

```
CLC-R21(config)#router ospf 200
CLC-R21(config-router)#router-id 100.21.21.21
CLC-R21(config-router)#network 100.21.21.21 0.0.0.0 area 0
CLC-R21(config-router)#network 192.168.40.2 0.0.0.0 area 0
CLC-R21(config-router)#network 192.168.40.13 0.0.0.0 area 0
CLC-R21(config-router)#exit
CLC-R21(config)#
```

On CLC-R22

```
CLC-R22(config)#router ospf 200
CLC-R22(config-router)#router-id 100.22.22.22
CLC-R22(config-router)#network 100.22.22.22 0.0.0.0 area 0
CLC-R22(config-router)#network 192.168.40.6 0.0.0.0 area 0
CLC-R22(config-router)#network 192.168.40.14 0.0.0.0 area 0
CLC-R22(config-router)#exit
CLC-R22(config)#
```

On CLC-R23

```
CLC-R23(config)#router ospf 200
CLC-R23(config-router)#router-id 100.23.23.23
```

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```
CLC-R23(config-router)#network 100.23.23.23 0.0.0.0 area 0
CLC-R23(config-router)#network 192.168.40.1 0.0.0.0 area 0
CLC-R23(config-router)#network 192.168.40.9 0.0.0.0 area 0
CLC-R23(config-router)#exit
CLC-R23(config)#
```

On CLC-R24

```
CLC-R24(config)#router ospf 200
CLC-R24(config-router)#router-id 100.24.24.24
CLC-R24(config-router)#network 100.24.24.24 0.0.0.0 area 0
CLC-R24(config-router)#network 192.168.40.5 0.0.0.0 area 0
CLC-R24(config-router)#network 192.168.40.10 0.0.0.0 area 0
CLC-R24(config-router)#exit
CLC-R24(config)#
```

On CLC-R25

```
CLC-R25(config)#router ospf 200
CLC-R25(config-router)#router-id 100.25.25.25
CLC-R25(config-router)#network 100.25.25.25 0.0.0.0 area 0
CLC-R25(config-router)#network 192.168.50.1 0.0.0.0 area 0
CLC-R25(config-router)#network 192.168.50.9 0.0.0.0 area 0
CLC-R25(config-router)#exit
CLC-R25(config)#
```

On CLC-R26

```
CLC-R26(config)#router ospf 200
CLC-R26(config-router)#router-id 100.26.26.26
CLC-R26(config-router)#network 100.26.26.26 0.0.0.0 area 0
CLC-R26(config-router)#network 192.168.50.5 0.0.0.0 area 0
CLC-R26(config-router)#network 192.168.50.10 0.0.0.0 area 0
CLC-R26(config-router)#exit
CLC-R26(config)#
```

On CLC-R27

```
CLC-R27(config)#router ospf 200
CLC-R27(config-router)#router-id 100.27.27.27
CLC-R27(config-router)#network 100.27.27.27 0.0.0.0 area 0
CLC-R27(config-router)#network 192.168.50.2 0.0.0.0 area 0
CLC-R27(config-router)#network 192.168.50.13 0.0.0.0 area 0
```

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```
CLC-R27(config-router)#exit  
CLC-R27(config)#
```

On CLC-R28

```
CLC-R28(config)#router ospf 200  
CLC-R28(config-router)#router-id 100.28.28.28  
CLC-R28(config-router)#network 100.28.28.28 0.0.0.0 area 0  
CLC-R28(config-router)#network 192.168.50.6 0.0.0.0 area 0  
CLC-R28(config-router)#network 192.168.50.14 0.0.0.0 area 0  
CLC-R28(config-router)#exit  
CLC-R28(config)#
```

Verification

On CLC-R21



```
CLC-R21#show ip ospf neighbor

Neighbor ID      Pri   State            Dead Time     Address          Interface
100.22.22.22      1    FULL/BDR        00:00:35     192.168.40.14  Ethernet0/2
100.23.23.23      1    FULL/BDR        00:00:39     192.168.40.1   Ethernet0/0
CLC-R21#
```

On CLC-R22



```
CLC-R22#show ip ospf neighbor

Neighbor ID      Pri   State            Dead Time     Address          Interface
100.21.21.21      1    FULL/DR         00:00:30     192.168.40.13  Ethernet0/2
100.24.24.24      1    FULL/BDR        00:00:39     192.168.40.5   Ethernet0/0
CLC-R22#
```

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On CLC-R23



```
CLC-R23#show ip ospf neighbor

Neighbor ID      Pri   State            Dead Time    Address          Interface
100.24.24.24     1     FULL/BDR        00:00:32    192.168.40.10  Ethernet0/2
100.21.21.21     1     FULL/DR         00:00:38    192.168.40.2   Ethernet0/0
CLC-R23#
```

On CLC-R24



```
CLC-R24#show ip ospf neighbor

Neighbor ID      Pri   State            Dead Time    Address          Interface
100.23.23.23     1     FULL/DR         00:00:35    192.168.40.9   Ethernet0/2
100.22.22.22     1     FULL/DR         00:00:36    192.168.40.6   Ethernet0/0
CLC-R24#
```

On CLC-R25



```
CLC-R25#show ip ospf neighbor

Neighbor ID      Pri   State            Dead Time    Address          Interface
100.26.26.26     1     FULL/BDR        00:00:33    192.168.50.10  Ethernet0/2
100.27.27.27     1     FULL/BDR        00:00:32    192.168.50.2   Ethernet0/0
CLC-R25#
```

On CLC-R26

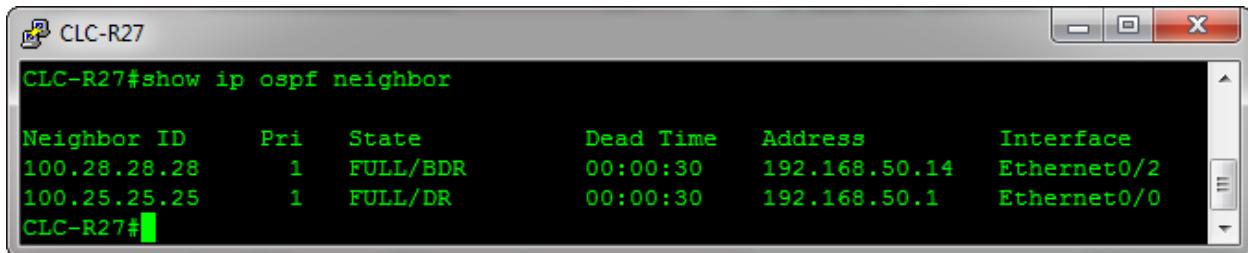


```
CLC-R26#show ip ospf neighbor

Neighbor ID      Pri   State            Dead Time    Address          Interface
100.25.25.25     1     FULL/DR         00:00:33    192.168.50.9   Ethernet0/2
100.28.28.28     1     FULL/BDR        00:00:32    192.168.50.6   Ethernet0/0
CLC-R26#
```

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On CLC-R27



```
CLC-R27#show ip ospf neighbor

Neighbor ID      Pri   State            Dead Time    Address          Interface
100.28.28.28     1     FULL/BDR        00:00:30    192.168.50.14  Ethernet0/2
100.25.25.25     1     FULL/DR         00:00:30    192.168.50.1   Ethernet0/0
CLC-R27#
```

On CLC-R28



```
CLC-R28#show ip ospf neighbor

Neighbor ID      Pri   State            Dead Time    Address          Interface
100.27.27.27     1     FULL/DR         00:00:35    192.168.50.13  Ethernet0/2
100.26.26.26     1     FULL/DR         00:00:39    192.168.50.5   Ethernet0/0
CLC-R28#
```

CCIE Lab Center

SECTION 2.3: OSPF in Service Provider Distribution Area

QUESTION

Configure Service Provider Distribution Area (SPDA) site as per the following requirements:

1. Configure OSPF process id 100 Area 1 in SPDA as per the diagram
2. The interface loopback 0 at each router must not be seen as an internal OSPF prefix by all other L3 devices.
3. Do not try to modify the default OSPF cost on any device.
4. Ensure that OSPF is not running on any interface that is facing another AS not in use.
5. You are allowed to advertise only specific networks in OSPF to accomplish this requirement.

Solution

On CLC-R1

```
CLC-R1(config)#router ospf 100
CLC-R1(config-router)#network 192.168.20.1 0.0.0.0 area 1
CLC-R1(config-router)#exit
CLC-R1(config)#
```

On CLC-R2

```
CLC-R2(config)#router ospf 100
CLC-R2(config-router)#network 192.168.30.1 0.0.0.0 area 2
CLC-R2(config-router)#exit
CLC-R2(config)#
```

On CLC-R3

```
CLC-R3(config)#router ospf 100
CLC-R3(config-router)#network 192.168.20.5 0.0.0.0 area 1
CLC-R3(config-router)#exit
CLC-R3(config)#
```

On CLC-R4

```
CLC-R4(config)#router ospf 100
```

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```
CLC-R4(config-router)#network 192.168.30.5 0.0.0.0 area 2  
CLC-R4(config-router)#exit  
CLC-R4(config)#
```

On CLC-R21

```
CLC-R21(config)#router ospf 100  
CLC-R21(config-router)#network 192.168.20.2 0.0.0.0 area 1  
CLC-R21(config-router)#exit  
CLC-R21(config)#
```

On CLC-R22

```
CLC-R22(config)#router ospf 100  
CLC-R22(config-router)# network 192.168.20.6 0.0.0.0 area 1  
CLC-R22(config-router)#exit  
CLC-R22(config)#
```

On CLC-R25

```
CLC-R25(config)#router ospf 100  
CLC-R25(config-router)#network 192.168.30.2 0.0.0.0 area 2  
CLC-R25(config-router)#exit  
CLC-R25(config)#
```

On CLC-R26

```
CLC-R26(config)#router ospf 100  
CLC-R26(config-router)#network 192.168.30.6 0.0.0.0 area 2  
CLC-R26(config-router)#exit  
CLC-R26(config-router)#
```

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Verification

On CLC-R1

```
CLC-R1#show ip ospf neighbor

Neighbor ID      Pri  State            Dead Time    Address          Interface
100.255.255.255   1    FULL/DR        00:00:34     192.168.10.18  Ethernet0/3
100.3.3.3         1    FULL/BDR       00:00:32     192.168.10.10  Ethernet0/2
100.2.2.2         1    FULL/DR        00:00:35     192.168.10.2   Ethernet0/0
192.168.40.13     1    FULL/BDR       00:00:39     192.168.20.2   Ethernet0/1
CLC-R1#
```

On CLC-R2

```
CLC-R2#show ip ospf neighbor

Neighbor ID      Pri  State            Dead Time    Address          Interface
100.255.255.255   1    FULL/DR        00:00:38     192.168.10.22  Ethernet0/3
100.4.4.4         1    FULL/DR        00:00:35     192.168.10.14  Ethernet0/2
100.1.1.1         1    FULL/BDR       00:00:32     192.168.10.1   Ethernet0/0
192.168.50.9      1    FULL/BDR       00:00:30     192.168.30.2   Ethernet0/1
CLC-R2#
```

On CLC-R3

```
CLC-R3#show ip ospf neighbor

Neighbor ID      Pri  State            Dead Time    Address          Interface
100.255.255.255   1    FULL/DR        00:00:32     192.168.10.26  Ethernet0/3
100.1.1.1         1    FULL/DR        00:00:35     192.168.10.9   Ethernet0/2
100.4.4.4         1    FULL/DR        00:00:36     192.168.10.6   Ethernet0/0
192.168.40.14     1    FULL/BDR       00:00:35     192.168.20.6   Ethernet0/1
CLC-R3#
```

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On CLC-R4

```
CLC-R4#show ip ospf neighbor

Neighbor ID      Pri   State          Dead Time    Address        Interface
100.255.255.255     1   FULL/DR       00:00:34    192.168.10.30  Ethernet0/3
100.2.2.2          1   FULL/BDR      00:00:32    192.168.10.13  Ethernet0/2
100.3.3.3          1   FULL/BDR      00:00:34    192.168.10.5   Ethernet0/0
192.168.50.10       1   FULL/BDR      00:00:36    192.168.30.6   Ethernet0/1
CLC-R4#
```

On CLC-R21

```
CLC-R21#show ip ospf neighbor

Neighbor ID      Pri   State          Dead Time    Address        Interface
100.1.1.1          1   FULL/DR       00:00:37    192.168.20.1   Ethernet0/1
100.22.22.22        1   FULL/BDR      00:00:34    192.168.40.14  Ethernet0/2
100.23.23.23        1   FULL/BDR      00:00:33    192.168.40.1   Ethernet0/0
CLC-R21#
```

On CLC-R22

```
CLC-R22#show ip ospf neighbor

Neighbor ID      Pri   State          Dead Time    Address        Interface
100.3.3.3          1   FULL/DR       00:00:39    192.168.20.5   Ethernet0/1
100.21.21.21        1   FULL/DR       00:00:34    192.168.40.13  Ethernet0/2
100.24.24.24        1   FULL/BDR      00:00:36    192.168.40.5   Ethernet0/0
CLC-R22#
```

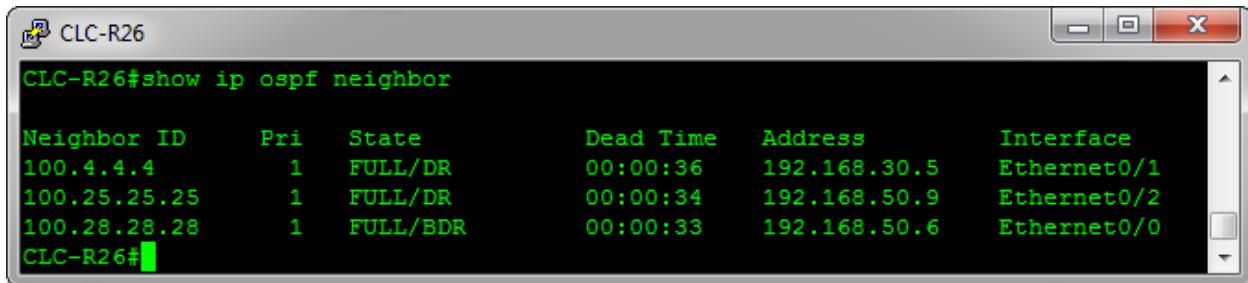
On CLC-R25

```
CLC-R25#show ip ospf neighbor

Neighbor ID      Pri   State          Dead Time    Address        Interface
100.2.2.2          1   FULL/DR       00:00:31    192.168.30.1   Ethernet0/1
100.26.26.26        1   FULL/BDR      00:00:35    192.168.50.10  Ethernet0/2
100.27.27.27        1   FULL/BDR      00:00:36    192.168.50.2   Ethernet0/0
CLC-R25#
```

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On CLC-R26



CLC-R26#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
100.4.4.4	1	FULL/DR	00:00:36	192.168.30.5	Ethernet0/1
100.25.25.25	1	FULL/DR	00:00:34	192.168.50.9	Ethernet0/2
100.28.28.28	1	FULL/BDR	00:00:33	192.168.50.6	Ethernet0/0
CLC-R26#					

CCIE Lab Center

SECTION 2.4: OSPF in Service Provider Internet Hub

QUESTION

Configure Service Provider Internet Hub site as per the following requirements:

1. Configure OSPF process id 200 Area 0 in SPIH as per the diagram
2. Set the router id to interface loopback 0 on all devices.
3. The interface loopback 0 at each router must be seen as an internal OSPF prefix by all other L3 devices.
4. Do not try to modify the default OSPF cost on any device.
5. Ensure that OSPF is not running on any interface that is facing another AS not in use.
6. You are allowed to advertise only specific networks in OSPF to accomplish this requirement

Solution

On CLC-R27

```
CLC-R27(config)#router ospf 200
CLC-R27(config-router)#network 162.40.1.1 0.0.0.0 area 0
CLC-R27(config-router)#exit
CLC-R27(config)#
```

On CLC-R28

```
CLC-R28(config)#router ospf 200
CLC-R28(config-router)#network 162.40.1.5 0.0.0.0 area 0
CLC-R28(config-router)#exit
CLC-R28(config)#
```

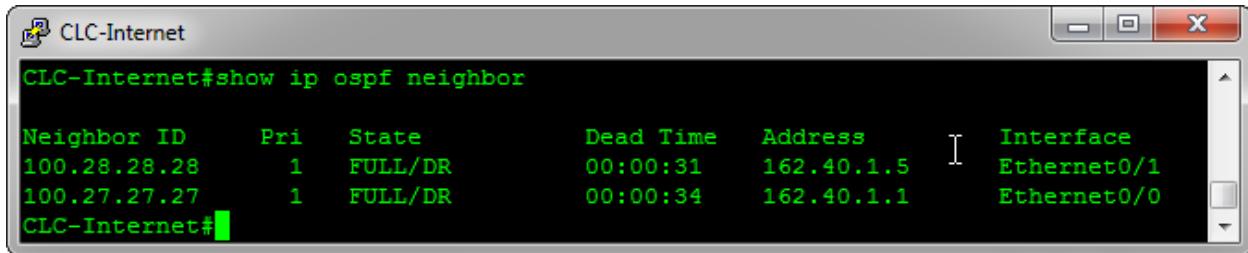
On CLC-Internet

```
CLC-Internet(config)#router ospf 200
CLC-Internet(config-router)#router-id 162.100.100.100
CLC-Internet(config-router)# network 162.40.1.2 0.0.0.0 area 0
CLC-Internet(config-router)# network 162.40.1.6 0.0.0.0 area 0
CLC-Internet(config-router)# network 162.100.100.100 0.0.0.0 area 0
CLC-Internet(config-router)#exit
CLC-Internet(config)#
```

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Verification

On CLC-Internet



A screenshot of a Windows-style terminal window titled "CLC-Internet". The window contains the output of the command "show ip ospf neighbor". The output shows two neighbors: one with IP 100.28.28.28 and another with IP 100.27.27.27. Both neighbors are in a FULL/DR state. The interface for the first neighbor is Ethernet0/1 and for the second is Ethernet0/0. Dead time values are 00:00:31 and 00:00:34 respectively.

```
CLC-Internet#show ip ospf neighbor

Neighbor ID      Pri   State            Dead Time     Address          Interface
100.28.28.28      1    FULL/DR        00:00:31    162.40.1.5      Ethernet0/1
100.27.27.27      1    FULL/DR        00:00:34    162.40.1.1      Ethernet0/0
CLC-Internet#
```

CCIE Lab Center

SECTION 2.5: Service Provider IGP (OSPF) Redistribution

QUESTION

Redistribute the network in Service Provider Distribution Area & Service Provider Customer Area site as per the following requirements:

1. You must be able to get reachability end-to-end in Service Provider via IGP.
2. None of the devices/routes must fail to install the IGP routes.
3. You are allowed to redistribute IGP to IGP only on devices having more than one IGP network (Process/Protocol).
4. You must be able to see specific routes installed in the routing table
5. Do not filter any routes.
6. You are not allowed to enable any routing policies in IGP network.

Solution

On CLC-R21

```
CLC-R21(config)#router ospf 200
CLC-R21(config-router)#redistribute ospf 100 subnets
CLC-R21(config-router)#exit
CLC-R21(config)#
```

```
CLC-R21(config)#router ospf 100
CLC-R21(config-router)#redistribute ospf 200 subnets
CLC-R21(config-router)#exit
CLC-R21(config)#
```

On CLC-R22

```
CLC-R22(config)#router ospf 200
CLC-R22(config-router)#redistribute ospf 100 subnets
CLC-R22(config-router)#exit
CLC-R22(config)#
```

```
CLC-R22(config)#router ospf 100
CLC-R22(config-router)#redistribute ospf 200 subnets
CLC-R22(config-router)#exit
CLC-R22(config)#
```

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On CLC-R25

```
CLC-R25(config)#router ospf 200  
CLC-R25(config-router)#redistribute ospf 100 subnets  
CLC-R25(config-router)#exit  
CLC-R25(config)#
```

```
CLC-R25(config)#router ospf 100  
CLC-R25(config-router)#redistribute ospf 200 subnets  
CLC-R25(config-router)#exit  
CLC-R25(config)#
```

On CLC-R26

```
CLC-R26(config)#router ospf 200  
CLC-R26(config-router)#redistribute ospf 100 subnets  
CLC-R26(config-router)#exit  
CLC-R26(config)#
```

```
CLC-R26(config)#router ospf 100  
CLC-R26(config-router)#redistribute ospf 200 subnets  
CLC-R26(config-router)#exit  
CLC-R26(config)#
```

Verification

On CLC-SP-Backbone

CCIE Lab Center

```

CLC-SP-Backbone#show ip route ospf
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
        a - application route
        + - replicated route, % - next hop override

Gateway of last resort is not set

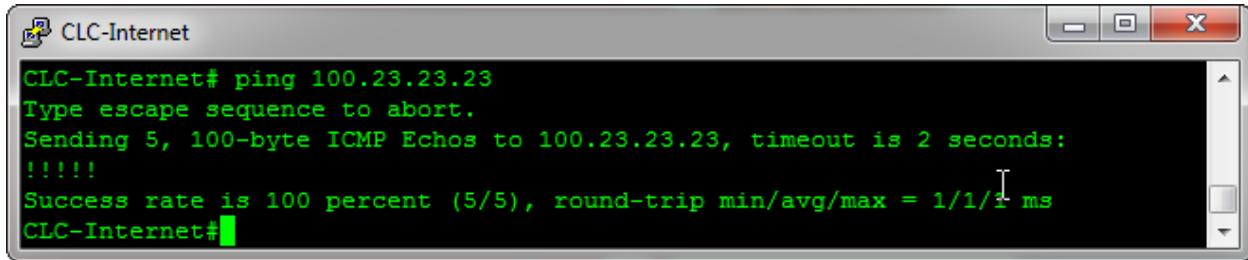
      100.0.0.0/32 is subnetted, 13 subnets
O       100.1.1.1 [110/11] via 192.168.10.17, 02:22:00, Ethernet0/0
O       100.2.2.2 [110/11] via 192.168.10.21, 02:22:00, Ethernet0/1
O       100.3.3.3 [110/11] via 192.168.10.25, 01:31:21, Ethernet0/2
O       100.4.4.4 [110/11] via 192.168.10.29, 02:22:00, Ethernet0/3
O E2     100.21.21.21 [110/1] via 192.168.10.17, 00:03:17, Ethernet0/0
O E2     100.22.22.22 [110/1] via 192.168.10.25, 00:03:07, Ethernet0/2
O E2     100.23.23.23 [110/11] via 192.168.10.17, 00:03:17, Ethernet0/0
O E2     100.24.24.24 [110/11] via 192.168.10.25, 00:03:07, Ethernet0/2
O E2     100.25.25.25 [110/1] via 192.168.10.21, 00:02:52, Ethernet0/1
O E2     100.26.26.26 [110/1] via 192.168.10.29, 00:02:52, Ethernet0/3
O E2     100.27.27.27 [110/11] via 192.168.10.21, 00:02:52, Ethernet0/1
O E2     100.28.28.28 [110/11] via 192.168.10.29, 00:02:52, Ethernet0/3
      162.40.0.0/30 is subnetted, 2 subnets
O E2     162.40.1.0 [110/20] via 192.168.10.21, 00:02:52, Ethernet0/1
O E2     162.40.1.4 [110/20] via 192.168.10.29, 00:02:52, Ethernet0/3
      162.100.0.0/32 is subnetted, 1 subnets
O E2     162.100.100.100 [110/21] via 192.168.10.29, 00:02:52, Ethernet0/3
                           [110/21] via 192.168.10.21, 00:02:52, Ethernet0/1
      192.168.10.0/24 is variably subnetted, 12 subnets, 2 masks
O         192.168.10.0/30 [110/20] via 192.168.10.21, 02:22:00, Ethernet0/1
                           [110/20] via 192.168.10.17, 02:21:50, Ethernet0/0
O         192.168.10.4/30 [110/20] via 192.168.10.29, 02:22:00, Ethernet0/3
                           [110/20] via 192.168.10.25, 01:31:21, Ethernet0/2
O         192.168.10.8/30 [110/20] via 192.168.10.25, 01:31:21, Ethernet0/2
                           [110/20] via 192.168.10.17, 01:31:31, Ethernet0/0
O         192.168.10.12/30 [110/20] via 192.168.10.29, 02:22:00, Ethernet0/3
                           [110/20] via 192.168.10.21, 02:22:00, Ethernet0/1

CLC-SP-Backbone#
      192.168.20.0/30 is subnetted, 2 subnets
O IA     192.168.20.0 [110/20] via 192.168.10.17, 01:29:13, Ethernet0/0
O IA     192.168.20.4 [110/20] via 192.168.10.25, 01:32:13, Ethernet0/2
      192.168.30.0/30 is subnetted, 2 subnets
O IA     192.168.30.0 [110/20] via 192.168.10.21, 01:34:37, Ethernet0/1
O IA     192.168.30.4 [110/20] via 192.168.10.29, 01:30:41, Ethernet0/3
      192.168.40.0/30 is subnetted, 4 subnets
O E2     192.168.40.0 [110/10] via 192.168.10.17, 00:04:24, Ethernet0/0
O E2     192.168.40.4 [110/10] via 192.168.10.25, 00:04:14, Ethernet0/2
O E2     192.168.40.8 [110/20] via 192.168.10.25, 00:04:14, Ethernet0/2
                           [110/20] via 192.168.10.17, 00:04:14, Ethernet0/0
O E2     192.168.40.12 [110/10] via 192.168.10.25, 00:04:14, Ethernet0/2
                           [110/10] via 192.168.10.17, 00:04:24, Ethernet0/0
      192.168.50.0/30 is subnetted, 4 subnets
O E2     192.168.50.0 [110/10] via 192.168.10.21, 00:03:59, Ethernet0/1
O E2     192.168.50.4 [110/10] via 192.168.10.29, 00:03:59, Ethernet0/3
O E2     192.168.50.8 [110/10] via 192.168.10.29, 00:03:59, Ethernet0/3
                           [110/10] via 192.168.10.21, 00:03:59, Ethernet0/1
O E2     192.168.50.12 [110/20] via 192.168.10.29, 00:03:59, Ethernet0/3
                           [110/20] via 192.168.10.21, 00:03:59, Ethernet0/1
CLC-SP-Backbone#

```

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On CLC-Internet



```
CLC-Internet# ping 100.23.23.23
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 100.23.23.23, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-Internet#
```

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SECTION 3: Service Provider BGP

SECTION 3.1: IGBP & VPN in Service Provider

QUESTION

Configure the network in Service Provider sites as per the following requirements:

1. Configure BGP neighborship between L3 devices in complete Service Provider Network.
2. All BGP routers must use their interface loopback0 as their BGP router-id.
3. Disable the default ipv4 unicast address family for peering session establishment in all BGP routers.
4. BGP neighborship must be established via interface loopback0 in VPNV4 technology.
5. BGP peering must be established between:
 - R1 to R3, R21, R22, R23, R24, BB
 - R2 to R4, R25, R26, R27, R28, BB
 - R3 to R1, R21, R22, R23, R24, BB
 - R4 to R2, R25, R26, R27, R28, BB
6. Devices R1, R2, R3, R4, BB must act as route-reflector with its peerings.
7. Use BGP Cluster id:
 - R1 – 1
 - R2 – 2
 - R3 – 3
 - R4 – 4
 - BB – 5
8. All IBGP Service Provider devices must be able to install the client routes. Make sure the next-hop is reachable for every IBGP & EBGP peerings.

Solution

On CLC-Backbone

```
CLC-SP-Backbone(config)#router bgp 6100
CLC-SP-Backbone(config-router)#bgp router-id 100.255.255.255
CLC-SP-Backbone(config-router)#bgp cluster-id 5
CLC-SP-Backbone(config-router)#no bgp default ipv4-unicast
CLC-SP-Backbone(config-router)#neighbor 100.1.1.1 remote-as 6100
CLC-SP-Backbone(config-router)#neighbor 100.1.1.1 update-source Loopback0
```

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```
CLC-SP-Backbone(config-router)#neighbor 100.2.2.2 remote-as 6100
CLC-SP-Backbone(config-router)#neighbor 100.2.2.2 update-source Loopback0
CLC-SP-Backbone(config-router)#neighbor 100.3.3.3 remote-as 6100
CLC-SP-Backbone(config-router)#neighbor 100.3.3.3 update-source Loopback0
CLC-SP-Backbone(config-router)#neighbor 100.4.4.4 remote-as 6100
CLC-SP-Backbone(config-router)#neighbor 100.4.4.4 update-source Loopback0
CLC-SP-Backbone(config-router)#

CLC-SP-Backbone(config-router)# address-family vpng4
CLC-SP-Backbone(config-router-af)#neighbor 100.1.1.1 activate
CLC-SP-Backbone(config-router-af)#neighbor 100.1.1.1 send-community extended
CLC-SP-Backbone(config-router-af)#neighbor 100.1.1.1 route-reflector-client
CLC-SP-Backbone(config-router-af)#neighbor 100.1.1.1 next-hop-self
CLC-SP-Backbone(config-router-af)#neighbor 100.2.2.2 activate
CLC-SP-Backbone(config-router-af)#neighbor 100.2.2.2 send-community extended
CLC-SP-Backbone(config-router-af)#neighbor 100.2.2.2 route-reflector-client
CLC-SP-Backbone(config-router-af)#neighbor 100.2.2.2 next-hop-self
CLC-SP-Backbone(config-router-af)#neighbor 100.3.3.3 activate
CLC-SP-Backbone(config-router-af)#neighbor 100.3.3.3 send-community extended
CLC-SP-Backbone(config-router-af)#neighbor 100.3.3.3 route-reflector-client
CLC-SP-Backbone(config-router-af)#neighbor 100.3.3.3 next-hop-self
CLC-SP-Backbone(config-router-af)#neighbor 100.4.4.4 activate
CLC-SP-Backbone(config-router-af)#neighbor 100.4.4.4 send-community extended
CLC-SP-Backbone(config-router-af)#neighbor 100.4.4.4 route-reflector-client
CLC-SP-Backbone(config-router-af)#neighbor 100.4.4.4 next-hop-self
CLC-SP-Backbone(config-router-af)#exit-address-family
CLC-SP-Backbone(config-router)#exit
CLC-SP-Backbone(config)#+
```

On CLC-R1

```
CLC-R1(config)#router bgp 6100
CLC-R1(config-router)#bgp router-id 100.1.1.1
CLC-R1(config-router)#bgp cluster-id 1
CLC-R1(config-router)#no bgp default ipv4-unicast
CLC-R1(config-router)#neighbor 100.3.3.3 remote-as 6100
CLC-R1(config-router)#neighbor 100.3.3.3 update-source Loopback0
CLC-R1(config-router)#neighbor 100.21.21.21 remote-as 6100
CLC-R1(config-router)#neighbor 100.21.21.21 update-source Loopback0
CLC-R1(config-router)#neighbor 100.22.22.22 remote-as 6100
CLC-R1(config-router)#neighbor 100.22.22.22 update-source Loopback0
CLC-R1(config-router)#neighbor 100.23.23.23 remote-as 6100
CLC-R1(config-router)#neighbor 100.23.23.23 update-source Loopback0
CLC-R1(config-router)#neighbor 100.24.24.24 remote-as 6100
CLC-R1(config-router)#neighbor 100.24.24.24 update-source Loopback0
CLC-R1(config-router)#neighbor 100.255.255.255 remote-as 6100
```

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```
CLC-R1(config-router)#neighbor 100.255.255.255 update-source Loopback0
CLC-R1(config-router)#

CLC-R1(config-router)#address-family vpng4
CLC-R1(config-router-af)#neighbor 100.3.3.3 activate
CLC-R1(config-router-af)#neighbor 100.3.3.3 send-community extended
CLC-R1(config-router-af)#neighbor 100.3.3.3 route-reflector-client
CLC-R1(config-router-af)#neighbor 100.3.3.3 next-hop-self
CLC-R1(config-router-af)#neighbor 100.21.21.21 activate
CLC-R1(config-router-af)#neighbor 100.21.21.21 send-community extended
CLC-R1(config-router-af)#neighbor 100.21.21.21 route-reflector-client
CLC-R1(config-router-af)#neighbor 100.21.21.21 next-hop-self
CLC-R1(config-router-af)#neighbor 100.22.22.22 activate
CLC-R1(config-router-af)#neighbor 100.22.22.22 send-community extended
CLC-R1(config-router-af)#neighbor 100.22.22.22 route-reflector-client
CLC-R1(config-router-af)#neighbor 100.22.22.22 next-hop-self
CLC-R1(config-router-af)#neighbor 100.23.23.23 activate
CLC-R1(config-router-af)#neighbor 100.23.23.23 send-community extended
CLC-R1(config-router-af)#neighbor 100.23.23.23 route-reflector-client
CLC-R1(config-router-af)#neighbor 100.23.23.23 next-hop-self
CLC-R1(config-router-af)#neighbor 100.24.24.24 activate
CLC-R1(config-router-af)#neighbor 100.24.24.24 send-community extended
CLC-R1(config-router-af)#neighbor 100.24.24.24 route-reflector-client
CLC-R1(config-router-af)#neighbor 100.24.24.24 next-hop-self
CLC-R1(config-router-af)#neighbor 100.255.255.255 activate
CLC-R1(config-router-af)#neighbor 100.255.255.255 send-community extended
CLC-R1(config-router-af)#neighbor 100.255.255.255 route-reflector-client
CLC-R1(config-router-af)#neighbor 100.255.255.255 next-hop-self
CLC-R1(config-router-af)# exit-address-family
CLC-R1(config-router)#exit
CLC-R1(config)#
```

On CLC-R2

```
CLC-R2(config)#router bgp 6100
CLC-R2(config-router)#bgp router-id 100.2.2.2
CLC-R2(config-router)#bgp cluster-id 2
CLC-R2(config-router)#no bgp default ipv4-unicast
CLC-R2(config-router)#neighbor 100.4.4.4 remote-as 6100
CLC-R2(config-router)#neighbor 100.4.4.4 update-source Loopback0
CLC-R2(config-router)#neighbor 100.25.25.25 remote-as 6100
CLC-R2(config-router)#neighbor 100.25.25.25 update-source Loopback0
CLC-R2(config-router)#neighbor 100.26.26.26 remote-as 6100
CLC-R2(config-router)#neighbor 100.26.26.26 update-source Loopback0
CLC-R2(config-router)#neighbor 100.27.27.27 remote-as 6100
CLC-R2(config-router)#neighbor 100.27.27.27 update-source Loopback0
```

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```
CLC-R2(config-router)#neighbor 100.28.28.28 remote-as 6100
CLC-R2(config-router)#neighbor 100.28.28.28 update-source Loopback0
CLC-R2(config-router)#neighbor 100.255.255.255 remote-as 6100
CLC-R2(config-router)#neighbor 100.255.255.255 update-source Loopback0
CLC-R2(config-router)#neighbor 162.100.100.100 remote-as 6100
CLC-R2(config-router)#neighbor 162.100.100.100 update-source Loopback0
CLC-R2(config-router)#

CLC-R2(config-router)#address-family vpng4
CLC-R2(config-router-af)#neighbor 100.4.4.4 activate
CLC-R2(config-router-af)#neighbor 100.4.4.4 send-community extended
CLC-R2(config-router-af)#neighbor 100.4.4.4 route-reflector-client
CLC-R2(config-router-af)#neighbor 100.4.4.4 next-hop-self
CLC-R2(config-router-af)#neighbor 100.25.25.25 activate
CLC-R2(config-router-af)#neighbor 100.25.25.25 send-community extended
CLC-R2(config-router-af)#neighbor 100.25.25.25 route-reflector-client
CLC-R2(config-router-af)#neighbor 100.25.25.25 next-hop-self
CLC-R2(config-router-af)#neighbor 100.26.26.26 activate
CLC-R2(config-router-af)#neighbor 100.26.26.26 send-community extended
CLC-R2(config-router-af)#neighbor 100.26.26.26 route-reflector-client
CLC-R2(config-router-af)#neighbor 100.26.26.26 next-hop-self
CLC-R2(config-router-af)#neighbor 100.27.27.27 activate
CLC-R2(config-router-af)#neighbor 100.27.27.27 send-community extended
CLC-R2(config-router-af)#neighbor 100.27.27.27 route-reflector-client
CLC-R2(config-router-af)#neighbor 100.27.27.27 next-hop-self
CLC-R2(config-router-af)#neighbor 100.28.28.28 activate
CLC-R2(config-router-af)#neighbor 100.28.28.28 send-community extended
CLC-R2(config-router-af)#neighbor 100.28.28.28 route-reflector-client
CLC-R2(config-router-af)#neighbor 100.28.28.28 next-hop-self
CLC-R2(config-router-af)#neighbor 100.255.255.255 activate
CLC-R2(config-router-af)#neighbor 100.255.255.255 send-community extended
CLC-R2(config-router-af)#neighbor 100.255.255.255 route-reflector-client
CLC-R2(config-router-af)#neighbor 100.255.255.255 next-hop-self
CLC-R2(config-router-af)#neighbor 162.100.100.100 activate
CLC-R2(config-router-af)#neighbor 162.100.100.100 send-community extended
CLC-R2(config-router-af)#neighbor 162.100.100.100 route-reflector-client
CLC-R2(config-router-af)#neighbor 162.100.100.100 next-hop-self
CLC-R2(config-router)# exit-address-family
CLC-R2(config-router)#exit
CLC-R2(config)#

```

On CLC-R3

```
CLC-R3(config)#router bgp 6100
CLC-R3(config-router)#bgp router-id 100.3.3.3
CLC-R3(config-router)#bgp cluster-id 3
```

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```
CLC-R3(config-router)#no bgp default ipv4-unicast
CLC-R3(config-router)#neighbor 100.1.1.1 remote-as 6100
CLC-R3(config-router)#neighbor 100.1.1.1 update-source Loopback0
CLC-R3(config-router)#neighbor 100.21.21.21 remote-as 6100
CLC-R3(config-router)#neighbor 100.21.21.21 update-source Loopback0
CLC-R3(config-router)#neighbor 100.22.22.22 remote-as 6100
CLC-R3(config-router)#neighbor 100.22.22.22 update-source Loopback0
CLC-R3(config-router)#neighbor 100.23.23.23 remote-as 6100
CLC-R3(config-router)#neighbor 100.23.23.23 update-source Loopback0
CLC-R3(config-router)#neighbor 100.24.24.24 remote-as 6100
CLC-R3(config-router)#neighbor 100.24.24.24 update-source Loopback0
CLC-R3(config-router)#neighbor 100.255.255.255 remote-as 6100
CLC-R3(config-router)#neighbor 100.255.255.255 update-source Loopback0
CLC-R3(config-router)#
CLC-R3(config-router)#address-family vpnv4
CLC-R3(config-router-af)#neighbor 100.1.1.1 activate
CLC-R3(config-router-af)#neighbor 100.1.1.1 send-community extended
CLC-R3(config-router-af)#neighbor 100.1.1.1 route-reflector-client
CLC-R3(config-router-af)#neighbor 100.1.1.1 next-hop-self
CLC-R3(config-router-af)#neighbor 100.21.21.21 activate
CLC-R3(config-router-af)#neighbor 100.21.21.21 send-community extended
CLC-R3(config-router-af)#neighbor 100.21.21.21 route-reflector-client
CLC-R3(config-router-af)#neighbor 100.21.21.21 next-hop-self
CLC-R3(config-router-af)#neighbor 100.22.22.22 activate
CLC-R3(config-router-af)#neighbor 100.22.22.22 send-community extended
CLC-R3(config-router-af)#neighbor 100.22.22.22 route-reflector-client
CLC-R3(config-router-af)#neighbor 100.22.22.22 next-hop-self
CLC-R3(config-router-af)#neighbor 100.23.23.23 activate
CLC-R3(config-router-af)#neighbor 100.23.23.23 send-community extended
CLC-R3(config-router-af)#neighbor 100.23.23.23 route-reflector-client
CLC-R3(config-router-af)#neighbor 100.23.23.23 next-hop-self
CLC-R3(config-router-af)#neighbor 100.24.24.24 activate
CLC-R3(config-router-af)#neighbor 100.24.24.24 send-community extended
CLC-R3(config-router-af)#neighbor 100.24.24.24 route-reflector-client
CLC-R3(config-router-af)#neighbor 100.24.24.24 next-hop-self
CLC-R3(config-router-af)#neighbor 100.255.255.255 activate
CLC-R3(config-router-af)#neighbor 100.255.255.255 send-community extended
CLC-R3(config-router-af)#neighbor 100.255.255.255 route-reflector-client
CLC-R3(config-router-af)#neighbor 100.255.255.255 next-hop-self
CLC-R3(config-router)# exit-address-family
CLC-R3(config-router)#
CLC-R3(config)#
```

On CLC-R4

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```
CLC-R4(config-router)#bgp router-id 100.4.4.4
CLC-R4(config-router)#bgp cluster-id 4
CLC-R4(config-router)#no bgp default ipv4-unicast
CLC-R4(config-router)#neighbor 100.2.2.2 remote-as 6100
CLC-R4(config-router)#neighbor 100.2.2.2 update-source Loopback0
CLC-R4(config-router)#neighbor 100.25.25.25 remote-as 6100
CLC-R4(config-router)#neighbor 100.25.25.25 update-source Loopback0
CLC-R4(config-router)#neighbor 100.26.26.26 remote-as 6100
CLC-R4(config-router)#neighbor 100.26.26.26 update-source Loopback0
CLC-R4(config-router)#neighbor 100.27.27.27 remote-as 6100
CLC-R4(config-router)#neighbor 100.27.27.27 update-source Loopback0
CLC-R4(config-router)#neighbor 100.28.28.28 remote-as 6100
CLC-R4(config-router)#neighbor 100.28.28.28 update-source Loopback0
CLC-R4(config-router)#neighbor 100.255.255.255 remote-as 6100
CLC-R4(config-router)#neighbor 100.255.255.255 update-source Loopback0
CLC-R4(config-router)#neighbor 162.100.100.100 remote-as 6100
CLC-R4(config-router)#neighbor 162.100.100.100 update-source Loopback0
CLC-R4(config-router)#

```

```
CLC-R4(config-router)#address-family vpnv4
CLC-R4(config-router-af)#neighbor 100.2.2.2 activate
CLC-R4(config-router-af)#neighbor 100.2.2.2 send-community extended
CLC-R4(config-router-af)#neighbor 100.2.2.2 route-reflector-client
CLC-R4(config-router-af)#neighbor 100.2.2.2 next-hop-self
CLC-R4(config-router-af)#neighbor 100.25.25.25 activate
CLC-R4(config-router-af)#neighbor 100.25.25.25 send-community extended
CLC-R4(config-router-af)#neighbor 100.25.25.25 route-reflector-client
CLC-R4(config-router-af)#neighbor 100.25.25.25 next-hop-self
CLC-R4(config-router-af)#neighbor 100.26.26.26 activate
CLC-R4(config-router-af)#neighbor 100.26.26.26 send-community extended
CLC-R4(config-router-af)#neighbor 100.26.26.26 route-reflector-client
CLC-R4(config-router-af)#neighbor 100.26.26.26 next-hop-self
CLC-R4(config-router-af)#neighbor 100.27.27.27 activate
CLC-R4(config-router-af)#neighbor 100.27.27.27 send-community extended
CLC-R4(config-router-af)#neighbor 100.27.27.27 route-reflector-client
CLC-R4(config-router-af)#neighbor 100.27.27.27 next-hop-self
CLC-R4(config-router-af)#neighbor 100.28.28.28 activate
CLC-R4(config-router-af)#neighbor 100.28.28.28 send-community extended
CLC-R4(config-router-af)#neighbor 100.28.28.28 route-reflector-client
CLC-R4(config-router-af)#neighbor 100.28.28.28 next-hop-self
CLC-R4(config-router-af)#neighbor 100.255.255.255 activate
CLC-R4(config-router-af)#neighbor 100.255.255.255 send-community extended
CLC-R4(config-router-af)#neighbor 100.255.255.255 route-reflector-client
CLC-R4(config-router-af)#neighbor 100.255.255.255 next-hop-self
CLC-R4(config-router-af)#neighbor 162.100.100.100 activate
CLC-R4(config-router-af)#neighbor 162.100.100.100 send-community extended
CLC-R4(config-router-af)#neighbor 162.100.100.100 route-reflector-client

```

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```
CLC-R4(config-router-af)#neighbor 162.100.100.100 next-hop-self  
CLC-R4(config-router-af)# exit-address-family  
CLC-R4(config-router)#exit  
CLC-R4(config)#
```

On CLC-R21

```
CLC-R21(config)#router bgp 6100  
CLC-R21(config-router)#bgp router-id 100.21.21.21  
CLC-R21(config-router)#no bgp default ipv4-unicast  
CLC-R21(config-router)#neighbor 100.1.1.1 remote-as 6100  
CLC-R21(config-router)#neighbor 100.1.1.1 update-source Loopback0  
CLC-R21(config-router)#neighbor 100.3.3.3 remote-as 6100  
CLC-R21(config-router)#neighbor 100.3.3.3 update-source Loopback0  
CLC-R21(config-router)#  
  
CLC-R21(config-router)#address-family vpng4  
CLC-R21(config-router-af)#neighbor 100.1.1.1 activate  
CLC-R21(config-router-af)#neighbor 100.1.1.1 send-community extended  
CLC-R21(config-router-af)#neighbor 100.1.1.1 next-hop-self  
CLC-R21(config-router-af)#neighbor 100.3.3.3 activate  
CLC-R21(config-router-af)#neighbor 100.3.3.3 send-community extended  
CLC-R21(config-router-af)#neighbor 100.3.3.3 next-hop-self  
CLC-R21(config-router-af)#exit-address-family  
CLC-R21(config-router)#exit  
CLC-R21(config)#
```

On CLC-R22

```
CLC-R22(config)#router bgp 6100  
CLC-R22(config-router)#bgp router-id 100.22.22.22  
CLC-R22(config-router)#no bgp default ipv4-unicast  
CLC-R22(config-router)#neighbor 100.1.1.1 remote-as 6100  
CLC-R22(config-router)#neighbor 100.1.1.1 update-source Loopback0  
CLC-R22(config-router)#neighbor 100.3.3.3 remote-as 6100  
CLC-R22(config-router)#neighbor 100.3.3.3 update-source Loopback0  
CLC-R22(config-router)#  
  
CLC-R22(config-router)#address-family vpng4  
CLC-R22(config-router-af)#neighbor 100.1.1.1 activate  
CLC-R22(config-router-af)#neighbor 100.1.1.1 send-community extended  
CLC-R22(config-router-af)#neighbor 100.1.1.1 next-hop-self  
CLC-R22(config-router-af)#neighbor 100.3.3.3 activate  
CLC-R22(config-router-af)#neighbor 100.3.3.3 send-community extended  
CLC-R22(config-router-af)#neighbor 100.3.3.3 next-hop-self
```

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```
CLC-R22(config-router-af)#exit-address-family  
CLC-R22(config-router)#exit  
CLC-R22(config)#
```

On CLC-R23

```
CLC-R23(config)#router bgp 6100  
CLC-R23(config-router)#bgp router-id 100.23.23.23  
CLC-R23(config-router)#no bgp default ipv4-unicast  
CLC-R23(config-router)#neighbor 100.1.1.1 remote-as 6100  
CLC-R23(config-router)#neighbor 100.1.1.1 update-source Loopback0  
CLC-R23(config-router)#neighbor 100.3.3.3 remote-as 6100  
CLC-R23(config-router)#neighbor 100.3.3.3 update-source Loopback0  
CLC-R23(config-router)#  
  
CLC-R23(config-router)#address-family vpngv4  
CLC-R23(config-router-af)#neighbor 100.1.1.1 activate  
CLC-R23(config-router-af)#neighbor 100.1.1.1 send-community extended  
CLC-R23(config-router-af)#neighbor 100.1.1.1 next-hop-self  
CLC-R23(config-router-af)#neighbor 100.3.3.3 activate  
CLC-R23(config-router-af)#neighbor 100.3.3.3 send-community extended  
CLC-R23(config-router-af)#neighbor 100.3.3.3 next-hop-self  
CLC-R23(config-router-af)#exit-address-family  
CLC-R23(config-router)#exit  
CLC-R23(config)#
```

On CLC-R24

```
CLC-R24(config)#router bgp 6100  
CLC-R24(config-router)#bgp router-id 100.24.24.24  
CLC-R24(config-router)#no bgp default ipv4-unicast  
CLC-R24(config-router)#neighbor 100.1.1.1 remote-as 6100  
CLC-R24(config-router)#neighbor 100.1.1.1 update-source Loopback0  
CLC-R24(config-router)#neighbor 100.3.3.3 remote-as 6100  
CLC-R24(config-router)#neighbor 100.3.3.3 update-source Loopback0  
CLC-R24(config-router)#  
  
CLC-R24(config-router)#address-family vpngv4  
CLC-R24(config-router-af)#neighbor 100.1.1.1 activate  
CLC-R24(config-router-af)#neighbor 100.1.1.1 send-community extended  
CLC-R24(config-router-af)#neighbor 100.1.1.1 next-hop-self  
CLC-R24(config-router-af)#neighbor 100.3.3.3 activate  
CLC-R24(config-router-af)#neighbor 100.3.3.3 send-community extended  
CLC-R24(config-router-af)#neighbor 100.3.3.3 next-hop-self  
CLC-R24(config-router-af)#exit-address-family
```

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```
CLC-R24(config-router)#exit  
CLC-R24(config)#
```

On CLC-R25

```
CLC-R25(config)#router bgp 6100  
CLC-R25(config-router)#bgp router-id 100.25.25.25  
CLC-R25(config-router)#no bgp default ipv4-unicast  
CLC-R25(config-router)#neighbor 100.2.2.2 remote-as 6100  
CLC-R25(config-router)#neighbor 100.2.2.2 update-source Loopback0  
CLC-R25(config-router)#neighbor 100.4.4.4 remote-as 6100  
CLC-R25(config-router)#neighbor 100.4.4.4 update-source Loopback0  
CLC-R25(config-router)#  
  
CLC-R25(config-router)#address-family vpng4  
CLC-R25(config-router-af)#neighbor 100.2.2.2 activate  
CLC-R25(config-router-af)#neighbor 100.2.2.2 send-community extended  
CLC-R25(config-router-af)#neighbor 100.2.2.2 next-hop-self  
CLC-R25(config-router-af)#neighbor 100.4.4.4 activate  
CLC-R25(config-router-af)#neighbor 100.4.4.4 send-community extended  
CLC-R25(config-router-af)#neighbor 100.4.4.4 next-hop-self  
CLC-R25(config-router-af)#exit-address-family  
CLC-R25(config-router)#exit  
CLC-R25(config)#
```

On CLC-R26

```
CLC-R26(config)#router bgp 6100  
CLC-R26(config-router)#bgp router-id 100.26.26.26  
CLC-R26(config-router)#no bgp default ipv4-unicast  
CLC-R26(config-router)#neighbor 100.2.2.2 remote-as 6100  
CLC-R26(config-router)#neighbor 100.2.2.2 update-source Loopback0  
CLC-R26(config-router)#neighbor 100.4.4.4 remote-as 6100  
CLC-R26(config-router)#neighbor 100.4.4.4 update-source Loopback0  
CLC-R26(config-router)#  
  
CLC-R26(config-router)#address-family vpng4  
CLC-R26(config-router-af)#neighbor 100.2.2.2 activate  
CLC-R26(config-router-af)#neighbor 100.2.2.2 send-community extended  
CLC-R26(config-router-af)#neighbor 100.2.2.2 next-hop-self  
CLC-R26(config-router-af)#neighbor 100.4.4.4 activate  
CLC-R26(config-router-af)#neighbor 100.4.4.4 send-community extended  
CLC-R26(config-router-af)#neighbor 100.4.4.4 next-hop-self  
CLC-R26(config-router-af)#exit-address-family  
CLC-R26(config-router)#exit
```

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CLC-R26(config)#

On CLC-R27

```
CLC-R27(config)#router bgp 6100
CLC-R27(config-router)#bgp router-id 100.27.27.27
CLC-R27(config-router)#no bgp default ipv4-unicast
CLC-R27(config-router)#neighbor 100.2.2.2 remote-as 6100
CLC-R27(config-router)#neighbor 100.2.2.2 update-source Loopback0
CLC-R27(config-router)#neighbor 100.4.4.4 remote-as 6100
CLC-R27(config-router)#neighbor 100.4.4.4 update-source Loopback0
CLC-R27(config-router)#
CLC-R27(config-router)#address-family vpng4
CLC-R27(config-router-af)#neighbor 100.2.2.2 activate
CLC-R27(config-router-af)#neighbor 100.2.2.2 send-community extended
CLC-R27(config-router-af)#neighbor 100.2.2.2 next-hop-self
CLC-R27(config-router-af)#neighbor 100.4.4.4 activate
CLC-R27(config-router-af)#neighbor 100.4.4.4 send-community extended
CLC-R27(config-router-af)#neighbor 100.4.4.4 next-hop-self
CLC-R27(config-router-af)#exit-address-family
CLC-R27(config-router)#exit
CLC-R27(config)#
```

On CLC-R28

```
CLC-R28(config)#router bgp 6100
CLC-R28(config-router)#bgp router-id 100.28.28.28
CLC-R28(config-router)#no bgp default ipv4-unicast
CLC-R28(config-router)#neighbor 100.2.2.2 remote-as 6100
CLC-R28(config-router)#neighbor 100.2.2.2 update-source Loopback0
CLC-R28(config-router)#neighbor 100.4.4.4 remote-as 6100
CLC-R28(config-router)#neighbor 100.4.4.4 update-source Loopback0
CLC-R28(config-router)#
CLC-R28(config-router)#address-family vpng4
CLC-R28(config-router-af)#neighbor 100.2.2.2 activate
CLC-R28(config-router-af)#neighbor 100.2.2.2 send-community extended
CLC-R28(config-router-af)#neighbor 100.2.2.2 next-hop-self
CLC-R28(config-router-af)#neighbor 100.4.4.4 activate
CLC-R28(config-router-af)#neighbor 100.4.4.4 send-community extended
CLC-R28(config-router-af)#neighbor 100.4.4.4 next-hop-self
CLC-R28(config-router-af)#exit-address-family
CLC-R28(config-router)#exit
CLC-R28(config)#
```

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On CLC-Internet

```
CLC-Internet(config)#router bgp 6100
CLC-Internet(config-router)#bgp router-id 162.100.100.100
CLC-Internet(config-router)#no bgp default ipv4-unicast
CLC-Internet(config-router)#neighbor 100.2.2.2 remote-as 6100
CLC-Internet(config-router)#neighbor 100.2.2.2 update-source Loopback0
CLC-Internet(config-router)#neighbor 100.4.4.4 remote-as 6100
CLC-Internet(config-router)#neighbor 100.4.4.4 update-source Loopback0
CLC-Internet(config-router)#

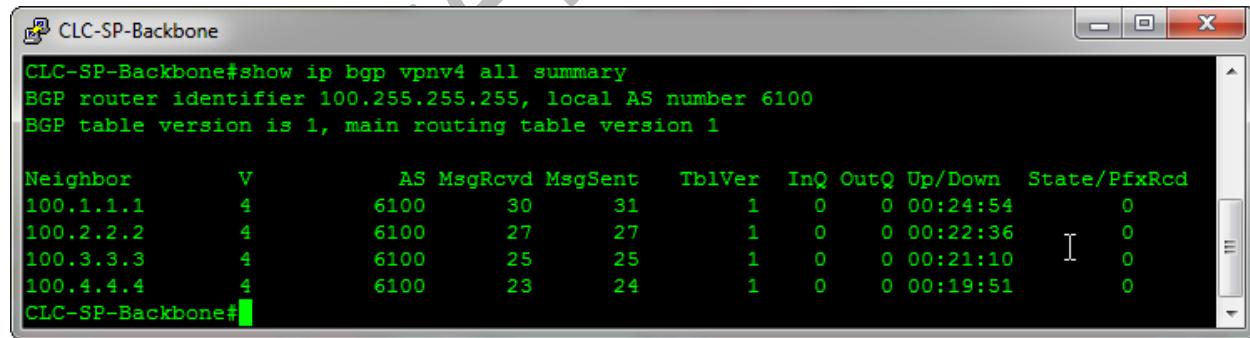
```

```
CLC-Internet(config-router)#address-family vpng4
CLC-Internet(config-router-af)#neighbor 100.2.2.2 activate
CLC-Internet(config-router-af)#neighbor 100.2.2.2 send-community extended
CLC-Internet(config-router-af)#neighbor 100.2.2.2 next-hop-self
CLC-Internet(config-router-af)#neighbor 100.4.4.4 activate
CLC-Internet(config-router-af)#neighbor 100.4.4.4 send-community extended
CLC-Internet(config-router-af)#neighbor 100.4.4.4 next-hop-self
CLC-Internet(config-router-af)#exit-address-family
CLC-Internet(config-router)#exit
CLC-Internet(config)#

```

Verification

On CLC-SP-Backbone

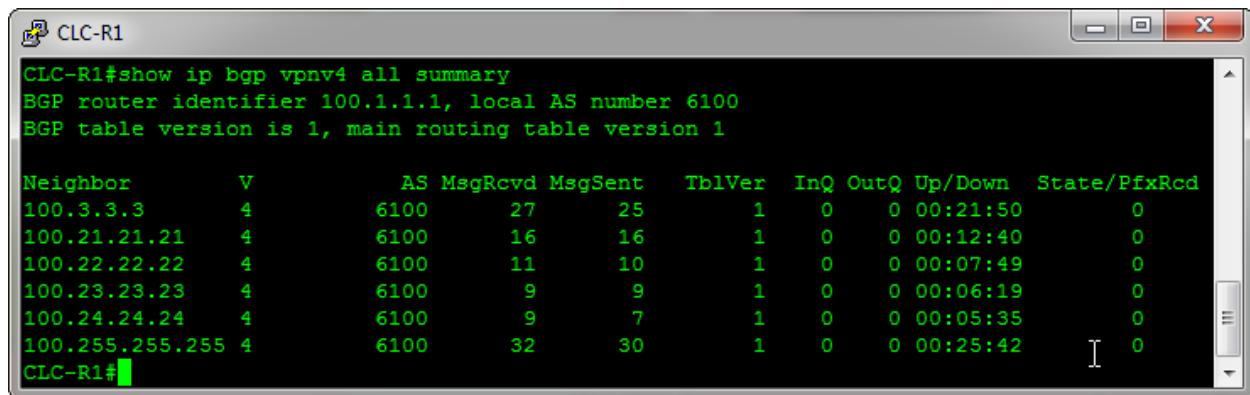


```
CLC-SP-Backbone#show ip bgp vpng4 all summary
BGP router identifier 100.255.255.255, local AS number 6100
BGP table version is 1, main routing table version 1

Neighbor          V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1        4      6100    30     31       1      0    0 00:24:54      0
100.2.2.2        4      6100    27     27       1      0    0 00:22:36      0
100.3.3.3        4      6100    25     25       1      0    0 00:21:10      I  0
100.4.4.4        4      6100    23     24       1      0    0 00:19:51      0
CLC-SP-Backbone#
```

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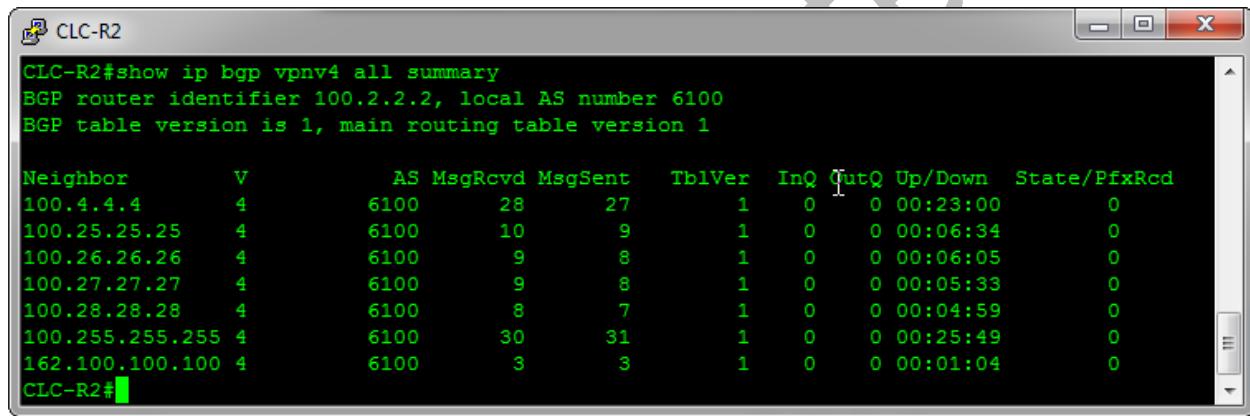
On CLC-R1



```
CLC-R1#show ip bgp vpnv4 all summary
BGP router identifier 100.1.1.1, local AS number 6100
BGP table version is 1, main routing table version 1

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.3.3.3     4      6100    27     25       1      0    0 00:21:50  0
100.21.21.21  4      6100    16     16       1      0    0 00:12:40  0
100.22.22.22  4      6100    11     10       1      0    0 00:07:49  0
100.23.23.23  4      6100    9      9        1      0    0 00:06:19  0
100.24.24.24  4      6100    9      7        1      0    0 00:05:35  0
100.255.255.255 4  6100    32     30       1      0    0 00:25:42  0
CLC-R1#
```

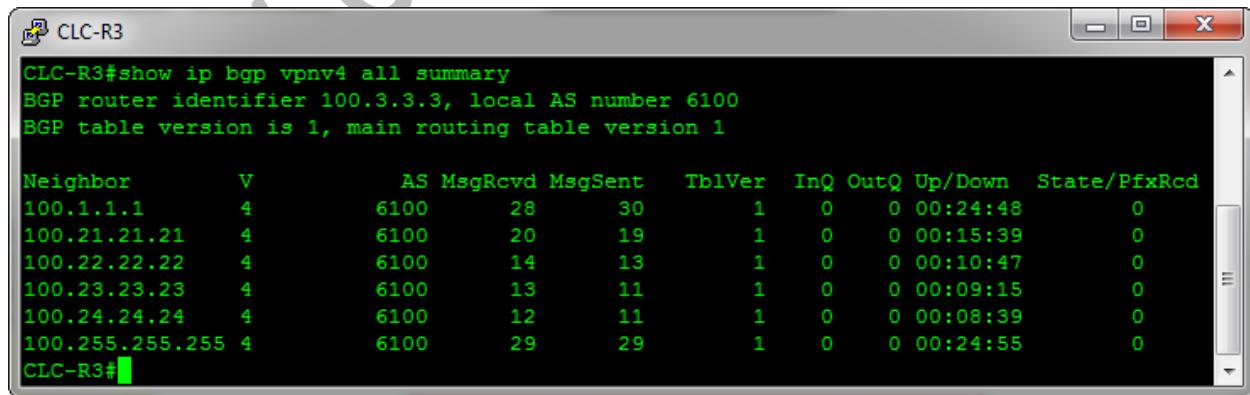
On CLC-R2



```
CLC-R2#show ip bgp vpnv4 all summary
BGP router identifier 100.2.2.2, local AS number 6100
BGP table version is 1, main routing table version 1

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.4.4.4     4      6100    28     27       1      0    0 00:23:00  0
100.25.25.25  4      6100    10     9        1      0    0 00:06:34  0
100.26.26.26  4      6100    9      8        1      0    0 00:06:05  0
100.27.27.27  4      6100    9      8        1      0    0 00:05:33  0
100.28.28.28  4      6100    8      7        1      0    0 00:04:59  0
100.255.255.255 4  6100    30     31       1      0    0 00:25:49  0
162.100.100.100 4  6100    3      3        1      0    0 00:01:04  0
CLC-R2#
```

On CLC-R3

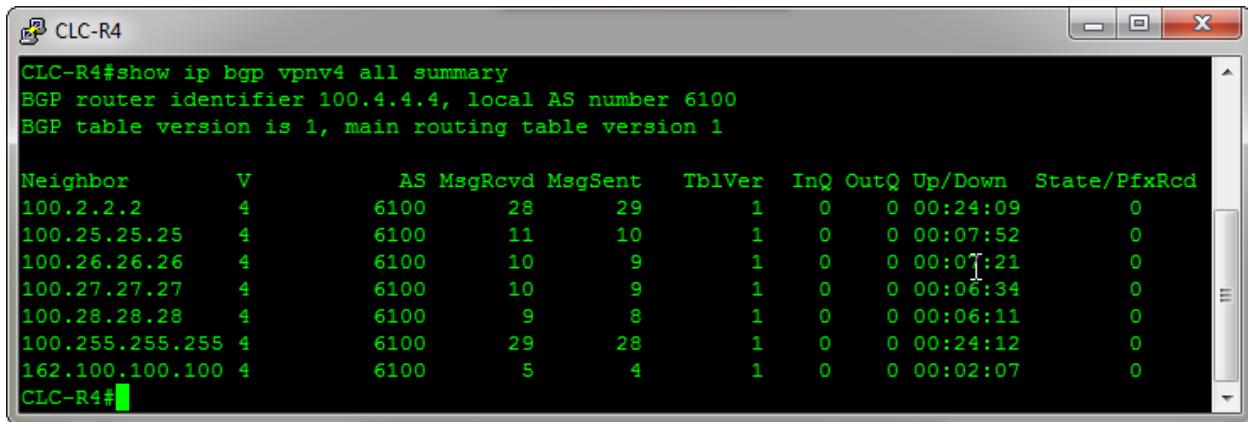


```
CLC-R3#show ip bgp vpnv4 all summary
BGP router identifier 100.3.3.3, local AS number 6100
BGP table version is 1, main routing table version 1

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1     4      6100    28     30       1      0    0 00:24:48  0
100.21.21.21  4      6100    20     19       1      0    0 00:15:39  0
100.22.22.22  4      6100    14     13       1      0    0 00:10:47  0
100.23.23.23  4      6100    13     11       1      0    0 00:09:15  0
100.24.24.24  4      6100    12     11       1      0    0 00:08:39  0
100.255.255.255 4  6100    29     29       1      0    0 00:24:55  0
CLC-R3#
```

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On CLC-R4



CLC-R4#show ip bgp vpng4 all summary
BGP router identifier 100.4.4.4, local AS number 6100
BGP table version is 1, main routing table version 1

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
100.2.2.2	4	6100	28	29	1	0	0	00:24:09	0
100.25.25.25	4	6100	11	10	1	0	0	00:07:52	0
100.26.26.26	4	6100	10	9	1	0	0	00:01:21	0
100.27.27.27	4	6100	10	9	1	0	0	00:06:34	0
100.28.28.28	4	6100	9	8	1	0	0	00:06:11	0
100.255.255.255	4	6100	29	28	1	0	0	00:24:12	0
162.100.100.100	4	6100	5	4	1	0	0	00:02:07	0

CLC-R4#

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SECTION 3.2: MPLS Services in SPCH & SPDA

QUESTION

Configure MPLS network in SPCH & SPDA site as per the following requirements:

1. Configure MPLS network on all P & PE routers using LDP protocol.
2. Enable LDP only on required interfaces on all routers in AS 9100
3. Use the interface loopback 0 to establish LDP peering
4. Ensure that no MPLS interface that belongs to any router in AS 9100 is visible on a traceroute that originates outside of the AS.
5. You can use any method for LDP peering.

Solution

On CLC-SP-Backbone

```
CLC-SP-Backbone(config)#mpls ldp router-id loopback 0 force  
CLC-SP-Backbone(config)#no mpls ip propagate-ttl  
CLC-SP-Backbone(config)#
```

```
CLC-SP-Backbone(config)#router ospf 100  
CLC-SP-Backbone(config-router)#mpls ldp autoconfig  
CLC-SP-Backbone(config-router)#exit  
CLC-SP-Backbone(config)#
```

On CLC-R1

```
CLC-R1(config)#mpls ldp router-id loopback 0 force  
CLC-R1(config)#no mpls ip propagate-ttl  
CLC-R1(config)#
```

```
CLC-R1(config)#router ospf 100  
CLC-R1(config-router)#mpls ldp autoconfig  
CLC-R1(config-router)#exit  
CLC-R1(config)#
```

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On CLC-R2

```
CLC-R2(config)#mpls ldp router-id loopback 0 force
CLC-R2(config)#no mpls ip propagate-ttl
CLC-R2(config)#
CLC-R2(config)#router ospf 100
CLC-R2(config-router)#mpls ldp autoconfig
CLC-R2(config-router)#exit
CLC-R2(config)#+
```

On CLC-R3

```
CLC-R3(config)#mpls ldp router-id loopback 0 force
CLC-R3(config)#no mpls ip propagate-ttl
CLC-R3(config)#
CLC-R3(config)#router ospf 100
CLC-R3(config-router)#mpls ldp autoconfig
CLC-R3(config-router)#exit
CLC-R3(config)#+
```

On CLC-R4

```
CLC-R4(config)#mpls ldp router-id loopback 0 force
CLC-R4(config)#no mpls ip propagate-ttl
CLC-R4(config)#
CLC-R4(config)#router ospf 100
CLC-R4(config-router)#mpls ldp autoconfig
CLC-R4(config-router)#exit
CLC-R4(config)#+
```

On CLC-R21

```
CLC-R21(config)#mpls ldp router-id loopback 0 force
CLC-R21(config)#no mpls ip propagate-ttl
CLC-R21(config)#
CLC-R21(config)#router ospf 100
CLC-R21(config-router)#mpls ldp autoconfig
CLC-R21(config-router)#exit
CLC-R21(config)#+
```

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On CLC-R22

```
CLC-R22(config)#mpls ldp router-id loopback 0 force  
CLC-R22(config)#no mpls ip propagate-ttl  
CLC-R22(config)#
```

```
CLC-R22(config)#router ospf 100  
CLC-R22(config-router)#mpls ldp autoconfig  
CLC-R22(config-router)#exit  
CLC-R22(config)#
```

On CLC-R25

```
CLC-R25(config)#mpls ldp router-id loopback 0 force  
CLC-R25(config)#no mpls ip propagate-ttl  
CLC-R25(config)#
```

```
CLC-R25(config)#router ospf 100  
CLC-R25(config-router)#mpls ldp autoconfig  
CLC-R25(config-router)#exit  
CLC-R25(config)#
```

On CLC-R26

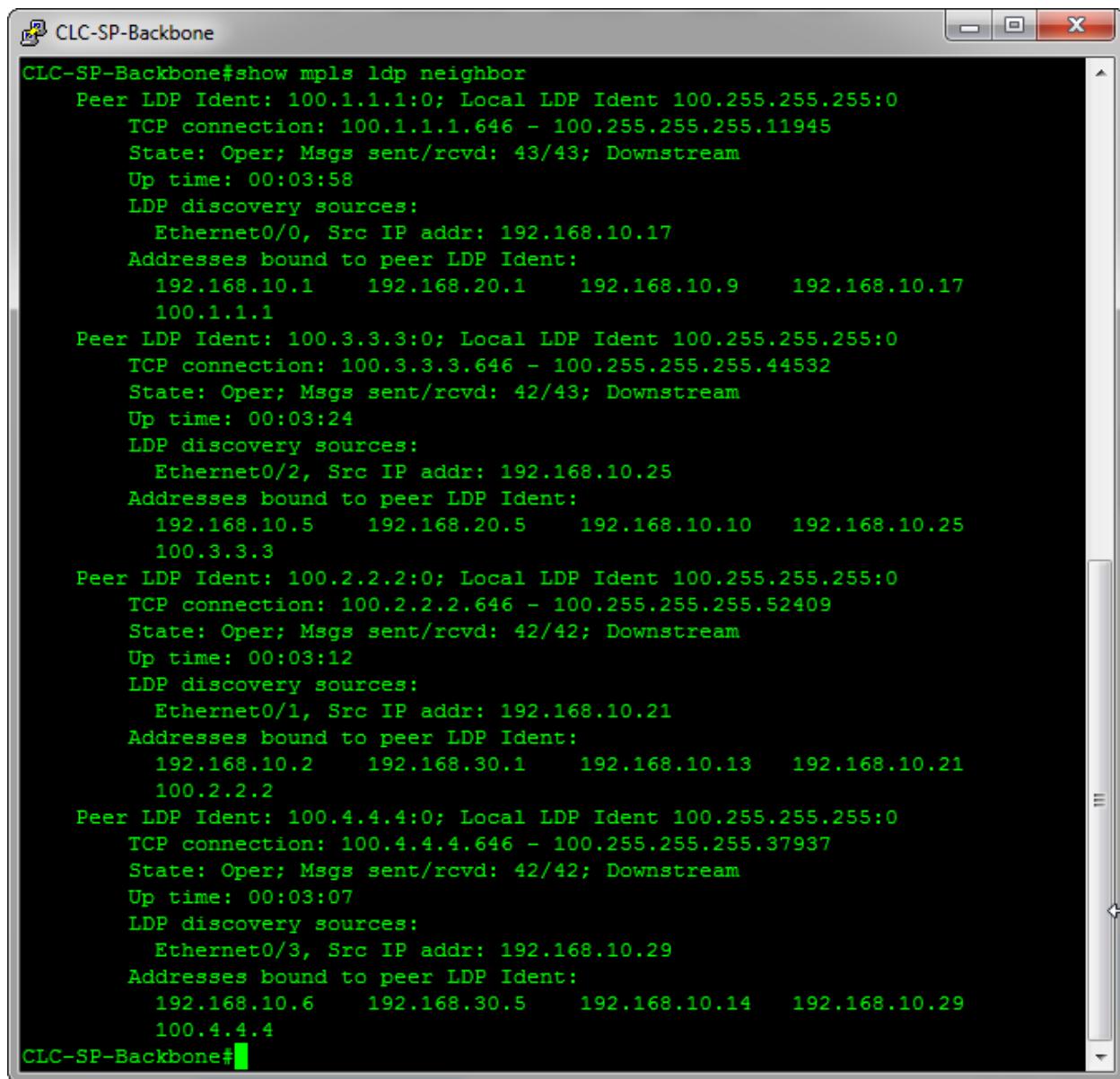
```
CLC-R26(config)#mpls ldp router-id loopback 0 force  
CLC-R26(config)#no mpls ip propagate-ttl  
CLC-R26(config)#
```

```
CLC-R26(config)#router ospf 100  
CLC-R26(config-router)#mpls ldp autoconfig  
CLC-R26(config-router)#exit  
CLC-R26(config)#
```

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Verification

On CLC-SP-Backbone



A terminal window titled "CLC-SP-Backbone" displaying the output of the command "show mpls ldp neighbor". The window shows four LDP neighbors with their respective details:

- Peer LDP Ident: 100.1.1.1:0; Local LDP Ident 100.255.255.255:0
TCP connection: 100.1.1.646 - 100.255.255.255.11945
State: Oper; Msgs sent/rcvd: 43/43; Downstream
Up time: 00:03:58
LDP discovery sources:
Ethernet0/0, Src IP addr: 192.168.10.17
Addresses bound to peer LDP Ident:
192.168.10.1 192.168.20.1 192.168.10.9 192.168.10.17
100.1.1.1
- Peer LDP Ident: 100.3.3.3:0; Local LDP Ident 100.255.255.255:0
TCP connection: 100.3.3.3.646 - 100.255.255.255.44532
State: Oper; Msgs sent/rcvd: 42/43; Downstream
Up time: 00:03:24
LDP discovery sources:
Ethernet0/2, Src IP addr: 192.168.10.25
Addresses bound to peer LDP Ident:
192.168.10.5 192.168.20.5 192.168.10.10 192.168.10.25
100.3.3.3
- Peer LDP Ident: 100.2.2.2:0; Local LDP Ident 100.255.255.255:0
TCP connection: 100.2.2.2.646 - 100.255.255.255.52409
State: Oper; Msgs sent/rcvd: 42/42; Downstream
Up time: 00:03:12
LDP discovery sources:
Ethernet0/1, Src IP addr: 192.168.10.21
Addresses bound to peer LDP Ident:
192.168.10.2 192.168.30.1 192.168.10.13 192.168.10.21
100.2.2.2
- Peer LDP Ident: 100.4.4.4:0; Local LDP Ident 100.255.255.255:0
TCP connection: 100.4.4.4.646 - 100.255.255.255.37937
State: Oper; Msgs sent/rcvd: 42/42; Downstream
Up time: 00:03:07
LDP discovery sources:
Ethernet0/3, Src IP addr: 192.168.10.29
Addresses bound to peer LDP Ident:
192.168.10.6 192.168.30.5 192.168.10.14 192.168.10.29
100.4.4.4

CLC-SP-Backbone#

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On CLC-R1

```
CLC-R1#show mpls ldp neighbor
Peer LDP Ident: 100.255.255.255:0; Local LDP Ident 100.1.1.1:0
    TCP connection: 100.255.255.255.11945 - 100.1.1.1.646
    State: Oper; Msgs sent/rcvd: 44/44; Downstream
    Up time: 00:04:36
    LDP discovery sources:
        Ethernet0/3, Src IP addr: 192.168.10.18
        Addresses bound to peer LDP Ident:
            192.168.10.18  192.168.10.22  192.168.10.26  192.168.10.30
            100.255.255.255
Peer LDP Ident: 100.21.21.21:0; Local LDP Ident 100.1.1.1:0
    TCP connection: 100.21.21.21.34911 - 100.1.1.1.646
    State: Oper; Msgs sent/rcvd: 44/45; Downstream
    Up time: 00:04:17
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.20.2
        Addresses bound to peer LDP Ident:
            192.168.40.2  192.168.20.2  192.168.40.13  101.2.1.1
            101.2.2.1  100.21.21.21
Peer LDP Ident: 100.3.3.3:0; Local LDP Ident 100.1.1.1:0
    TCP connection: 100.3.3.3.47338 - 100.1.1.1.646
    State: Oper; Msgs sent/rcvd: 43/43; Downstream
    Up time: 00:04:02
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.10.10
        Addresses bound to peer LDP Ident:
            192.168.10.5  192.168.20.5  192.168.10.10  192.168.10.25
            100.3.3.3
Peer LDP Ident: 100.2.2.2:0; Local LDP Ident 100.1.1.1:0
    TCP connection: 100.2.2.2.27917 - 100.1.1.1.646
    State: Oper; Msgs sent/rcvd: 43/43; Downstream
    Up time: 00:03:50
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.10.2
        Addresses bound to peer LDP Ident:
            192.168.10.2  192.168.30.1  192.168.10.13  192.168.10.21
            100.2.2.2
```

CLC-R1#

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On CLC-R2

```
CLC-R2#show mpls ldp neighbor
Peer LDP Ident: 100.1.1.1:0; Local LDP Ident 100.2.2.2:0
    TCP connection: 100.1.1.646 - 100.2.2.2.27917
    State: Oper; Msgs sent/rcvd: 44/44; Downstream
    Up time: 00:04:28
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.10.1
        Addresses bound to peer LDP Ident:
            192.168.10.1    192.168.20.1    192.168.10.9    192.168.10.17
            100.1.1.1
Peer LDP Ident: 100.255.255.255:0; Local LDP Ident 100.2.2.2:0
    TCP connection: 100.255.255.52409 - 100.2.2.2.646
    State: Oper; Msgs sent/rcvd: 44/44; Downstream
    Up time: 00:04:28
    LDP discovery sources:
        Ethernet0/3, Src IP addr: 192.168.10.22
        Addresses bound to peer LDP Ident:
            192.168.10.18    192.168.10.22    192.168.10.26    192.168.10.30
            100.255.255.255
Peer LDP Ident: 100.4.4.4:0; Local LDP Ident 100.2.2.2:0
    TCP connection: 100.4.4.4.17964 - 100.2.2.2.646
    State: Oper; Msgs sent/rcvd: 44/43; Downstream
    Up time: 00:04:22
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.10.14
        Addresses bound to peer LDP Ident:
            192.168.10.6    192.168.30.5    192.168.10.14    192.168.10.29
            100.4.4.4
Peer LDP Ident: 100.25.25.25:0; Local LDP Ident 100.2.2.2:0
    TCP connection: 100.25.25.25.43874 - 100.2.2.2.646
    State: Oper; Msgs sent/rcvd: 44/45; Downstream
    Up time: 00:04:18
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.30.2
        Addresses bound to peer LDP Ident:
            192.168.50.1    192.168.30.2    192.168.50.9    101.3.2.1
            101.3.1.1    100.25.25.25
```

CLC-R2#

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On CLC-R3

```
CLC-R3#show mpls ldp neighbor
Peer LDP Ident: 100.1.1.1:0; Local LDP Ident 100.3.3.3:0
    TCP connection: 100.1.1.646 - 100.3.3.3.47338
    State: Oper; Msgs sent/rcvd: 45/45; Downstream
    Up time: 00:05:13
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.10.9
        Addresses bound to peer LDP Ident:
            192.168.10.1    192.168.20.1    192.168.10.9    192.168.10.17
            100.1.1.1
Peer LDP Ident: 100.255.255.255:0; Local LDP Ident 100.3.3.3:0
    TCP connection: 100.255.255.44532 - 100.3.3.3.646
    State: Oper; Msgs sent/rcvd: 45/45; Downstream
    Up time: 00:05:13
    LDP discovery sources:
        Ethernet0/3, Src IP addr: 192.168.10.26
        Addresses bound to peer LDP Ident:
            192.168.10.18   192.168.10.22   192.168.10.26   192.168.10.30
            100.255.255.255
Peer LDP Ident: 100.22.22.22:0; Local LDP Ident 100.3.3.3:0
    TCP connection: 100.22.22.22.21081 - 100.3.3.3.646
    State: Oper; Msgs sent/rcvd: 45/47; Downstream
    Up time: 00:05:13
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.20.6
        Addresses bound to peer LDP Ident:
            192.168.40.6    192.168.20.6    192.168.40.14    102.2.1.1
            102.2.2.1      100.22.22.22
Peer LDP Ident: 100.4.4.4:0; Local LDP Ident 100.3.3.3:0
    TCP connection: 100.4.4.4.38064 - 100.3.3.3.646
    State: Oper; Msgs sent/rcvd: 44/44; Downstream
    Up time: 00:04:56
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.10.6
        Addresses bound to peer LDP Ident:
            192.168.10.6    192.168.30.5    192.168.10.14    192.168.10.29
            100.4.4.4
```

CLC-R3#

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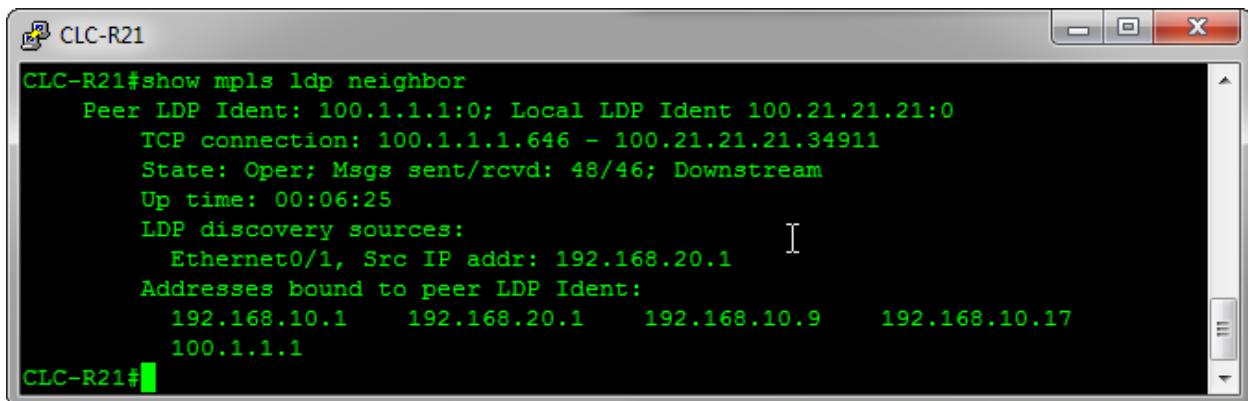
On CLC-R4

```
CLC-R4#show mpls ldp neighbor
Peer LDP Ident: 100.3.3.3:0; Local LDP Ident 100.4.4.4:0
    TCP connection: 100.3.3.3.646 - 100.4.4.4.38064
    State: Oper; Msgs sent/rcvd: 45/45; Downstream
    Up time: 00:05:21
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.10.5
        Addresses bound to peer LDP Ident:
            192.168.10.5    192.168.20.5    192.168.10.10    192.168.10.25
            100.3.3.3
Peer LDP Ident: 100.2.2.2:0; Local LDP Ident 100.4.4.4:0
    TCP connection: 100.2.2.2.646 - 100.4.4.4.17964
    State: Oper; Msgs sent/rcvd: 45/45; Downstream
    Up time: 00:05:21
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.10.13
        Addresses bound to peer LDP Ident:
            192.168.10.2    192.168.30.1    192.168.10.13    192.168.10.21
            100.2.2.2
Peer LDP Ident: 100.255.255.255:0; Local LDP Ident 100.4.4.4:0
    TCP connection: 100.255.255.255.37937 - 100.4.4.4.646
    State: Oper; Msgs sent/rcvd: 45/45; Downstream
    Up time: 00:05:21
    LDP discovery sources:
        Ethernet0/3, Src IP addr: 192.168.10.30
        Addresses bound to peer LDP Ident:
            192.168.10.18    192.168.10.22    192.168.10.26    192.168.10.30
            100.255.255.255
Peer LDP Ident: 100.26.26.26:0; Local LDP Ident 100.4.4.4:0
    TCP connection: 100.26.26.26.61614 - 100.4.4.4.646
    State: Oper; Msgs sent/rcvd: 45/45; Downstream
    Up time: 00:05:12
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.30.6
        Addresses bound to peer LDP Ident:
            192.168.50.5    192.168.30.6    192.168.50.10    102.3.2.1
            100.26.26.26
```

CLC-R4#

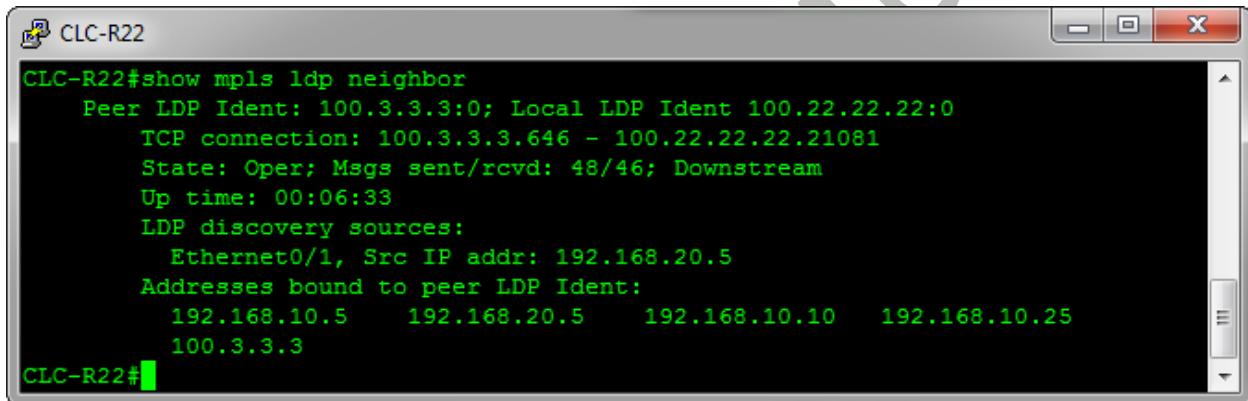
CCIE Lab Center

On CLC-R21



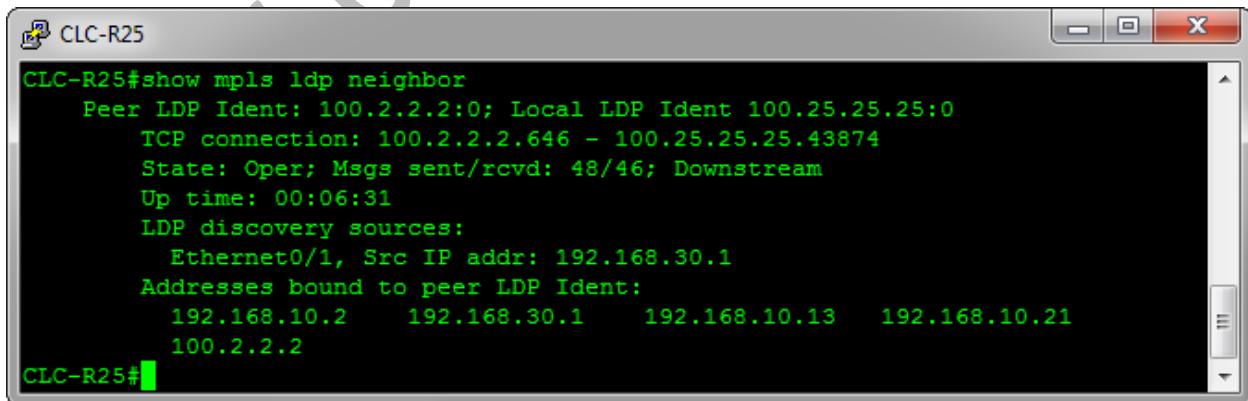
```
CLC-R21#show mpls ldp neighbor
Peer LDP Ident: 100.1.1.1:0; Local LDP Ident 100.21.21.21:0
    TCP connection: 100.1.1.1.646 - 100.21.21.21.34911
    State: Oper; Msgs sent/rcvd: 48/46; Downstream
    Up time: 00:06:25
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.20.1
        Addresses bound to peer LDP Ident:
            192.168.10.1    192.168.20.1    192.168.10.9    192.168.10.17
            100.1.1.1
CLC-R21#
```

On CLC-R22



```
CLC-R22#show mpls ldp neighbor
Peer LDP Ident: 100.3.3.3:0; Local LDP Ident 100.22.22.22:0
    TCP connection: 100.3.3.3.646 - 100.22.22.22.21081
    State: Oper; Msgs sent/rcvd: 48/46; Downstream
    Up time: 00:06:33
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.20.5
        Addresses bound to peer LDP Ident:
            192.168.10.5    192.168.20.5    192.168.10.10    192.168.10.25
            100.3.3.3
CLC-R22#
```

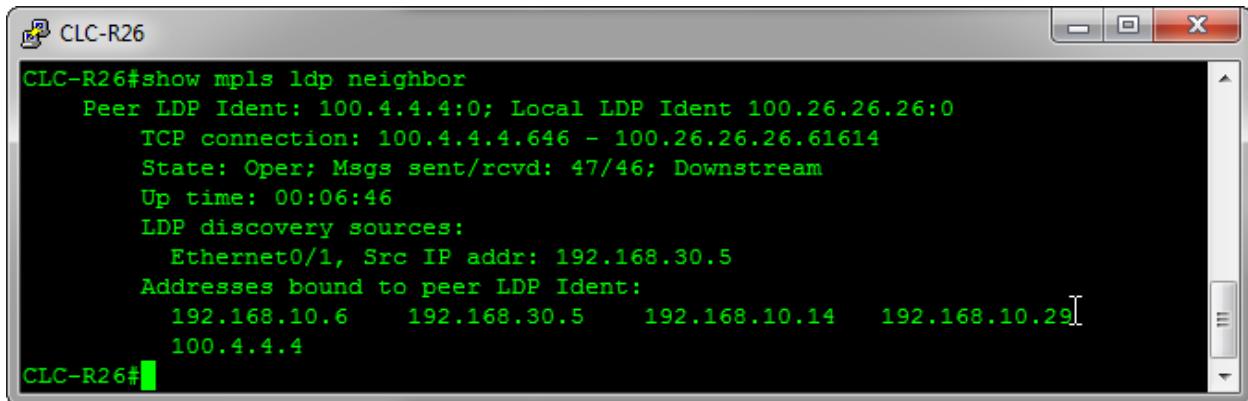
On CLC-R25



```
CLC-R25#show mpls ldp neighbor
Peer LDP Ident: 100.2.2.2:0; Local LDP Ident 100.25.25.25:0
    TCP connection: 100.2.2.2.646 - 100.25.25.25.43874
    State: Oper; Msgs sent/rcvd: 48/46; Downstream
    Up time: 00:06:31
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.30.1
        Addresses bound to peer LDP Ident:
            192.168.10.2    192.168.30.1    192.168.10.13    192.168.10.21
            100.2.2.2
CLC-R25#
```

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On CLC-R26



CLC-R26#show mpls ldp neighbor

Peer LDP Ident: 100.4.4.4:0; Local LDP Ident 100.26.26.26:0
TCP connection: 100.4.4.4.646 - 100.26.26.26.61614
State: Oper; Msgs sent/rcvd: 47/46; Downstream
Up time: 00:06:46
LDP discovery sources:
Ethernet0/1, Src IP addr: 192.168.30.5
Addresses bound to peer LDP Ident:
192.168.10.6 192.168.30.5 192.168.10.14 192.168.10.29
100.4.4.4

CLC-R26#

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SECTION 3.3: MPLS Services in SPCA & SPIH

QUESTION

Configure MPLS network in SPCA & SPIH site as per the following requirements:

1. Configure MPLS network on all P & PE routers using LDP protocol.
2. Enable LDP only on required interfaces on all routers in AS 9100
3. Use the interface loopback 0 to establish LDP peering
4. Ensure that no MPLS interface that belongs to any router in AS 9100 is visible on a traceroute that originates outside of the AS.
5. You can use any method for LDP peering.

Solution

On CLC-R21

```
CLC-R21(config)#router ospf 200
CLC-R21(config-router)#mpls ldp autoconfig
CLC-R21(config-router)#exit
CLC-R21(config)#
```

On CLC-R22

```
CLC-R22(config)#router ospf 200
CLC-R22(config-router)#mpls ldp autoconfig
CLC-R22(config-router)#exit
CLC-R22(config)#
```

On CLC-R23

```
CLC-R23(config)#mpls ldp router-id loopback 0 force
CLC-R23(config)#no mpls ip propagate-ttl
CLC-R23(config)#
```

```
CLC-R23(config)#router ospf 200
CLC-R23(config-router)#mpls ldp autoconfig
CLC-R23(config-router)#exit
CLC-R23(config)#
```

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On CLC-R24

```
CLC-R24(config)#mpls ldp router-id loopback 0 force  
CLC-R24(config)#no mpls ip propagate-ttl  
CLC-R24(config)#
```

```
CLC-R24(config)#router ospf 200  
CLC-R24(config-router)#mpls ldp autoconfig  
CLC-R24(config-router)#exit  
CLC-R24(config)#
```

On CLC-R25

```
CLC-R25(config)#router ospf 200  
CLC-R25(config-router)#mpls ldp autoconfig  
CLC-R25(config-router)#exit  
CLC-R25(config)#
```

On CLC-R26

```
CLC-R26(config)#router ospf 200  
CLC-R26(config-router)#mpls ldp autoconfig  
CLC-R26(config-router)#exit  
CLC-R26(config)#
```

On CLC-R27

```
CLC-R27(config)#mpls ldp router-id loopback 0 force  
CLC-R27(config)#no mpls ip propagate-ttl  
CLC-R27(config)#
```

```
CLC-R27(config)#router ospf 200  
CLC-R27(config-router)#mpls ldp autoconfig  
CLC-R27(config-router)#exit  
CLC-R27(config)#
```

On CLC-R28

```
CLC-R28(config)#mpls ldp router-id loopback 0 force  
CLC-R28(config)#no mpls ip propagate-ttl  
CLC-R28(config)#
```

```
CLC-R28(config)#router ospf 200
```

CCIE Lab Center

```
CLC-R28(config-router)#mpls ldp autoconfig  
CLC-R28(config-router)#exit  
CLC-R28(config)#
```

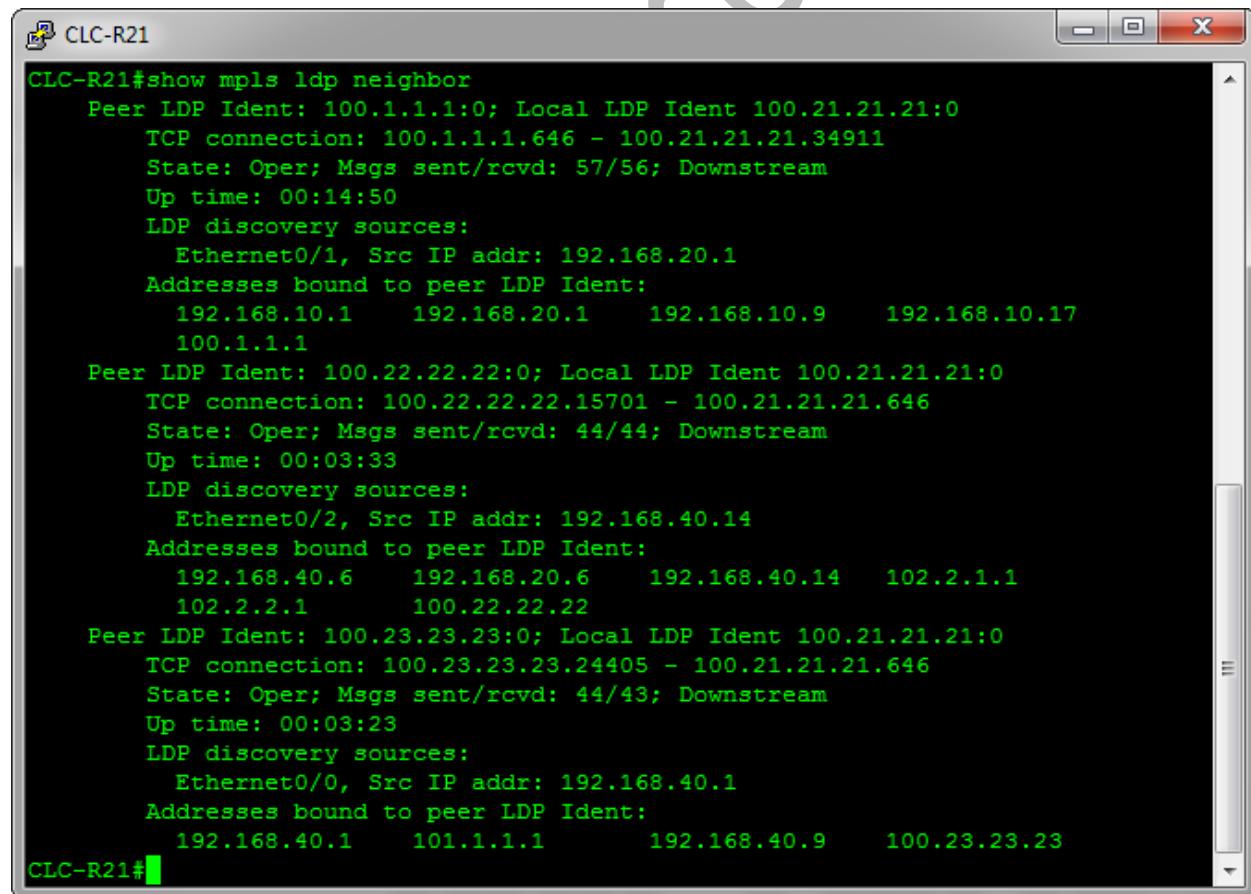
On CLC-Internet

```
CLC-Internet(config)#mpls ldp router-id loopback 0 force  
CLC-Internet(config)#no mpls ip propagate-ttl  
CLC-Internet(config)#
```

```
CLC-Internet(config)#router ospf 200  
CLC-Internet(config-router)#mpls ldp autoconfig  
CLC-Internet(config-router)#exit  
CLC-Internet(config)#
```

Verification

On CLC-R21



A screenshot of a Windows-style terminal window titled "CLC-R21". The window displays the output of the command "show mpls ldp neighbor". The output shows three LDP neighbors with their respective connection details, state, up time, and LDP discovery sources.

```
CLC-R21#show mpls ldp neighbor  
Peer LDP Ident: 100.1.1.1:0; Local LDP Ident 100.21.21.21:0  
TCP connection: 100.1.1.1.646 - 100.21.21.21.34911  
State: Oper; Msgs sent/rcvd: 57/56; Downstream  
Up time: 00:14:50  
LDP discovery sources:  
    Ethernet0/1, Src IP addr: 192.168.20.1  
    Addresses bound to peer LDP Ident:  
        192.168.10.1    192.168.20.1    192.168.10.9    192.168.10.17  
        100.1.1.1  
Peer LDP Ident: 100.22.22.22:0; Local LDP Ident 100.21.21.21:0  
TCP connection: 100.22.22.22.15701 - 100.21.21.21.646  
State: Oper; Msgs sent/rcvd: 44/44; Downstream  
Up time: 00:03:33  
LDP discovery sources:  
    Ethernet0/2, Src IP addr: 192.168.40.14  
    Addresses bound to peer LDP Ident:  
        192.168.40.6    192.168.20.6    192.168.40.14    102.2.1.1  
        102.2.2.1    100.22.22.22  
Peer LDP Ident: 100.23.23.23:0; Local LDP Ident 100.21.21.21:0  
TCP connection: 100.23.23.23.24405 - 100.21.21.21.646  
State: Oper; Msgs sent/rcvd: 44/43; Downstream  
Up time: 00:03:23  
LDP discovery sources:  
    Ethernet0/0, Src IP addr: 192.168.40.1  
    Addresses bound to peer LDP Ident:  
        192.168.40.1    101.1.1.1    192.168.40.9    100.23.23.23  
CLC-R21#
```

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On CLC-R22

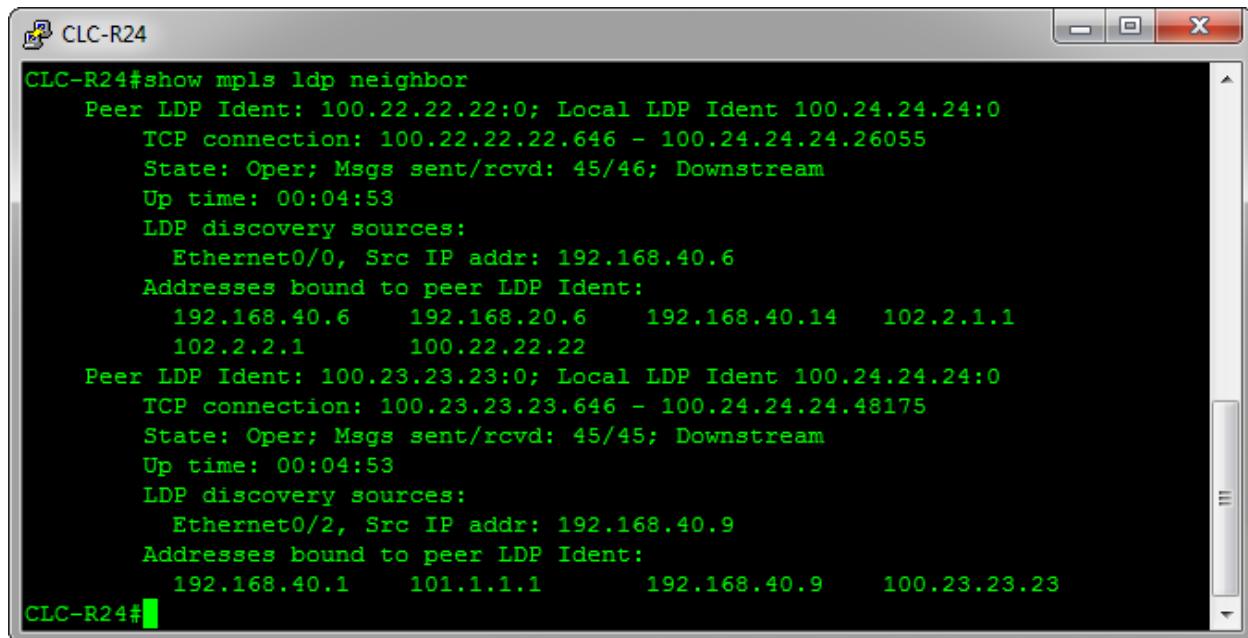
```
CLC-R22#show mpls ldp neighbor
Peer LDP Ident: 100.3.3.3:0; Local LDP Ident 100.22.22.22:0
    TCP connection: 100.3.3.3.646 - 100.22.22.22.21081
    State: Oper; Msgs sent/rcvd: 58/56; Downstream
    Up time: 00:15:14
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.20.5
        Addresses bound to peer LDP Ident:
            192.168.10.5    192.168.20.5    192.168.10.10    192.168.10.25
            100.3.3.3
Peer LDP Ident: 100.21.21.21:0; Local LDP Ident 100.22.22.22:0
    TCP connection: 100.21.21.21.646 - 100.22.22.22.15701
    State: Oper; Msgs sent/rcvd: 45/45; Downstream
    Up time: 00:04:13
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.40.13
        Addresses bound to peer LDP Ident:
            192.168.40.2    192.168.20.2    192.168.40.13    101.2.1.1
            101.2.2.1      100.21.21.21
Peer LDP Ident: 100.24.24.24:0; Local LDP Ident 100.22.22.22:0
    TCP connection: 100.24.24.24.26055 - 100.22.22.22.646
    State: Oper; Msgs sent/rcvd: 45/44; Downstream
    Up time: 00:03:57
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.40.5
        Addresses bound to peer LDP Ident:
            192.168.40.5    192.168.40.10    102.1.1.1        100.24.24.24
CLC-R22#
```

On CLC-R23

```
CLC-R23#show mpls ldp neighbor
Peer LDP Ident: 100.21.21.21:0; Local LDP Ident 100.23.23.23:0
    TCP connection: 100.21.21.21.646 - 100.23.23.23.24405
    State: Oper; Msgs sent/rcvd: 45/46; Downstream
    Up time: 00:04:32
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.40.2
        Addresses bound to peer LDP Ident:
            192.168.40.2    192.168.20.2    192.168.40.13    101.2.1.1
            101.2.2.1      100.21.21.21
Peer LDP Ident: 100.24.24.24:0; Local LDP Ident 100.23.23.23:0
    TCP connection: 100.24.24.24.48175 - 100.23.23.23.646
    State: Oper; Msgs sent/rcvd: 45/45; Downstream
    Up time: 00:04:26
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.40.10
        Addresses bound to peer LDP Ident:
            192.168.40.5    192.168.40.10    102.1.1.1        100.24.24.24
CLC-R23#
```

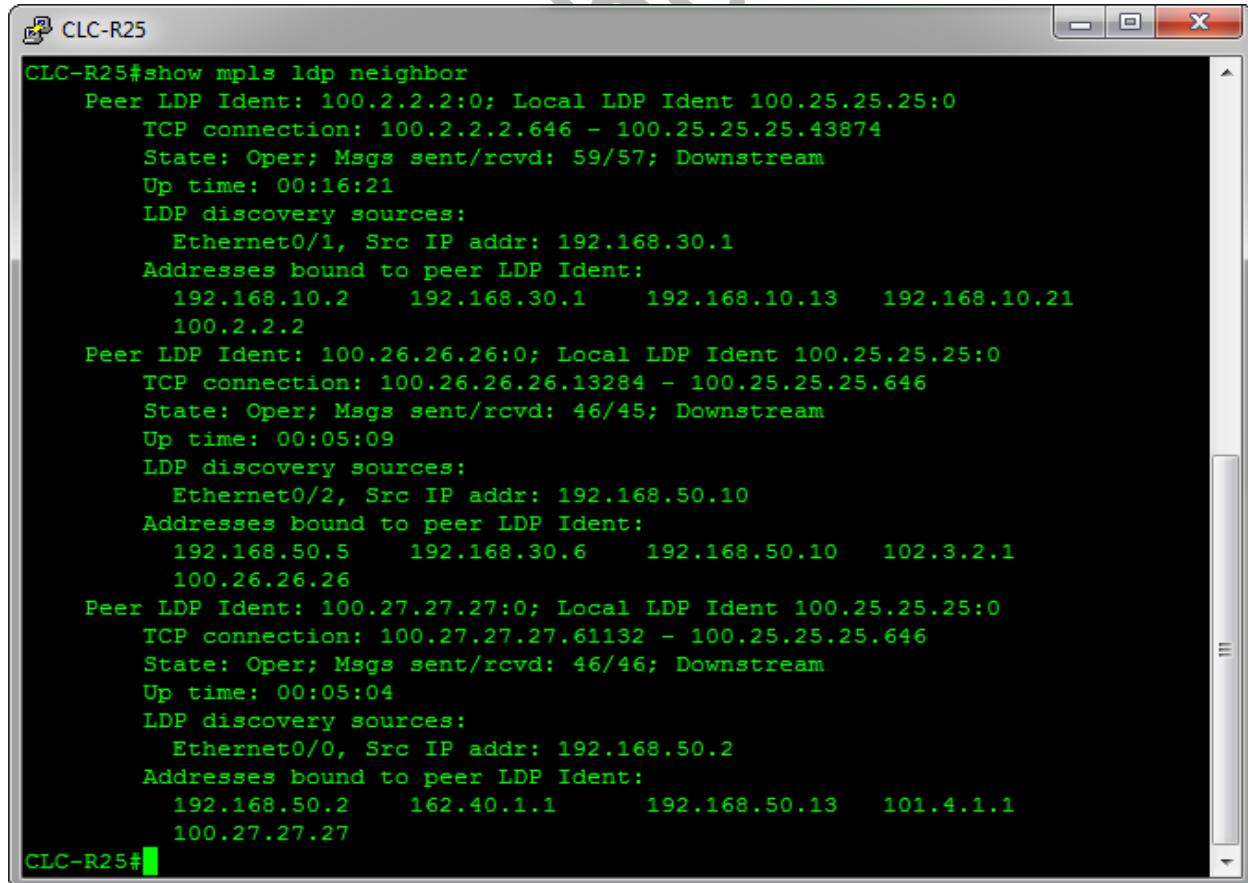
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On CLC-R24



```
CLC-R24#show mpls ldp neighbor
Peer LDP Ident: 100.22.22.22:0; Local LDP Ident 100.24.24.24:0
    TCP connection: 100.22.22.22.646 - 100.24.24.24.26055
    State: Oper; Msgs sent/rcvd: 45/46; Downstream
    Up time: 00:04:53
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.40.6
        Addresses bound to peer LDP Ident:
            192.168.40.6      192.168.20.6      192.168.40.14      102.2.1.1
            102.2.2.1          100.22.22.22
Peer LDP Ident: 100.23.23.23:0; Local LDP Ident 100.24.24.24:0
    TCP connection: 100.23.23.23.646 - 100.24.24.24.48175
    State: Oper; Msgs sent/rcvd: 45/45; Downstream
    Up time: 00:04:53
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.40.9
        Addresses bound to peer LDP Ident:
            192.168.40.1      101.1.1.1      192.168.40.9      100.23.23.23
CLC-R24#
```

On CLC-R25



```
CLC-R25#show mpls ldp neighbor
Peer LDP Ident: 100.2.2.2:0; Local LDP Ident 100.25.25.25:0
    TCP connection: 100.2.2.2.646 - 100.25.25.25.43874
    State: Oper; Msgs sent/rcvd: 59/57; Downstream
    Up time: 00:16:21
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.30.1
        Addresses bound to peer LDP Ident:
            192.168.10.2      192.168.30.1      192.168.10.13      192.168.10.21
            100.2.2.2
Peer LDP Ident: 100.26.26.26:0; Local LDP Ident 100.25.25.25:0
    TCP connection: 100.26.26.26.13284 - 100.25.25.25.646
    State: Oper; Msgs sent/rcvd: 46/45; Downstream
    Up time: 00:05:09
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.50.10
        Addresses bound to peer LDP Ident:
            192.168.50.5      192.168.30.6      192.168.50.10      102.3.2.1
            100.26.26.26
Peer LDP Ident: 100.27.27.27:0; Local LDP Ident 100.25.25.25:0
    TCP connection: 100.27.27.27.61132 - 100.25.25.25.646
    State: Oper; Msgs sent/rcvd: 46/46; Downstream
    Up time: 00:05:04
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.50.2
        Addresses bound to peer LDP Ident:
            192.168.50.2      162.40.1.1      192.168.50.13      101.4.1.1
            100.27.27.27
CLC-R25#
```

CCIE Lab Center

On CLC-R26

```
CLC-R26#show mpls ldp neighbor
Peer LDP Ident: 100.4.4.4:0; Local LDP Ident 100.26.26.26:0
    TCP connection: 100.4.4.4.646 - 100.26.26.26.61614
    State: Oper; Msgs sent/rcvd: 58/58; Downstream
    Up time: 00:16:41
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 192.168.30.5
        Addresses bound to peer LDP Ident:
            192.168.10.6    192.168.30.5    192.168.10.14    192.168.10.29
            100.4.4.4
Peer LDP Ident: 100.25.25.25:0; Local LDP Ident 100.26.26.26:0
    TCP connection: 100.25.25.25.646 - 100.26.26.26.13284
    State: Oper; Msgs sent/rcvd: 46/47; Downstream
    Up time: 00:05:33
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.50.9
        Addresses bound to peer LDP Ident:
            192.168.50.1    192.168.30.2    192.168.50.9    101.3.2.1
            101.3.1.1    100.25.25.25
Peer LDP Ident: 100.28.28.28:0; Local LDP Ident 100.26.26.26:0
    TCP connection: 100.28.28.28.45455 - 100.26.26.26.646
    State: Oper; Msgs sent/rcvd: 45/44; Downstream
    Up time: 00:05:22
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.50.6
        Addresses bound to peer LDP Ident:
            192.168.50.6    162.40.1.5    192.168.50.14    100.28.28.28
CLC-R26#
```

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On CLC-R27

```
CLC-R27#show mpls ldp neighbor
Peer LDP Ident: 100.25.25.25:0; Local LDP Ident 100.27.27.27:0
    TCP connection: 100.25.25.25.646 - 100.27.27.27.61132
    State: Oper; Msgs sent/rcvd: 46/47; Downstream
    Up time: 00:05:56
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.50.1
        Addresses bound to peer LDP Ident:
            192.168.50.1    192.168.30.2    192.168.50.9    101.3.2.1
            101.3.1.1    100.25.25.25
Peer LDP Ident: 100.28.28.28:0; Local LDP Ident 100.27.27.27:0
    TCP connection: 100.28.28.28.32301 - 100.27.27.27.646
    State: Oper; Msgs sent/rcvd: 46/45; Downstream
    Up time: 00:05:49
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.50.14
        Addresses bound to peer LDP Ident:
            192.168.50.6    162.40.1.5    192.168.50.14    100.28.28.28
Peer LDP Ident: 162.100.100.100:0; Local LDP Ident 100.27.27.27:0
    TCP connection: 162.100.100.100.48126 - 100.27.27.27.646
    State: Oper; Msgs sent/rcvd: 46/48; Downstream
    Up time: 00:05:41
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 162.40.1.2
        Addresses bound to peer LDP Ident:
            162.40.1.2    162.40.1.6    192.168.0.110    102.3.1.1
            162.100.100.100
CLC-R27#
```

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On CLC-R28

```

CLC-R28#show mpls ldp neighbor
Peer LDP Ident: 100.27.27.27:0; Local LDP Ident 100.28.28.28:0
    TCP connection: 100.27.27.27.646 - 100.28.28.28.32301
    State: Oper; Msgs sent/rcvd: 45/47; Downstream
    Up time: 00:06:16
    LDP discovery sources:
        Ethernet0/2, Src IP addr: 192.168.50.13
    Addresses bound to peer LDP Ident:
        192.168.50.2      162.40.1.1      192.168.50.13      101.4.1.1
        100.27.27.27

Peer LDP Ident: 100.26.26.26:0; Local LDP Ident 100.28.28.28:0
    TCP connection: 100.26.26.26.646 - 100.28.28.28.45455
    State: Oper; Msgs sent/rcvd: 45/46; Downstream
    Up time: 00:06:16
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 192.168.50.5
    Addresses bound to peer LDP Ident:
        192.168.50.5      192.168.30.6      192.168.50.10      102.3.2.1
        100.26.26.26

Peer LDP Ident: 162.100.100.100:0; Local LDP Ident 100.28.28.28:0
    TCP connection: 162.100.100.100.58438 - 100.28.28.28.646
    State: Oper; Msgs sent/rcvd: 45/48; Downstream
    Up time: 00:06:07
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 162.40.1.6
    Addresses bound to peer LDP Ident:
        162.40.1.2      162.40.1.6      192.168.0.110      102.3.1.1
        162.100.100.100

CLC-R28#

```

On CLC-Internet

```

CLC-Internet#show mpls ldp neighbor
Peer LDP Ident: 100.28.28.28:0; Local LDP Ident 162.100.100.100:0
    TCP connection: 100.28.28.28.646 - 162.100.100.100.58438
    State: Oper; Msgs sent/rcvd: 49/46; Downstream
    Up time: 00:06:29
    LDP discovery sources:
        Ethernet0/1, Src IP addr: 162.40.1.5
    Addresses bound to peer LDP Ident:
        192.168.50.6      162.40.1.5      192.168.50.14      100.28.28.28

Peer LDP Ident: 100.27.27.27:0; Local LDP Ident 162.100.100.100:0
    TCP connection: 100.27.27.27.646 - 162.100.100.100.48126
    State: Oper; Msgs sent/rcvd: 49/47; Downstream
    Up time: 00:06:29
    LDP discovery sources:
        Ethernet0/0, Src IP addr: 162.40.1.1
    Addresses bound to peer LDP Ident:
        192.168.50.2      162.40.1.1      192.168.50.13      101.4.1.1
        100.27.27.27

CLC-Internet#

```

CCIE Lab Center

SECTION 4: Service Provider EBGP & VRF

SECTION 4.1: EBGP-VRF

QUESTION

Configure PE device in Service Provider Customer Area sites as per the following requirements:

1. Configure PE routers in such a way that they must be able established EBGP peering with CE via VRF
2. Consider VRF's name as per given in topology (Case Sensitive).
3. The PE (WAN) interfaces must be under VRF forwarding.
4. You can use any RD value.
5. The EBGP peering must be established using physical WAN interface ip address.
6. You are not supposed to modify any changes on CE Routers to accomplish this task.

Solution

On CLC-R21

```
CLC-R21(config)#ip vrf Sydney-Group-Connect-1
CLC-R21(config-vrf)#rd 64510:21
CLC-R21(config-vrf)#exit
CLC-R21(config)#

CLC-R21(config-vrf)#ip vrf Victoria-Group-Site-2
CLC-R21(config-vrf)#rd 64520:21
CLC-R21(config-vrf)#exit
CLC-R21(config)#

CLC-R21(config)#interface Ethernet0/3
CLC-R21(config-if)#ip vrf forwarding Sydney-Group-Connect-1
CLC-R21(config-if)#ip address 101.2.1.1 255.255.255.252
CLC-R21(config-if)#exit
CLC-R21(config)#

CLC-R21(config)#interface Ethernet1/0
CLC-R21(config-if)#ip vrf forwarding Victoria-Group-Site-2
```

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```
CLC-R21(config-if)#ip address 101.2.2.1 255.255.255.252  
CLC-R21(config-if)#exit  
CLC-R21(config)#
```

```
CLC-R21(config)#router bgp 6100  
CLC-R21(config-router)#address-family ipv4 vrf Sydney-Group-Connect-1  
CLC-R21(config-router-af)#neighbor 101.2.1.2 remote-as 64510  
CLC-R21(config-router-af)#neighbor 101.2.1.2 activate  
CLC-R21(config-router-af)#exit-address-family  
CLC-R21(config-router)#
```

```
CLC-R21(config-router)#address-family ipv4 vrf Victoria-Group-Site-2  
CLC-R21(config-router-af)#neighbor 101.2.2.2 remote-as 64520  
CLC-R21(config-router-af)#neighbor 101.2.2.2 activate  
CLC-R21(config-router-af)#exit-address-family  
CLC-R21(config-router)#exit  
CLC-R21(config)#
```

On CLC-R22

```
CLC-R22(config)#ip vrf Queensland-Group-Comp-1  
CLC-R22(config-vrf)#rd 64530:22  
CLC-R22(config-vrf)#exit  
CLC-R22(config)#
```

```
CLC-R22(config)#ip vrf Sydney-Group-Hub  
CLC-R22(config-vrf)#rd 64510:22  
CLC-R22(config-vrf)#exit  
CLC-R22(config)#
```

```
CLC-R22(config)#interface Ethernet0/3  
CLC-R22(config-if)#ip vrf forwarding Queensland-Group-Comp-1  
CLC-R22(config-if)#ip address 102.2.1.1 255.255.255.252  
CLC-R22(config-if)#exit  
CLC-R22(config)#
```

```
CLC-R22(config)#interface Ethernet1/0  
CLC-R22(config-if)#ip vrf forwarding Sydney-Group-Hub  
CLC-R22(config-if)#ip address 102.2.2.1 255.255.255.252  
CLC-R22(config-if)#exit  
CLC-R22(config)#
```

```
CLC-R22(config)#router bgp 6100  
CLC-R22(config-router)#address-family ipv4 vrf Queensland-Group-Comp-1  
CLC-R22(config-router-af)#neighbor 102.2.1.2 remote-as 64530  
CLC-R22(config-router-af)#neighbor 102.2.1.2 activate
```

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```
CLC-R22(config-router-af)#exit-address-family  
CLC-R22(config-router)#  
  
CLC-R22(config-router)#address-family ipv4 vrf Sydney-Group-Hub  
CLC-R22(config-router-af)#neighbor 102.2.2.2 remote-as 64510  
CLC-R22(config-router-af)#neighbor 102.2.2.2 activate  
CLC-R22(config-router-af)#exit-address-family  
CLC-R22(config-router)#exit  
CLC-R22(config)#
```

On CLC-R23

```
CLC-R23(config)#ip vrf ANZ-Bank-Branch-1  
CLC-R23(config-vrf)#rd 62111:23  
CLC-R23(config-vrf)#exit  
CLC-R23(config)#  
  
CLC-R23(config)#interface Ethernet0/1  
CLC-R23(config-if)#ip vrf forwarding ANZ-Bank-Branch-1  
CLC-R23(config-if)#ip address 101.1.1.1 255.255.255.252  
CLC-R23(config-if)#exit  
CLC-R23(config)#  
  
CLC-R23(config)#router bgp 6100  
CLC-R23(config-router)#address-family ipv4 vrf ANZ-Bank-Branch-1  
CLC-R23(config-router-af)#neighbor 101.1.1.2 remote-as 62111  
CLC-R23(config-router-af)#neighbor 101.1.1.2 activate  
CLC-R23(config-router-af)#exit-address-family  
CLC-R23(config-router)#exit  
CLC-R23(config)#
```

On CLC-R24

```
CLC-R24(config)#ip vrf ANZ-Bank-Hub  
CLC-R24(config-vrf)#rd 62111:13  
CLC-R24(config-vrf)#exit  
CLC-R24(config)#  
  
CLC-R24(config)#interface Ethernet0/3  
CLC-R24(config-if)#ip vrf forwarding ANZ-Bank-Hub  
CLC-R24(config-if)#ip address 102.1.1.1 255.255.255.252  
CLC-R24(config-if)#exit  
CLC-R24(config)#  
  
CLC-R24(config)#router bgp 6100
```

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```
CLC-R24(config-router)#address-family ipv4 vrf ANZ-Bank-Hub  
CLC-R24(config-router-af)#neighbor 102.1.1.2 remote-as 62111  
CLC-R24(config-router-af)#neighbor 102.1.1.2 activate  
CLC-R24(config-router-af)#exit-address-family  
CLC-R24(config-router)#exit  
CLC-R24(config)#
```

On CLC-R25

```
CLC-R25(config)#ip vrf Sydney-Group-Connect-2  
CLC-R25(config-vrf)#rd 64510:25  
CLC-R25(config-vrf)#exit  
CLC-R25(config)#
```

```
CLC-R25(config)#ip vrf Victoria-Group-Site-1  
CLC-R25(config-vrf)#rd 64520:25  
CLC-R25(config-vrf)#exit  
CLC-R25(config)#
```

```
CLC-R25(config)#interface Ethernet0/3  
CLC-R25(config-if)#ip vrf forwarding Sydney-Group-Connect-2  
CLC-R25(config-if)#ip address 101.3.2.1 255.255.255.252  
CLC-R25(config-if)#exit  
CLC-R25(config)#
```

```
CLC-R25(config)#interface Ethernet1/0  
CLC-R25(config-if)#ip vrf forwarding Victoria-Group-Site-1  
CLC-R25(config-if)#ip address 101.3.1.1 255.255.255.252  
CLC-R25(config-if)#exit  
CLC-R25(config)#
```

```
CLC-R25(config)#router bgp 6100  
CLC-R25(config-router)#address-family ipv4 vrf Sydney-Group-Connect-2  
CLC-R25(config-router-af)#neighbor 101.3.2.2 remote-as 64510  
CLC-R25(config-router-af)#neighbor 101.3.2.2 activate  
CLC-R25(config-router-af)#exit-address-family  
CLC-R25(config-router)#
```

```
CLC-R25(config-router)#address-family ipv4 vrf Victoria-Group-Site-1  
CLC-R25(config-router-af)#neighbor 101.3.1.2 remote-as 64520  
CLC-R25(config-router-af)#neighbor 101.3.1.2 activate  
CLC-R25(config-router-af)#exit-address-family  
CLC-R25(config-router)#exit  
CLC-R25(config)#
```

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On CLC-R26

```
CLC-R26(config)#ip vrf Queensland-Group-Comp-2
CLC-R26(config-vrf)#rd 64530:26
CLC-R26(config-vrf)#exit
CLC-R26(config)#

CLC-R26(config)#interface Ethernet1/0
CLC-R26(config-if)#ip vrf forwarding Queensland-Group-Comp-2
CLC-R26(config-if)#ip address 102.3.2.1 255.255.255.252
CLC-R26(config-if)#exit
CLC-R26(config)#
CLC-R26(config)#

CLC-R26(config)#router bgp 6100
CLC-R26(config-router)#address-family ipv4 vrf Queensland-Group-Comp-2
CLC-R26(config-router-af)#neighbor 102.3.2.2 remote-as 64530
CLC-R26(config-router-af)#neighbor 102.3.2.2 activate
CLC-R26(config-router-af)#exit-address-family
CLC-R26(config-router)#exit
CLC-R26(config)#+
```

On CLC-R27

```
CLC-R27(config)#ip vrf ANZ-Bank-Branch-2
CLC-R27(config-vrf)#rd 62111:27
CLC-R27(config-vrf)#exit
CLC-R27(config)#

CLC-R27(config)#interface Ethernet0/3
CLC-R27(config-if)#ip vrf forwarding ANZ-Bank-Branch-2
CLC-R27(config-if)#ip address 101.4.1.1 255.255.255.252
CLC-R27(config-if)#exit
CLC-R27(config)#

CLC-R27(config)#router bgp 6100
CLC-R27(config-router)#address-family ipv4 vrf ANZ-Bank-Branch-2
CLC-R27(config-router-af)#neighbor 101.4.1.2 remote-as 62111
CLC-R27(config-router-af)#neighbor 101.4.1.2 activate
CLC-R27(config-router-af)#exit-address-family
CLC-R27(config-router)#exit
CLC-R27(config)#+
```

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Verification

On CLC-R21

```
CLC-R21#show ip bgp vpnv4 all summary
BGP router identifier 100.21.21.21, local AS number 6100
BGP table version is 9648, main routing table version 9648
28 network entries using 4368 bytes of memory
44 path entries using 3520 bytes of memory
22/9 BGP path/bestpath attribute entries using 3520 bytes of memory
4 BGP rrinfo entries using 128 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
3 BGP extended community entries using 72 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 11656 total bytes of memory
BGP activity 2665/2637 prefixes, 7115/7071 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1     4      6100  11923   3013    9648    0    0 1d01h    10
100.3.3.3     4      6100  12713   3004    9648    0    0 1d01h    10
101.2.1.2     4      64510  19      14      9648    0    0 00:07:14   12
101.2.2.2     4      64520  1695   1700    9648    0    0 1d01h    2
CLC-R21#
```

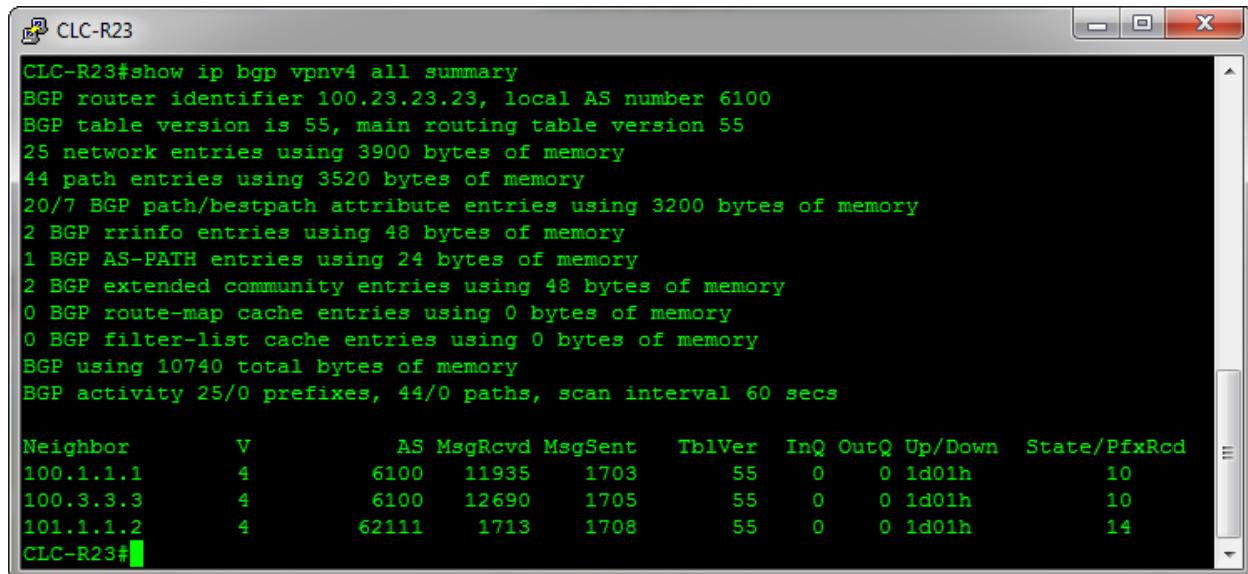
On CLC-R22

```
CLC-R22#show ip bgp vpnv4 all summary
BGP router identifier 100.22.22.22, local AS number 6100
BGP table version is 17654, main routing table version 17654
40 network entries using 6240 bytes of memory
72 path entries using 5760 bytes of memory
25/13 BGP path/bestpath attribute entries using 4000 bytes of memory
6 BGP rrinfo entries using 208 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
4 BGP extended community entries using 96 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 16352 total bytes of memory
BGP activity 3366/3326 prefixes, 12284/12212 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1     4      6100  11935   2525    17654   0    0 1d01h    18
100.3.3.3     4      6100  12697   2525    17654   0    0 1d01h    18
102.2.1.2     4      64530  1697    1702    17654   0    0 1d01h    6
102.2.2.2     4      64510  20      21      17654   0    0 00:07:56   12
CLC-R22#
```

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On CLC-R23



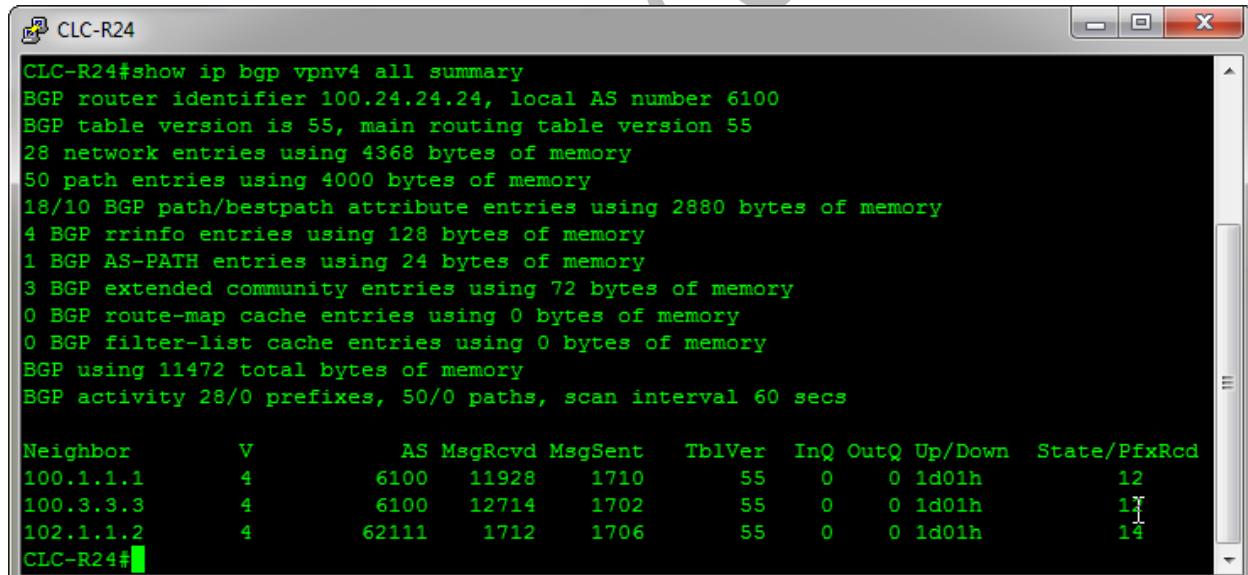
```

CLC-R23#show ip bgp vpnv4 all summary
BGP router identifier 100.23.23.23, local AS number 6100
BGP table version is 55, main routing table version 55
25 network entries using 3900 bytes of memory
44 path entries using 3520 bytes of memory
20/7 BGP path/bestpath attribute entries using 3200 bytes of memory
2 BGP rrinfo entries using 48 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
2 BGP extended community entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 10740 total bytes of memory
BGP activity 25/0 prefixes, 44/0 paths, scan interval 60 secs

Neighbor      V          AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1      4        6100    11935    1703      55     0    0 1d01h      10
100.3.3.3      4        6100    12690    1705      55     0    0 1d01h      10
101.1.1.2      4       62111    1713    1708      55     0    0 1d01h      14
CLC-R23#

```

On CLC-R24



```

CLC-R24#show ip bgp vpnv4 all summary
BGP router identifier 100.24.24.24, local AS number 6100
BGP table version is 55, main routing table version 55
28 network entries using 4368 bytes of memory
50 path entries using 4000 bytes of memory
18/10 BGP path/bestpath attribute entries using 2880 bytes of memory
4 BGP rrinfo entries using 128 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
3 BGP extended community entries using 72 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 11472 total bytes of memory
BGP activity 28/0 prefixes, 50/0 paths, scan interval 60 secs

Neighbor      V          AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1      4        6100    11928    1710      55     0    0 1d01h      12
100.3.3.3      4        6100    12714    1702      55     0    0 1d01h      17
102.1.1.2      4       62111    1712    1706      55     0    0 1d01h      14
CLC-R24#

```

CCIE Lab Center

On CLC-R25

```
CLC-R25#show ip bgp vpnv4 all summary
BGP router identifier 100.25.25.25, local AS number 6100
BGP table version is 10530, main routing table version 10530
28 network entries using 4368 bytes of memory
44 path entries using 3520 bytes of memory
22/9 BGP path/bestpath attribute entries using 3520 bytes of memory
4 BGP rrinfo entries using 160 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
3 BGP extended community entries using 72 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 11688 total bytes of memory
BGP activity 2704/2676 prefixes, 7414/7370 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.2.2.2      4      6100  12478   3191    10530   0    0 1d01h      10
100.4.4.4      4      6100  12817   3187    10530   0    0 1d01h      10
101.3.1.2      4      64520  1706    1701    10530   0    0 1d01h      2
101.3.2.2      4      64510   25     19     10530   0    0 00:11:59    12
CLC-R25#
```

On CLC-R26

```
CLC-R26#show ip bgp vpnv4 all summary
BGP router identifier 100.26.26.26, local AS number 6100
BGP table version is 23, main routing table version 23
11 network entries using 1716 bytes of memory
18 path entries using 1440 bytes of memory
7/2 BGP path/bestpath attribute entries using 1120 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
1 BGP extended community entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 4404 total bytes of memory
BGP activity 11/0 prefixes, 18/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.2.2.2      4      6100  12477   1705    23     0    0 1d01h      4
100.4.4.4      4      6100  12800   1706    23     0    0 1d01h      4
102.3.2.2      4      64530  1704    1705    23     0    0 1d01h      6
CLC-R26#
```

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On CLC-R27

```
CLC-R27#show ip bgp vpnv4 all summary
BGP router identifier 100.27.27.27, local AS number 6100
BGP table version is 55, main routing table version 55
25 network entries using 3900 bytes of memory
44 path entries using 3520 bytes of memory
20/7 BGP path/bestpath attribute entries using 3200 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
2 BGP extended community entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 10772 total bytes of memory
BGP activity 25/0 prefixes, 44/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.2.2.2      4      6100  12484   1709      55    0    0  1d01h      10
100.4.4.4      4      6100  12805   1705      55    0    0  1d01h      10
101.4.1.2      4      62111  1709   1712      55    0    0  1d01h      14
CLC-R27#
```

CCIE Lab Center

SECTION 4.2: MPLS Traffic Engineering

QUESTION

Configure PE device in Service Provider Customer Area sites as per the following requirements:

1. Configure PE routers in such a way that they must be able to receive and send routes from CE.
2. Configure Sydney-Group as below
 - Sydney-Group-Hub must receive routes from Sydney-Group-Connect-1 and Sydney-Group-Connect-2
 - Sydney-Group-Connect-1 must receive routes from Sydney-Group-Hub and must not receive from Sydney-Group-Connect-2
 - Sydney-Group-Connect-2 must receive routes from Sydney-Group-Hub and must not receive from Sydney-Group-Connect-1
3. Configure ANZ-Bank as below
 - ANZ-Bank-Hub must receive routes from ANZ-Bank-Branch-1 and ANZ-Bank-Branch-2
 - ANZ-Bank-Branch-1 must receive routes from ANZ-Bank-Hub and must not receive from ANZ-Bank-Branch-2
 - ANZ-Bank-Branch-2 must receive routes from ANZ-Bank-Hub and must not receive from ANZ-Bank-Branch-1
4. Configure Victoria-Group as below
 - Victoria-Group-Site-1 must receive routes from Victoria-Group-Site-2 and Vice Versa.
5. Configure Queensland-Group as below
 - Queensland-Group-Comp-1 must receive routes from Queensland-Group-Comp-2 and Vice Versa.

Solution

On CLC-R21

```
CLC-R21(config)#ip vrf Sydney-Group-Connect-1
CLC-R21(config-vrf)#route-target export 64510:29
CLC-R21(config-vrf)#route-target import 64510:34
CLC-R21(config-vrf)#exit
CLC-R21(config)#
```

```
CLC-R21(config)#ip vrf Victoria-Group-Site-2
CLC-R21(config-vrf)#route-target export 64520:64520
CLC-R21(config-vrf)#route-target import 64520:64520
```

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```
CLC-R21(config-vrf)#exit  
CLC-R21(config)#
```

On CLC-R22

```
CLC-R22(config)#ip vrf Queensland-Group-Comp-1  
CLC-R22(config-vrf)#route-target export 64530:64530  
CLC-R22(config-vrf)#route-target import 64530:64530  
CLC-R22(config-vrf)#exit  
CLC-R22(config)#
```

```
CLC-R22(config)#ip vrf Sydney-Group-Hub  
CLC-R22(config-vrf)#route-target export 64510:34  
CLC-R22(config-vrf)#route-target import 64510:29  
CLC-R22(config-vrf)#route-target import 64510:32  
CLC-R22(config-vrf)#exit  
CLC-R22(config)#
```

On CLC-R23

```
CLC-R23(config)#ip vrf ANZ-Bank-Branch-1  
CLC-R23(config-vrf)#route-target export 62111:6  
CLC-R23(config-vrf)#route-target import 62111:13  
CLC-R23(config-vrf)#exit  
CLC-R23(config)#^Z
```

On CLC-R24

```
CLC-R24(config)#ip vrf ANZ-Bank-Hub  
CLC-R24(config-vrf)#route-target export 62111:13  
CLC-R24(config-vrf)#route-target import 62111:6  
CLC-R24(config-vrf)#route-target import 62111:12  
CLC-R24(config-vrf)#exit  
CLC-R24(config)#
```

On CLC-R25

```
CLC-R25(config)#ip vrf Sydney-Group-Connect-2  
CLC-R25(config-vrf)#route-target export 64510:32  
CLC-R25(config-vrf)#route-target import 64510:34  
CLC-R25(config-vrf)#exit  
CLC-R25(config)#
```

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```
CLC-R25(config)#ip vrf Victoria-Group-Site-1
CLC-R25(config-vrf)# route-target export 64520:64520
CLC-R25(config-vrf)# route-target import 64520:64520
CLC-R25(config-vrf)#exit
CLC-R25(config)#
```

On CLC-R26

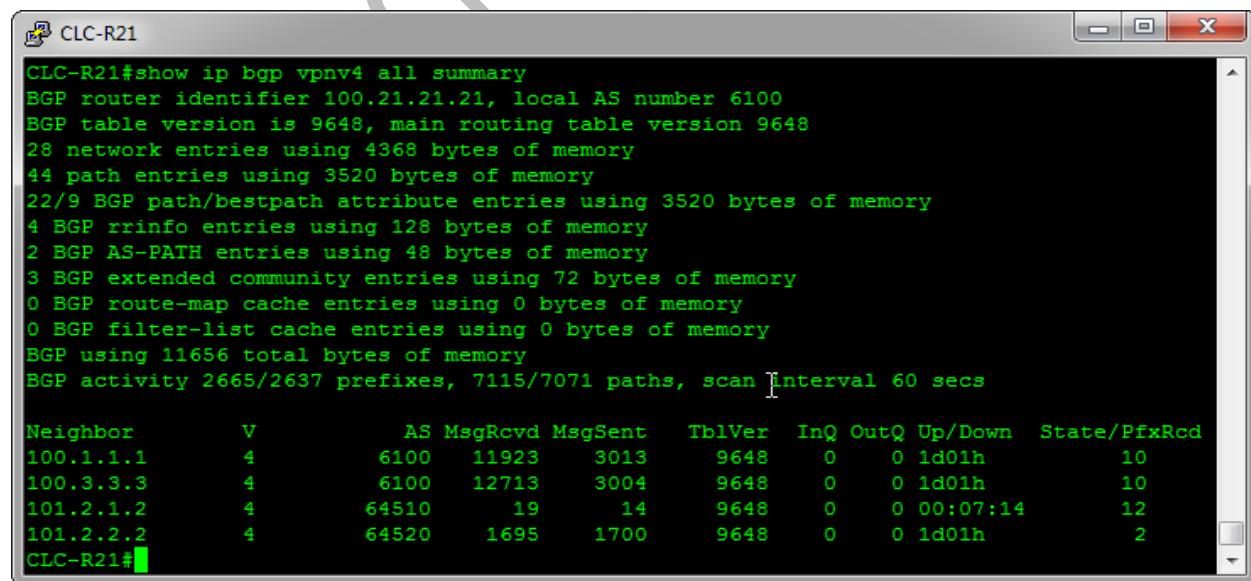
```
CLC-R26(config)#ip vrf Queensland-Group-Comp-2
CLC-R26(config-vrf)#route-target export 64530:64530
CLC-R26(config-vrf)#route-target import 64530:64530
CLC-R26(config-vrf)#exit
CLC-R26(config)#
```

On CLC-R27

```
CLC-R27(config)#ip vrf ANZ-Bank-Branch-2
CLC-R27(config-vrf)# route-target export 62111:12
CLC-R27(config-vrf)# route-target import 62111:13
CLC-R27(config-vrf)#exit
CLC-R27(config)#
```

Verification

On CLC-R21

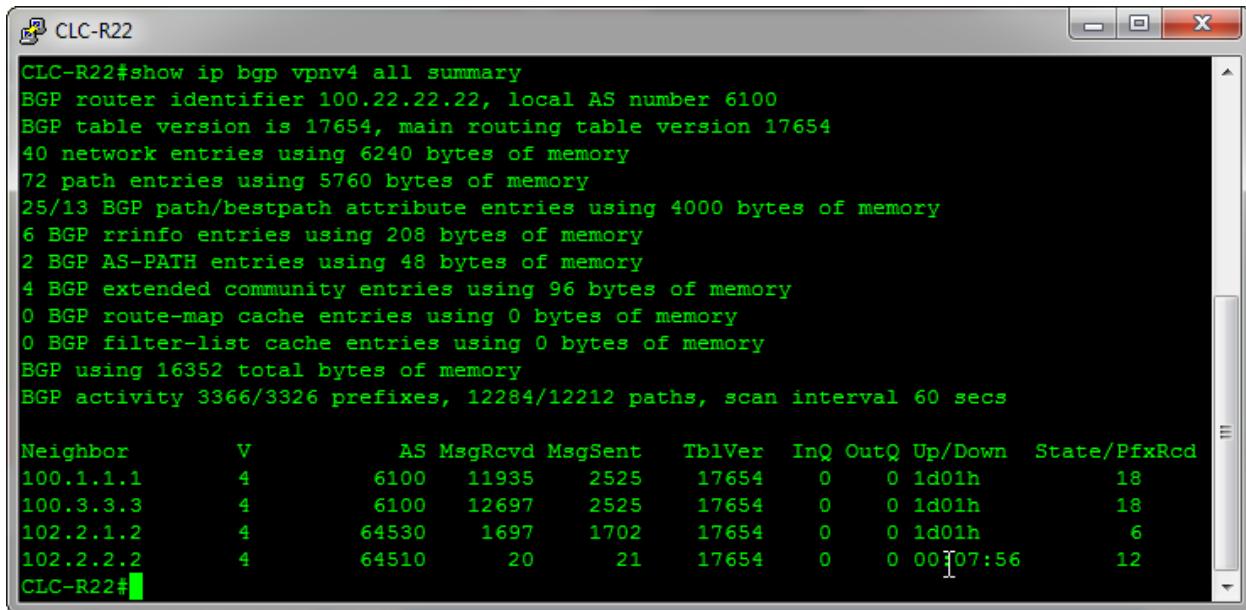


```
CLC-R21#show ip bgp vpng4 all summary
BGP router identifier 100.21.21.21, local AS number 6100
BGP table version is 9648, main routing table version 9648
28 network entries using 4368 bytes of memory
44 path entries using 3520 bytes of memory
22/9 BGP path/bestpath attribute entries using 3520 bytes of memory
4 BGP rrinfo entries using 128 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
3 BGP extended community entries using 72 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 11656 total bytes of memory
BGP activity 2665/2637 prefixes, 7115/7071 paths, scan Interval 60 secs

Neighbor      V          AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1      4        6100    11923    3013     9648    0    0 1d01h      10
100.3.3.3      4        6100    12713    3004     9648    0    0 1d01h      10
101.2.1.2      4       64510      19      14     9648    0    0 00:07:14     12
101.2.2.2      4       64520    1695     1700     9648    0    0 1d01h       2
CLC-R21#
```

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On CLC-R22



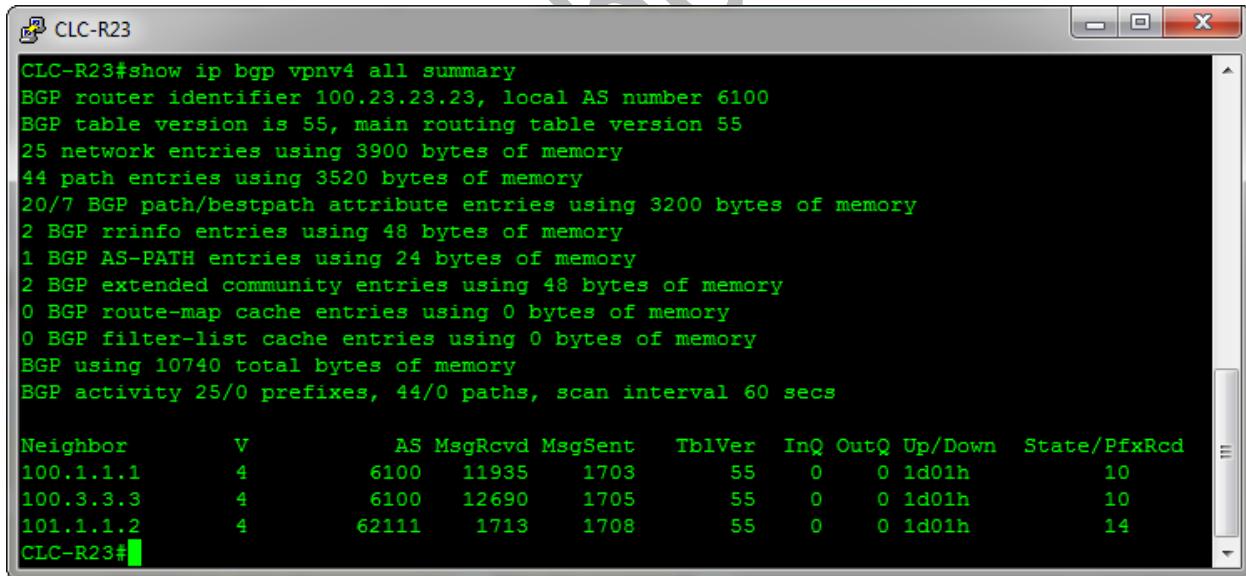
```

CLC-R22#show ip bgp vpnv4 all summary
BGP router identifier 100.22.22.22, local AS number 6100
BGP table version is 17654, main routing table version 17654
40 network entries using 6240 bytes of memory
72 path entries using 5760 bytes of memory
25/13 BGP path/bestpath attribute entries using 4000 bytes of memory
6 BGP rrinfo entries using 208 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
4 BGP extended community entries using 96 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 16352 total bytes of memory
BGP activity 3366/3326 prefixes, 12284/12212 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1     4      6100  11935   2525    17654   0     0  1d01h    18
100.3.3.3     4      6100  12697   2525    17654   0     0  1d01h    18
102.2.1.2     4      64530  1697    1702    17654   0     0  1d01h    6
102.2.2.2     4      64510   20     21     17654   0     0  00:07:56   12
CLC-R22#

```

On CLC-R23



```

CLC-R23#show ip bgp vpnv4 all summary
BGP router identifier 100.23.23.23, local AS number 6100
BGP table version is 55, main routing table version 55
25 network entries using 3900 bytes of memory
44 path entries using 3520 bytes of memory
20/7 BGP path/bestpath attribute entries using 3200 bytes of memory
2 BGP rrinfo entries using 48 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
2 BGP extended community entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 10740 total bytes of memory
BGP activity 25/0 prefixes, 44/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1     4      6100  11935   1703    55     0     0  1d01h    10
100.3.3.3     4      6100  12690   1705    55     0     0  1d01h    10
101.1.1.2     4      62111  1713    1708    55     0     0  1d01h    14
CLC-R23#

```

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On CLC-R24

```
CLC-R24#show ip bgp vpng4 all summary
BGP router identifier 100.24.24.24, local AS number 6100
BGP table version is 55, main routing table version 55
28 network entries using 4368 bytes of memory
50 path entries using 4000 bytes of memory
18/10 BGP path/bestpath attribute entries using 2880 bytes of memory
4 BGP rrinfo entries using 128 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
3 BGP extended community entries using 72 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 11472 total bytes of memory
BGP activity 28/0 prefixes, 50/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.1.1.1     4      6100  11928   1710      55    0    0  1d01h    12
100.3.3.3     4      6100  12714   1702      55    0    0  1d01h    17
102.1.1.2     4      62111  1712    1706      55    0    0  1d01h    14
CLC-R24#
```

On CLC-R25

```
CLC-R25#show ip bgp vpng4 all summary
BGP router identifier 100.25.25.25, local AS number 6100
BGP table version is 10530, main routing table version 10530
28 network entries using 4368 bytes of memory
44 path entries using 3520 bytes of memory
22/9 BGP path/bestpath attribute entries using 3520 bytes of memory
4 BGP rrinfo entries using 160 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
3 BGP extended community entries using 72 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 11688 total bytes of memory
BGP activity 2704/2676 prefixes, 7414/7370 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
100.2.2.2     4      6100  12478   3191      10530  0    0  1d01h    10
100.4.4.4     4      6100  12817   3187      10530  0    0  1d01h    10
101.3.1.2     4      64520  1706    1701      10530  0    0  1d01h    2
101.3.2.2     4      64510  25      19       10530  0    0  00:11:59   12
CLC-R25#
```

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On CLC-R26

```
CLC-R26#show ip bgp vpng4 all summary
BGP router identifier 100.26.26.26, local AS number 6100
BGP table version is 23, main routing table version 23
11 network entries using 1716 bytes of memory
18 path entries using 1440 bytes of memory
7/2 BGP path/bestpath attribute entries using 1120 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
1 BGP extended community entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 4404 total bytes of memory
BGP activity 11/0 prefixes, 18/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down State/PfxRcd
100.2.2.2      4      6100  12477   1705      23    0    0  1d01h   4
100.4.4.4      4      6100  12800   1706      23    0    0  1d01h   4
102.3.2.2      4      64530  1704    1705      23    0    0  1d01h   6
CLC-R26#
```

On CLC-R27

```
CLC-R27#show ip bgp vpng4 all summary
BGP router identifier 100.27.27.27, local AS number 6100
BGP table version is 55, main routing table version 55
25 network entries using 3900 bytes of memory
44 path entries using 3520 bytes of memory
20/7 BGP path/bestpath attribute entries using 3200 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
2 BGP extended community entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 10772 total bytes of memory
BGP activity 25/0 prefixes, 44/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down State/PfxRcd
100.2.2.2      4      6100  12484   1709      55    0    0  1d01h   10
100.4.4.4      4      6100  12805   1705      55    0    0  1d01h   10
101.4.1.2      4      62111  1709    1712      55    0    0  1d01h   14
CLC-R27#
```

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SECTION 5: Customer IGP Services

SECTION 5.1: OSPF in Queensland-Group

QUESTION

Configure the network in Queensland-Group site as per the following requirements:

1. Configure OSPF process id 3 Area 0 in Queensland-Group Site-1 & Site-2 as per the diagram
2. Set the router id to interface loopback 0 on all devices.
3. The interface loopback 0 at each router must be seen as an internal OSPF prefix by all other L3 devices.
4. Users in LAN Network of Site-1 must be able to reach Users in LAN Network of Site-2 and Vice Versa.
5. Tunnel 0 has pre-configured DMVPN configuration and you must be running IGP network as per topology
6. Do not try to modify the default OSPF cost on any device.
7. Ensure that OSPF is not running on any interface that is facing another AS not in use.
8. You are allowed to advertise only specific networks in OSPF to accomplish this requirement.

Solution

On CLC-R36

```
CLC-R36(config)#router ospf 3
CLC-R36(config-router)#router-id 36.36.36.36
CLC-R36(config-router)#network 30.30.1.1 0.0.0.0 area 0
CLC-R36(config-router)#network 30.30.30.1 0.0.0.0 area 0
CLC-R36(config-router)#network 36.36.36.36 0.0.0.0 area 0
CLC-R36(config-router)#exit
CLC-R36(config)#
```

On CLC-R37

```
CLC-R37(config-if)#router ospf 3
CLC-R37(config-router)#router-id 37.37.37.37
CLC-R37(config-router)#network 30.30.2.1 0.0.0.0 area 0
```

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```
CLC-R37(config-router)#network 30.30.30.2 0.0.0.0 area 0  
CLC-R37(config-router)#network 37.37.37.37 0.0.0.0 area 0  
CLC-R37(config-router)#exit  
CLC-R37(config)#
```

Verification

On CLC-R36

```
CLC-R36#show ip ospf neighbor  
  
Neighbor ID      Pri   State          Dead Time     Address           Interface  
37.37.37.37      0     FULL/ -       00:00:35     30.30.30.2    Tunnel0  
CLC-R36#
```

```
CLC-R36#show ip route ospf  
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, 1 - LISP  
       a - application route  
       + - replicated route, % - next hop override  
  
Gateway of last resort is not set  
  
      30.0.0.0/8 is variably subnetted, 5 subnets, 3 masks  
O        30.30.2.0/24 [110/1010] via 30.30.30.2, 1d01h, Tunnel0  
O        37.0.0.0/32 is subnetted, 1 subnets  
O        37.37.37.37 [110/1001] via 30.30.30.2, 1d01h, Tunnel0  
CLC-R36#
```

```
CLC-R36#ping 37.37.37.37  
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 37.37.37.37, timeout is 2 seconds:  
!!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms  
CLC-R36#
```

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```
CLC-R36#traceroute 37.37.37.37 numeric
Type escape sequence to abort.
Tracing the route to 37.37.37.37
VRF info: (vrf in name/id, vrf out name/id)
 1 30.30.30.2 1 msec * 0 msec
CLC-R36#
```

```
CLC-R36#ping 30.30.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 30.30.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-R36#
```

```
CLC-R36#traceroute 30.30.2.1 numeric
Type escape sequence to abort.
Tracing the route to 30.30.2.1
VRF info: (vrf in name/id, vrf out name/id)
 1 30.30.30.2 1 msec * 0 msec
CLC-R36#
```

On CLC-R37

```
CLC-R37#ping 30.30.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 30.30.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-R37#
```

```
CLC-R37#traceroute 30.30.1.1 numeric
Type escape sequence to abort.
Tracing the route to 30.30.1.1
VRF info: (vrf in name/id, vrf out name/id)
 1 30.30.30.1 5 msec * 0 msec
CLC-R37#
```

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SECTION 5.2: OSPF in Victoria-Group

QUESTION

Configure the network in Victoria-Group site as per the following requirements:

1. Configure OSPF process id 2 Area 0 in Victoria-Group Comp-1 & Comp-2 as per the diagram
2. Set the router id to interface loopback 0 on all devices.
3. The interface loopback 0 at each router must be seen as an internal OSPF prefix by all other L3 devices.
4. Users in LAN Network of Comp-1 must be able to reach Users in LAN Network of Comp-2 and Vice Versa.
5. Do not try to modify the default OSPF cost on any device.
6. Ensure that OSPF is not running on any interface that is facing another AS not in use.
7. You are allowed to advertise only specific networks in OSPF to accomplish this requirement.

Solution

On CLC-R31

```
CLC-R31(config)#router ospf 2
CLC-R31(config-router)# router-id 31.31.31.31
CLC-R31(config-router)# network 20.20.2.1 0.0.0.0 area 0
CLC-R31(config-router)# network 31.31.31.31 0.0.0.0 area 0
CLC-R31(config-router)#exit
CLC-R31(config)#
```

On CLC-R33

```
CLC-R33(config)#router ospf 2
CLC-R33(config-router)# network 20.20.1.1 0.0.0.0 area 0
CLC-R33(config-router)# network 33.33.33.33 0.0.0.0 area 0
CLC-R33(config-router)#exit
CLC-R33(config)#
```

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Verification

On CLC-R31

```
CLC-R31#ping 20.20.1.1 source ethernet 0/1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.20.1.1, timeout is 2 seconds:
Packet sent with a source address of 20.20.2.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-R31#
```

```
CLC-R31#traceroute 20.20.1.1 source ethernet 0/1 numeric
Type escape sequence to abort.
Tracing the route to 20.20.1.1
VRF info: (vrf in name/id, vrf out name/id)
 1 101.2.2.1 0 msec 0 msec 0 msec
 2 101.3.1.1 [MPLS: Label 51 Exp 0] 1 msec 0 msec 0 msec
 3 101.3.1.2 0 msec * 1 msec
CLC-R31#
```

On CLC-R33

```
CLC-R33#ping 20.20.2.1 source ethernet 0/1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.20.2.1, timeout is 2 seconds:
Packet sent with a source address of 20.20.1.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-R33#
```

```
CLC-R33#traceroute 20.20.2.1 source ethernet 0/1 numeric
Type escape sequence to abort.
Tracing the route to 20.20.2.1
VRF info: (vrf in name/id, vrf out name/id)
 1 101.3.1.1 1 msec 0 msec 0 msec
 2 101.2.2.1 [MPLS: Label 52 Exp 0] 0 msec 1 msec 0 msec
 3 101.2.2.2 1 msec * 1 msec
CLC-R33#
```

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SECTION 5.3: OSPF in Sydney-Group

QUESTION

Configure the network in Sydney-Group site as per the following requirements:

1. Configure OSPF process id 1 Area 0 in Sydney-Group-Hub as per the diagram
2. Configure OSPF process id 1 Area 1 in Sydney-Group-Connect-1 as per the diagram
3. Configure OSPF process id 1 Area 2 in Sydney-Group-Connect-2 as per the diagram
4. Set the router id to interface loopback 0 on all devices.
5. The interface loopback 0 at each router must be seen as an internal OSPF prefix by all other L3 devices.
6. Users in LAN Network of Sydney-Group-Connect-1 must be able to reach Users in LAN Network of Sydney-Group-Connect-2 and Vice Versa only via Sydney-Group-Hub.
7. Tunnel 0 has pre-configured DMVPN configuration and you must be running IGP network as per topology
8. Do not try to modify the default OSPF cost on any device.
9. Ensure that OSPF is not running on any interface that is facing another AS not in use.
10. You are allowed to advertise only specific networks in OSPF to accomplish this requirement.

Solution

On CLC-R29

```
CLC-R29(config)#router ospf 1
CLC-R29(config-router)#router-id 29.29.29.29
CLC-R29(config-router)#network 10.10.2.1 0.0.0.0 area 1
CLC-R29(config-router)#network 29.29.29.29 0.0.0.0 area 1
CLC-R29(config-router)#network 10.10.10.2 0.0.0.0 area 0
CLC-R29(config-router)#exit
CLC-R29(config)#
```

On CLC-R32

```
CLC-R32(config)#router ospf 1
CLC-R32(config-router)# router-id 32.32.32.32
CLC-R32(config-router)# network 10.10.3.1 0.0.0.0 area 2
CLC-R32(config-router)# network 32.32.32.32 0.0.0.0 area 2
CLC-R32(config-router)# network 10.10.10.3 0.0.0.0 area 0
CLC-R32(config-router)#exit
CLC-R32(config)#
```

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On CLC-R34

```
CLC-R34(config)#router ospf 1
CLC-R34(config-router)#router-id 34.34.34.34
CLC-R34(config-router)#network 10.10.1.1 0.0.0.0 area 0
CLC-R34(config-router)#network 10.10.10.1 0.0.0.0 area 0
CLC-R34(config-router)#network 34.34.34.34 0.0.0.0 area 0
CLC-R34(config-router)#exit
CLC-R34(config)#
```

On CLC-R35

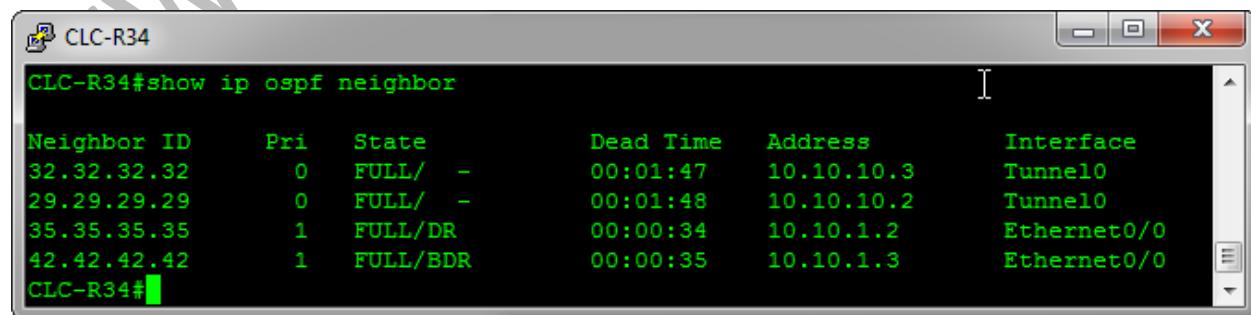
```
R35(config)#router ospf 1
R35(config-router)#router-id 35.35.35.35
R35(config-router)#network 10.10.1.2 0.0.0.0 area 0
R35(config-router)#network 35.35.35.35 0.0.0.0 area 0
R35(config-router)#exit
R35(config)#
```

On CLC-R42

```
R42(config)#router ospf 1
R42(config-router)#router-id 42.42.42.42
R42(config-router)#network 10.10.1.3 0.0.0.0 area 0
R42(config-router)#network 42.42.42.42 0.0.0.0 area 0
R42(config-router)#exit
R42(config)#
```

Verification

On CLC-R34



A terminal window titled "CLC-R34" displaying the output of the command "show ip ospf neighbor". The output shows five neighbors with their respective details:

Neighbor ID	Pri	State	Dead Time	Address	Interface
32.32.32.32	0	FULL/ -	00:01:47	10.10.10.3	Tunnel0
29.29.29.29	0	FULL/ -	00:01:48	10.10.10.2	Tunnel0
35.35.35.35	1	FULL/DR	00:00:34	10.10.1.2	Ethernet0/0
42.42.42.42	1	FULL/BDR	00:00:35	10.10.1.3	Ethernet0/0

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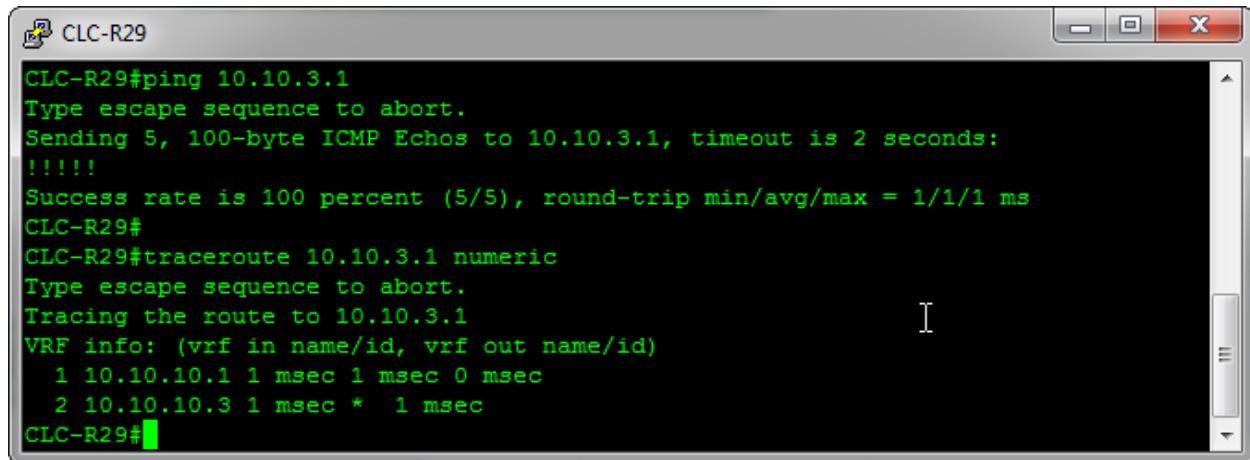
```
CLC-R34#ping 10.10.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-R34#
CLC-R34#traceroute 10.10.2.1 numeric
Type escape sequence to abort.
Tracing the route to 10.10.2.1
VRF info: (vrf in name/id, vrf out name/id)
 1 10.10.10.2 1 msec * 5 msec
CLC-R34#
```

```
CLC-R34#ping 10.10.3.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-R34#
CLC-R34#traceroute 10.10.3.1 numeric
Type escape sequence to abort.
Tracing the route to 10.10.3.1
VRF info: (vrf in name/id, vrf out name/id)
 1 10.10.10.3 5 msec * 1 msec
CLC-R34#
```

```
R32#ping 10.10.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R32#
R32#traceroute 10.10.2.1 numeric
Type escape sequence to abort.
Tracing the route to 10.10.2.1
VRF info: (vrf in name/id, vrf out name/id)
 1 10.10.10.1 5 msec 1 msec 0 msec
 2 10.10.10.2 1 msec * 2 msec
R32#
```

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On CLC-R29

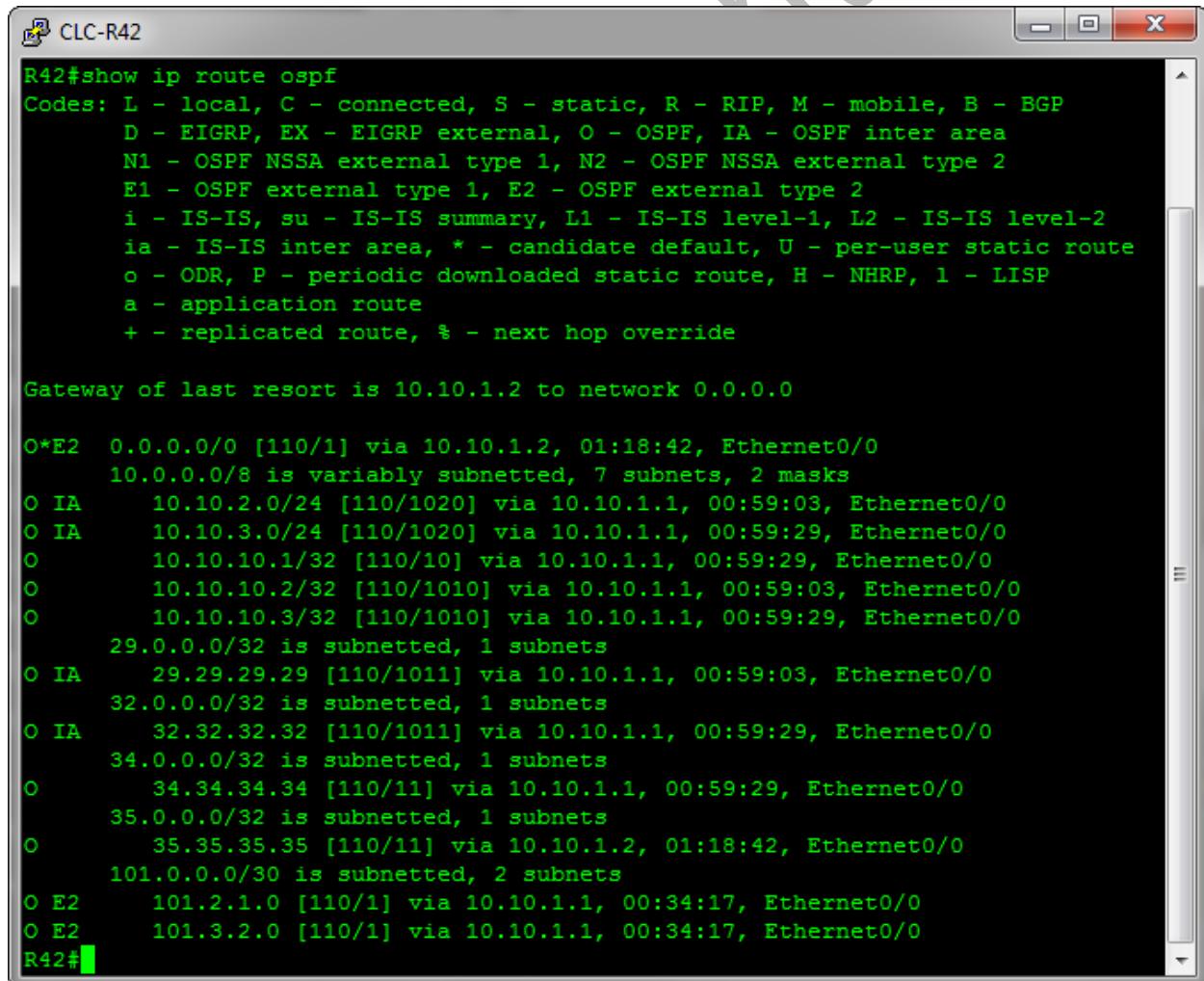


```

CLC-R29#ping 10.10.3.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-R29#
CLC-R29#traceroute 10.10.3.1 numeric
Type escape sequence to abort.
Tracing the route to 10.10.3.1
VRF info: (vrf in name/id, vrf out name/id)
  1 10.10.10.1 1 msec 1 msec 0 msec
  2 10.10.10.3 1 msec * 1 msec
CLC-R29#

```

On CLC-R42



```

R42#show ip route ospf
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 - LISPs
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is 10.10.1.2 to network 0.0.0.0

O*E2  0.0.0.0/0 [110/1] via 10.10.1.2, 01:18:42, Ethernet0/0
      10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks
O  IA    10.10.2.0/24 [110/1020] via 10.10.1.1, 00:59:03, Ethernet0/0
O  IA    10.10.3.0/24 [110/1020] via 10.10.1.1, 00:59:29, Ethernet0/0
O    10.10.10.1/32 [110/10] via 10.10.1.1, 00:59:29, Ethernet0/0
O    10.10.10.2/32 [110/1010] via 10.10.1.1, 00:59:03, Ethernet0/0
O    10.10.10.3/32 [110/1010] via 10.10.1.1, 00:59:29, Ethernet0/0
      29.0.0.0/32 is subnetted, 1 subnets
O  IA    29.29.29.29 [110/1011] via 10.10.1.1, 00:59:03, Ethernet0/0
      32.0.0.0/32 is subnetted, 1 subnets
O  IA    32.32.32.32 [110/1011] via 10.10.1.1, 00:59:29, Ethernet0/0
      34.0.0.0/32 is subnetted, 1 subnets
O    34.34.34.34 [110/11] via 10.10.1.1, 00:59:29, Ethernet0/0
      35.0.0.0/32 is subnetted, 1 subnets
O    35.35.35.35 [110/11] via 10.10.1.2, 01:18:42, Ethernet0/0
      101.0.0.0/30 is subnetted, 2 subnets
O  E2    101.2.1.0 [110/1] via 10.10.1.1, 00:34:17, Ethernet0/0
O  E2    101.3.2.0 [110/1] via 10.10.1.1, 00:34:17, Ethernet0/0
R42#

```

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SECTION 5.4: EIGRP in ANZ-Bank

QUESTION

Configure the network in ANZ-Bank site as per the following requirements:

1. Configure EIGRP process id 100 in ANZ-Bank-Hub & ANZ-Bank- Branch-1 & ANZ-Bank-Branch-2 as per the diagram
2. The interface loopback 0 at each router must be seen as an internal EIGRP prefix by all other L3 devices.
3. Users in LAN Network of ANZ-Bank-Branch-1 must be able to reach Users in LAN Network of ANZ-Bank- Branch-2 and Vice Versa only via ANZ-Bank-Hub.
4. Tunnel 0 has pre-configured DMVPN configuration and you must be running IGP network as per topology
5. Do not try to modify the default EIGRP Metrics on any device.
6. Ensure that EIGRP is not running on any interface that is facing another AS not in use.
7. You are allowed to advertise only specific networks in EIGRP to accomplish this requirement.

Solution

On CLC-R13

```
CLC-R13(config)#router eigrp 100
CLC-R13(config-router)#network 13.13.13.13 0.0.0.0
CLC-R13(config-router)#network 172.30.1.1 0.0.0.0
CLC-R13(config-router)#network 172.30.1.9 0.0.0.0
CLC-R13(config-router)#network 172.100.100.1 0.0.0.0
CLC-R13(config-router)#exit
CLC-R13(config)#
```

On CLC-R14

```
CLC-R14(config)#router eigrp 100
CLC-R14(config-router)#network 14.14.14.14 0.0.0.0
CLC-R14(config-router)#network 172.30.1.2 0.0.0.0
CLC-R14(config-router)#network 172.30.1.13 0.0.0.0
CLC-R14(config-router)#exit
CLC-R14(config)#
```

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On CLC-R15

```
CLC-R15(config)#router eigrp 100
CLC-R15(config-router)#network 15.15.15.15 0.0.0.0
CLC-R15(config-router)#network 172.30.1.5 0.0.0.0
CLC-R15(config-router)#network 172.30.1.10 0.0.0.0
CLC-R15(config-router)#exit
CLC-R15(config)#
```

On CLC-R16

```
CLC-R16(config)#router eigrp 100
CLC-R16(config-router)#network 16.16.16.16 0.0.0.0
CLC-R16(config-router)#network 172.30.1.6 0.0.0.0
CLC-R16(config-router)#network 172.30.1.14 0.0.0.0
CLC-R16(config-router)#exit
CLC-R16(config)#
```

On CLC-R6

```
CLC-R6(config)#router eigrp 100
CLC-R6(config-router)#network 6.6.6.6 0.0.0.0
CLC-R6(config-router)#network 172.10.2.1 0.0.0.0
CLC-R6(config-router)#network 172.100.100.2 0.0.0.0
CLC-R6(config-router)#exit
CLC-R6(config)#
```

On CLC-R12

```
CLC-R12(config)#router eigrp 100
CLC-R12(config-router)#network 12.12.12.12 0.0.0.0
CLC-R12(config-router)#network 172.10.3.1 0.0.0.0
CLC-R12(config-router)#network 172.100.100.3 0.0.0.0
CLC-R12(config-router)#exit
CLC-R12(config)#
```

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Verification

On CLC-R13

```
CLC-R13#show ip eigrp neighbors
EIGRP-IPv4 Neighbors for AS(100)
      H   Address           Interface      Hold Uptime    SRTT     RTO  Q  Seq
          (sec)          (ms)          Cnt Num
  3   172.100.100.2       Tu0            12 03:57:00  17  1434  0  4
  2   172.100.100.3       Tu0            11 03:57:00  5   1434  0  3
  1   172.30.1.10        Et0/1          10 03:59:00  5   100   0 13
  0   172.30.1.2         Et0/0          10 03:59:00  5   100   0 13
CLC-R13#
```

```
CLC-R13#show ip route eigrp
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
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is not set

      6.0.0.0/32 is subnetted, 1 subnets
D        6.6.6.6 [90/27008000] via 172.100.100.2, 03:57:32, Tunnel0
      12.0.0.0/32 is subnetted, 1 subnets
D        12.12.12.12 [90/27008000] via 172.100.100.3, 03:57:22, Tunnel0
      14.0.0.0/32 is subnetted, 1 subnets
D        14.14.14.14 [90/409600] via 172.30.1.2, 03:59:25, Ethernet0/0
      15.0.0.0/32 is subnetted, 1 subnets
D        15.15.15.15 [90/409600] via 172.30.1.10, 03:59:25, Ethernet0/1
      16.0.0.0/32 is subnetted, 1 subnets
D        16.16.16.16 [90/435200] via 172.30.1.10, 03:59:25, Ethernet0/1
                           [90/435200] via 172.30.1.2, 03:59:25, Ethernet0/0
      172.10.0.0/24 is subnetted, 2 subnets
D        172.10.2.0 [90/26905600] via 172.100.100.2, 03:57:32, Tunnel0
D        172.10.3.0 [90/26905600] via 172.100.100.3, 03:57:22, Tunnel0
      172.30.0.0/16 is variably subnetted, 6 subnets, 2 masks
D        172.30.1.4/30 [90/307200] via 172.30.1.10, 03:59:25, Ethernet0/1
D        172.30.1.12/30 [90/307200] via 172.30.1.2, 03:59:25, Ethernet0/0
CLC-R13#
```

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```
CLC-R13#ping 172.10.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.10.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-R13#
CLC-R13#traceroute 172.10.2.1 numeric
Type escape sequence to abort.
Tracing the route to 172.10.2.1
VRF info: (vrf in name/id, vrf out name/id)
 1 172.100.100.2 4 msec * 1 msec
CLC-R13#
```

```
CLC-R13#ping 172.10.3.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.10.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
CLC-R13#
CLC-R13#traceroute 172.10.3.1 numeric
Type escape sequence to abort.
Tracing the route to 172.10.3.1
VRF info: (vrf in name/id, vrf out name/id)
 1 172.100.100.3 1 msec * 3 msec
CLC-R13#
```

On CLC-R6

```
CLC-R6#ping 172.10.3.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.10.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
CLC-R6#
CLC-R6#traceroute 172.10.3.1 numeric
Type escape sequence to abort.
Tracing the route to 172.10.3.1
VRF info: (vrf in name/id, vrf out name/id)
 1 172.100.100.1 0 msec 1 msec 0 msec
 2 172.100.100.3 1 msec * 1 msec
CLC-R6#
```

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SECTION 6: Customer BGP Services

SECTION 6.1: BGP in all Customer Sites

QUESTION

Configure the network in Sydney-Group, Victoria-Group, Queensland-Group, ANZ-Bank sites as per the following:

1. Configure BGP ASN as per given in topology
2. All CE devices must establish EBGP peering with PE.
3. All BGP routers must use their interface loopback0 as their BGP router-id.
4. Disable the default ipv4 unicast address family for peering session establishment in all BGP routers.
5. The EBGP peering must be established using physical WAN interface ip address.
6. CE devices must install routes from same BGP ASN via EPG.
7. Do not configure BGP on device R35.
8. You are not supposed to modify any changes on PE Routers to accomplish this task.

Solution

On CLC-R31

```
CLC-R31(config)#router bgp 64520
CLC-R31(config-router)#bgp router-id 31.31.31.31
CLC-R31(config-router)#no bgp default ipv4-unicast
CLC-R31(config-router)#neighbor 101.2.2.1 remote-as 6100
CLC-R31(config-router)#
CLC-R31(config-router)#address-family ipv4
CLC-R31(config-router-af)#neighbor 101.2.2.1 activate
CLC-R31(config-router-af)#neighbor 101.2.2.1 allowas-in
CLC-R31(config-router-af)#exit-address-family
CLC-R31(config-router)#exit
CLC-R31(config)#

```

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On CLC-R33

```
CLC-R33(config)#router bgp 64520
CLC-R33(config-router)#bgp router-id 33.33.33.33
CLC-R33(config-router)#no bgp default ipv4-unicast
CLC-R33(config-router)#neighbor 101.3.1.1 remote-as 6100
CLC-R33(config-router)#

```

```
CLC-R33(config-router)#address-family ipv4
CLC-R33(config-router-af)#neighbor 101.3.1.1 activate
CLC-R33(config-router-af)#neighbor 101.3.1.1 allowas-in
CLC-R33(config-router-af)#exit-address-family
CLC-R33(config-router)#exit
CLC-R33(config)#

```

On CLC-R29

```
CLC-R29(config)#router bgp 64510
CLC-R29(config-router)#bgp router-id 29.29.29.29
CLC-R29(config-router)#no bgp default ipv4-unicast
CLC-R29(config-router)#neighbor 101.2.1.1 remote-as 6100
CLC-R29(config-router)#

```

```
CLC-R29(config-router)#address-family ipv4
CLC-R29(config-router-af)# neighbor 101.2.1.1 activate
CLC-R29(config-router-af)#neighbor 101.2.1.1 allowas-in
CLC-R29(config-router-af)#exit-address-family
CLC-R29(config-router)#exit
CLC-R29(config)#

```

On CLC-R32

```
CLC-R32(config)#router bgp 64510
CLC-R32(config-router)#bgp router-id 32.32.32.32
CLC-R32(config-router)#no bgp default ipv4-unicast
CLC-R32(config-router)#neighbor 101.3.2.1 remote-as 6100
CLC-R32(config-router)#

```

```
CLC-R32(config-router)#address-family ipv4
CLC-R32(config-router-af)#neighbor 101.3.2.1 activate
CLC-R32(config-router-af)#neighbor 101.3.2.1 allowas-in
CLC-R32(config-router-af)#exit-address-family
CLC-R32(config-router)#exit
CLC-R32(config)#

```

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On CLC-R6

```
CLC-R6(config)#router bgp 62111
CLC-R6(config-router)#bgp router-id 6.6.6.6
CLC-R6(config-router)#no bgp default ipv4-unicast
CLC-R6(config-router)#neighbor 101.1.1.1 remote-as 6100
CLC-R6(config-router)#

```

```
CLC-R6(config-router)#address-family ipv4
CLC-R6(config-router-af)#neighbor 101.1.1.1 activate
CLC-R6(config-router-af)#neighbor 101.1.1.1 allowas-in
CLC-R6(config-router-af)#exit-address-family
CLC-R6(config-router)#exit
CLC-R6(config)#

```

On CLC-R12

```
CLC-R12(config)#router bgp 62111
CLC-R12(config-router)#bgp router-id 12.12.12.12
CLC-R12(config-router)#no bgp default ipv4-unicast
CLC-R12(config-router)#neighbor 101.4.1.1 remote-as 6100
CLC-R12(config-router)#

```

```
CLC-R12(config-router)#address-family ipv4
CLC-R12(config-router-af)#neighbor 101.4.1.1 activate
CLC-R12(config-router-af)#neighbor 101.4.1.1 allowas-in
CLC-R12(config-router-af)#exit-address-family
CLC-R12(config-router)#exit
CLC-R12(config)#

```

On CLC-R13

```
CLC-R13(config)#router bgp 62111
CLC-R13(config-router)#bgp router-id 13.13.13.13
CLC-R13(config-router)#no bgp default ipv4-unicast
CLC-R13(config-router)#neighbor 102.1.1.1 remote-as 6100
CLC-R13(config-router)#

```

```
CLC-R13(config-router)#address-family ipv4
CLC-R13(config-router-af)#neighbor 102.1.1.1 activate
CLC-R13(config-router-af)#neighbor 102.1.1.1 allowas-in
CLC-R13(config-router-af)#exit-address-family
CLC-R13(config-router)#exit
CLC-R13(config)#

```

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On CLC-R34

```
CLC-R34(config)#router bgp 64510
CLC-R34(config-router)#bgp router-id 34.34.34.34
CLC-R34(config-router)#no bgp default ipv4-unicast
CLC-R34(config-router)#neighbor 102.2.2.1 remote-as 6100
CLC-R34(config-router)#

```

```
CLC-R34(config-router)#address-family ipv4
CLC-R34(config-router-af)#neighbor 102.2.2.1 activate
CLC-R34(config-router-af)#neighbor 102.2.2.1 allowas-in
CLC-R34(config-router-af)#exit-address-family
CLC-R34(config-router)# exit
CLC-R34(config)#

```

On CLC-R36

```
CLC-R36(config)#router bgp 64530
CLC-R36(config-router)#bgp router-id 36.36.36.36
CLC-R36(config-router)#no bgp default ipv4-unicast
CLC-R36(config-router)#neighbor 102.2.1.1 remote-as 6100
CLC-R36(config-router)#

```

```
CLC-R36(config-router)#address-family ipv4
CLC-R36(config-router-af)#neighbor 102.2.1.1 activate
CLC-R36(config-router-af)#neighbor 102.2.1.1 allowas-in
CLC-R36(config-router-af)#exit-address-family
CLC-R36(config-router)#exit
CLC-R36(config)#

```

On CLC-R37

```
CLC-R37(config)#router bgp 64530
CLC-R37(config-router)#bgp router-id 37.37.37.37
CLC-R37(config-router)#no bgp default ipv4-unicast
CLC-R37(config-router)#neighbor 102.3.2.1 remote-as 6100
CLC-R37(config-router)#

```

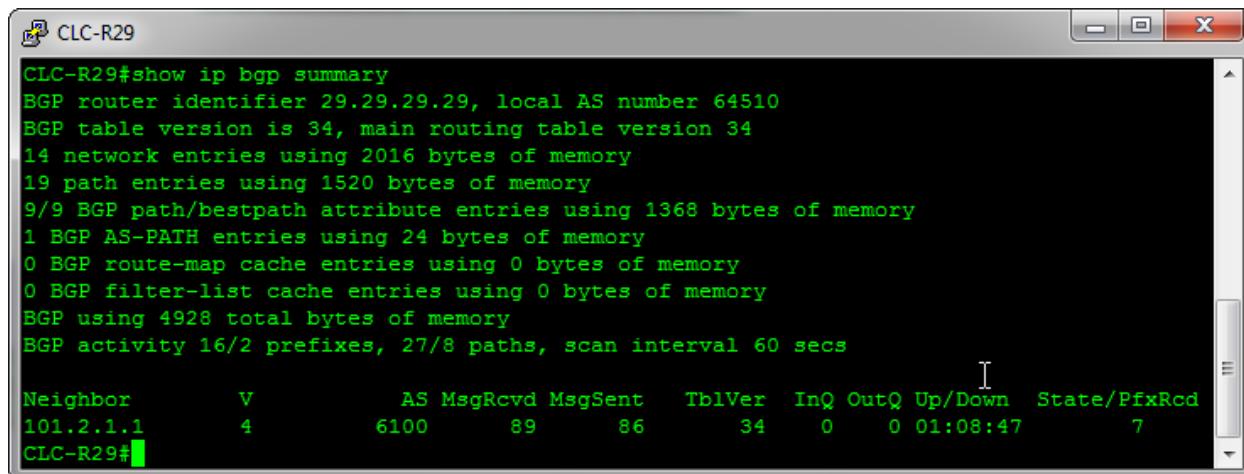
```
CLC-R37(config-router)#address-family ipv4
CLC-R37(config-router-af)#neighbor 102.3.2.1 activate
CLC-R37(config-router-af)#neighbor 102.3.2.1 allowas-in
CLC-R37(config-router-af)#exit-address-family
CLC-R37(config-router)#exit
CLC-R37(config)#

```

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Verification

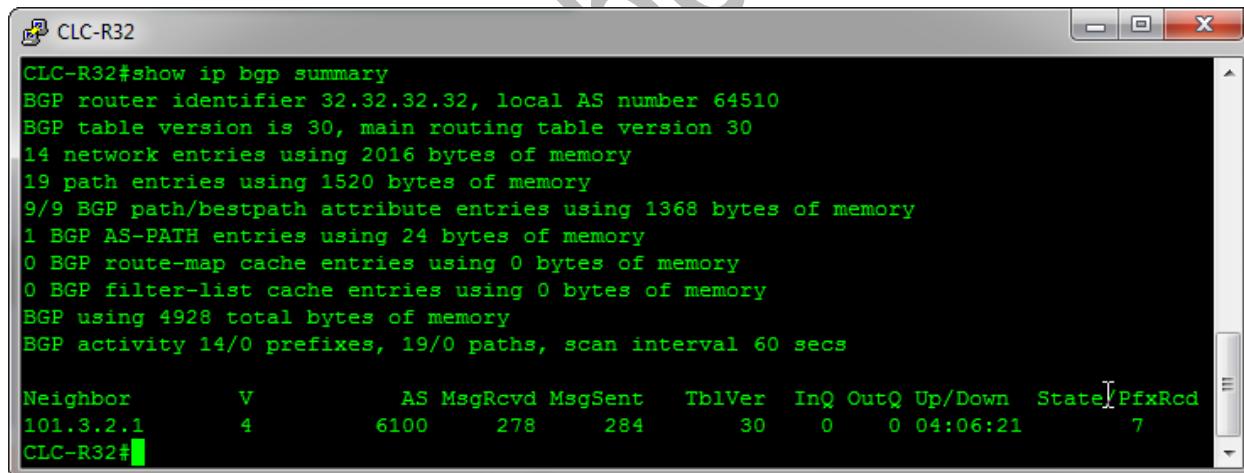
On CLC-R29



```
CLC-R29#show ip bgp summary
BGP router identifier 29.29.29.29, local AS number 64510
BGP table version is 34, main routing table version 34
14 network entries using 2016 bytes of memory
19 path entries using 1520 bytes of memory
9/9 BGP path/bestpath attribute entries using 1368 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 4928 total bytes of memory
BGP activity 16/2 prefixes, 27/8 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
101.2.1.1     4      6100    89     86       34      0     0 01:08:47          7
CLC-R29#
```

On CLC-R32



```
CLC-R32#show ip bgp summary
BGP router identifier 32.32.32.32, local AS number 64510
BGP table version is 30, main routing table version 30
14 network entries using 2016 bytes of memory
19 path entries using 1520 bytes of memory
9/9 BGP path/bestpath attribute entries using 1368 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 4928 total bytes of memory
BGP activity 14/0 prefixes, 19/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
101.3.2.1     4      6100    278    284       30      0     0 04:06:21          7
CLC-R32#
```

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On CLC-R31

```
CLC-R31#show ip bgp summary
BGP router identifier 31.31.31.31, local AS number 64520
BGP table version is 5, main routing table version 5
4 network entries using 576 bytes of memory
4 path entries using 320 bytes of memory
2/2 BGP path/bestpath attribute entries using 304 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 1224 total bytes of memory
BGP activity 4/0 prefixes, 4/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
101.2.2.1     4      6100    1768    1765        5      0    0 1d02h          2
CLC-R31#
```

On CLC-R37

```
CLC-R33#show ip bgp summary
BGP router identifier 33.33.33.33, local AS number 64520
BGP table version is 5, main routing table version 5
4 network entries using 576 bytes of memory
4 path entries using 320 bytes of memory
2/2 BGP path/bestpath attribute entries using 304 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 1224 total bytes of memory
BGP activity 4/0 prefixes, 4/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
101.3.1.1     4      6100    1766    1770        5      0    0 1d02h          2
CLC-R33#
```

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On CLC-R6

```
CLC-R6#show ip bgp summary
BGP router identifier 6.6.6.6, local AS number 62111
BGP table version is 32, main routing table version 32
15 network entries using 2160 bytes of memory
23 path entries using 1840 bytes of memory
9/9 BGP path/bestpath attribute entries using 1368 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 5392 total bytes of memory
BGP activity 15/0 prefixes, 23/0 paths, scan interval 60 secs

Neighbor      V          AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
101.1.1.1     4          6100    1775     1780       32      0    0 1d02h         9
CLC-R6#
```

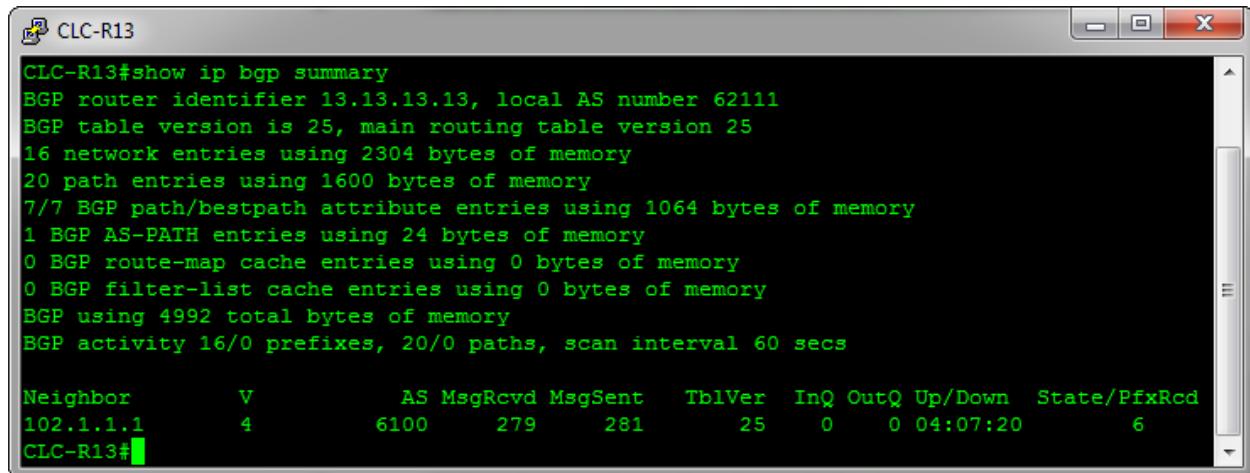
On CLC-R12

```
CLC-R12#show ip bgp summary
BGP router identifier 12.12.12.12, local AS number 62111
BGP table version is 32, main routing table version 32
15 network entries using 2160 bytes of memory
23 path entries using 1840 bytes of memory
9/9 BGP path/bestpath attribute entries using 1368 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 5392 total bytes of memory
BGP activity 15/0 prefixes, 23/0 paths, scan interval 60 secs

Neighbor      V          AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
101.4.1.1     4          6100    1774     1772       32      0    0 1d02h         9
CLC-R12#
```

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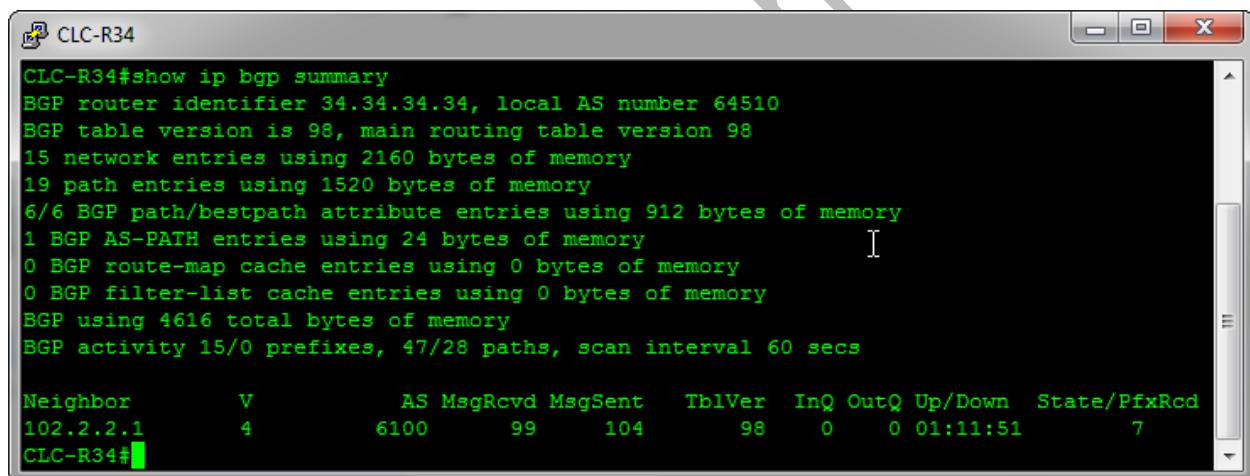
On CLC-R13



```
CLC-R13#show ip bgp summary
BGP router identifier 13.13.13.13, local AS number 62111
BGP table version is 25, main routing table version 25
16 network entries using 2304 bytes of memory
20 path entries using 1600 bytes of memory
7/7 BGP path/bestpath attribute entries using 1064 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 4992 total bytes of memory
BGP activity 16/0 prefixes, 20/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
102.1.1.1     4      6100    279     281       25      0     0 04:07:20      6
CLC-R13#
```

On CLC-R34



```
CLC-R34#show ip bgp summary
BGP router identifier 34.34.34.34, local AS number 64510
BGP table version is 98, main routing table version 98
15 network entries using 2160 bytes of memory
19 path entries using 1520 bytes of memory
6/6 BGP path/bestpath attribute entries using 912 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 4616 total bytes of memory
BGP activity 15/0 prefixes, 47/28 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
102.2.2.1     4      6100     99     104       98      0     0 01:11:51      7
CLC-R34#
```

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On CLC-R36

```
CLC-R36#show ip bgp summary
BGP router identifier 36.36.36.36, local AS number 64530
BGP table version is 12, main routing table version 12
7 network entries using 1008 bytes of memory
9 path entries using 720 bytes of memory
4/4 BGP path/bestpath attribute entries using 608 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 2360 total bytes of memory
BGP activity 7/0 prefixes, 9/0 paths, scan interval 60 secs

Neighbor      V          AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
102.2.1.1     4          6100    1772     1769       12      0    0 1d02h            3
CLC-R36#
```

On CLC-R37

```
CLC-R37#show ip bgp summary
BGP router identifier 37.37.37.37, local AS number 64530
BGP table version is 12, main routing table version 12
7 network entries using 1008 bytes of memory
9 path entries using 720 bytes of memory
4/4 BGP path/bestpath attribute entries using 608 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 2360 total bytes of memory
BGP activity 7/0 prefixes, 9/0 paths, scan interval 60 secs

Neighbor      V          AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
102.3.2.1     4          6100    1770     1771       12      0    0 1d02h            3
CLC-R37#
```

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SECTION 6.2: Customer-End Traffic Engineering

QUESTION

Redistribute the network at Customer-End sites as per the following requirements:

1. You must be able to get reachability end-to-end
2. None of the devices/routes must fail to install the IGP routes from same/different process id.
3. You are allowed to redistribute IGP to BGP on CE devices.
4. You are not allowed to redistribute BGP to IGP on CE devices.
5. All CE devices R29, R31, R32, R33 must install a default route in IGP for end-to-end reachability.
6. All CE devices R6, R12, R13, R34, R36, R37 must allow redistribution BGP to IGP
7. You must be able to see specific routes installed in the routing table
8. Do not filter any routes.
9. Make sure that the routes coming from BGP ASN (EBGP) on CE devices must prefer the IGP protocol via tunnel0 for reachability. You can use any method to achieve this task.

Solution

On CLC-R31

```
CLC-R31(config)#router ospf 2
CLC-R31(config-router)#default-information originate always
CLC-R31(config-router)#exit
CLC-R31(config)#
```

```
CLC-R31(config)#router bgp 64520
CLC-R31(config-router)#address-family ipv4
CLC-R31(config-router-af)#redistribute ospf 2
CLC-R31(config-router-af)#exit-address-family
CLC-R31(config-router)#exit
CLC-R31(config)#
```

On CLC-R33

```
CLC-R33(config)#router ospf 2
CLC-R33(config-router)#default-information originate always
CLC-R33(config-router)#exit
CLC-R33(config)#
```

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```
CLC-R33(config)#router bgp 64520
CLC-R33(config-router)#address-family ipv4
CLC-R33(config-router-af)#redistribute ospf 2
CLC-R33(config-router-af)#exit-address-family
CLC-R33(config-router)#exit
CLC-R33(config)#
```

On CLC-R29

```
CLC-R29(config)#router ospf 1
CLC-R29(config-router)#default-information originate always
CLC-R29(config-router)#exit
CLC-R29(config)#
```

```
CLC-R29(config)#router bgp 64510
CLC-R29(config-router)#address-family ipv4
CLC-R29(config-router-af)#redistribute connected
CLC-R29(config-router-af)#redistribute ospf 1
CLC-R29(config-router-af)#distance 111 101.2.1.1 0.0.0.0
CLC-R29(config-router-af)#exit-address-family
CLC-R29(config-router)#exit
CLC-R29(config)#
```

On CLC-R32

```
R32(config)#router ospf 1
R32(config-router)#default-information originate always
R32(config-router)#exit
R32(config)#
```

```
CLC-R32(config)#router bgp 64510
CLC-R32(config-router)#address-family ipv4
CLC-R32(config-router-af)#redistribute connected
CLC-R32(config-router-af)#redistribute ospf 1
CLC-R32(config-router-af)#distance 111 101.3.2.1 0.0.0.0
CLC-R32(config-router-af)#exit-address-family
CLC-R32(config-router)#exit
CLC-R32(config)#
```

On CLC-R6

```
CLC-R6(config)#router eigrp 100
CLC-R6(config-router)#redistribute bgp 62111
```

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```
CLC-R6(config-router)#exit  
CLC-R6(config)#  
  
CLC-R6(config)#router bgp 62111  
CLC-R6(config-router)# address-family ipv4  
CLC-R6(config-router-af)#redistribute connected  
CLC-R6(config-router-af)#redistribute eigrp 100  
CLC-R6(config-router-af)#distance 91 101.1.1.1 0.0.0.0  
CLC-R6(config-router-af)#exit-address-family  
CLC-R6(config-router)#exit  
CLC-R6(config)#
```

On CLC-R12

```
CLC-R12(config)#router eigrp 100  
CLC-R12(config-router)#redistribute bgp 62111  
CLC-R12(config-router)#exit  
CLC-R12(config)#
```

```
CLC-R12(config)#router bgp 62111  
CLC-R12(config-router)#address-family ipv4  
CLC-R12(config-router-af)#redistribute connected  
CLC-R12(config-router-af)#redistribute eigrp 100  
CLC-R12(config-router-af)#distance 91 101.4.1.1 0.0.0.0  
CLC-R12(config-router-af)#exit-address-family  
CLC-R12(config-router)#exit  
CLC-R12(config)#
```

On CLC-R13

```
CLC-R13(config)#router eigrp 100  
CLC-R13(config-router)# redistribute bgp 62111  
CLC-R13(config-router)#exit  
CLC-R13(config)#
```

```
CLC-R13(config)#router bgp 62111  
CLC-R13(config-router)#address-family ipv4  
CLC-R13(config-router-af)#redistribute connected  
CLC-R13(config-router-af)#redistribute eigrp 100  
CLC-R13(config-router-af)#distance 91 102.1.1.1 0.0.0.0  
CLC-R13(config-router-af)#exit-address-family  
CLC-R13(config-router)#exit  
CLC-R13(config)#
```

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On CLC-R34

```
CLC-R34(config)#router ospf 1  
CLC-R34(config-router)#redistribute bgp 64510 subnets  
CLC-R34(config-router)#exit  
CLC-R34(config)#
```

```
CLC-R34(config)#router bgp 64510  
CLC-R34(config-router)#address-family ipv4  
CLC-R34(config-router-af)#redistribute ospf 1  
CLC-R34(config-router-af)#distance 111 102.2.2.1 0.0.0.0  
CLC-R34(config-router-af)#exit-address-family  
CLC-R34(config-router)#exit  
CLC-R34(config)#
```

On CLC-R36

```
CLC-R36(config)#router ospf 3  
CLC-R36(config-router)#redistribute bgp 64530 subnets  
CLC-R36(config-router)#exit  
CLC-R36(config)#
```

```
CLC-R36(config)#router bgp 64530  
CLC-R36(config-router)#address-family ipv4  
CLC-R36(config-router-af)#redistribute connected  
CLC-R36(config-router-af)#redistribute ospf 3  
CLC-R36(config-router-af)#distance 111 102.2.1.1 0.0.0.0  
CLC-R36(config-router-af)#exit-address-family  
CLC-R36(config-router)#exit  
CLC-R36(config)#
```

On CLC-R37

```
CLC-R37(config)#router ospf 3  
CLC-R37(config-router)#redistribute bgp 64530 subnets  
CLC-R37(config-router)#exit  
CLC-R37(config)#
```

```
CLC-R37(config)#router bgp 64530  
CLC-R37(config-router)#address-family ipv4  
CLC-R37(config-router-af)#redistribute connected  
CLC-R37(config-router-af)#redistribute ospf 3  
CLC-R37(config-router-af)#distance 111 102.3.2.1 0.0.0.0  
CLC-R37(config-router-af)#exit-address-family  
CLC-R37(config-router)#exit  
CLC-R37(config)#
```

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Verification

On CLC-R31

```
CLC-R31#show ip route ospf
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
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is not set

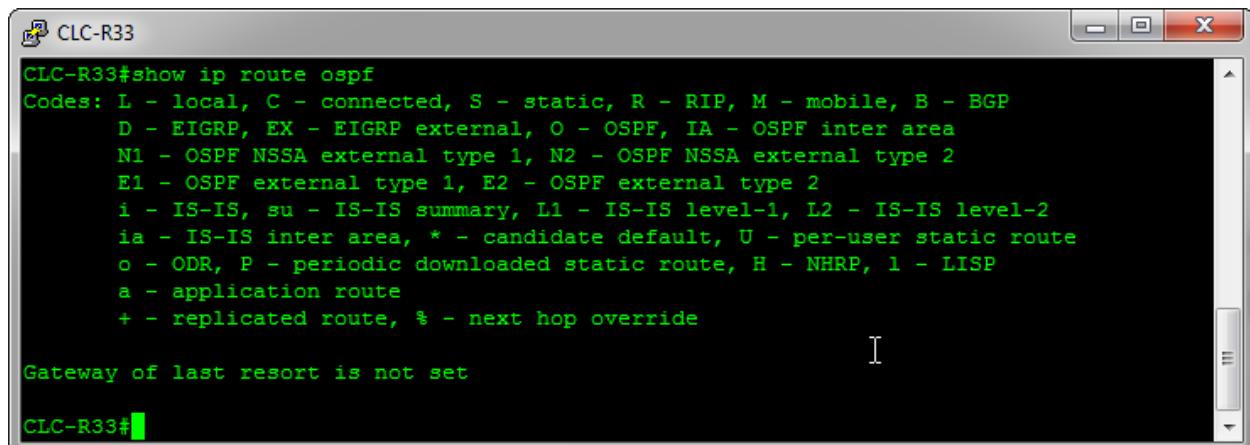
CLC-R31#
```

```
CLC-R31#show ip bgp
BGP table version is 5, local router ID is 31.31.31.31
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
               x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

      Network          Next Hop            Metric LocPrf Weight Path
*>  20.20.1.0/24    101.2.2.1                  0       6100  64520 ?
*>  20.20.2.0/24    0.0.0.0                 0       32768 ?
*>  31.31.31.31/32  0.0.0.0                 0       32768 ?
*>  33.33.33.33/32  101.2.2.1                  0       6100  64520 ?
CLC-R31#
```

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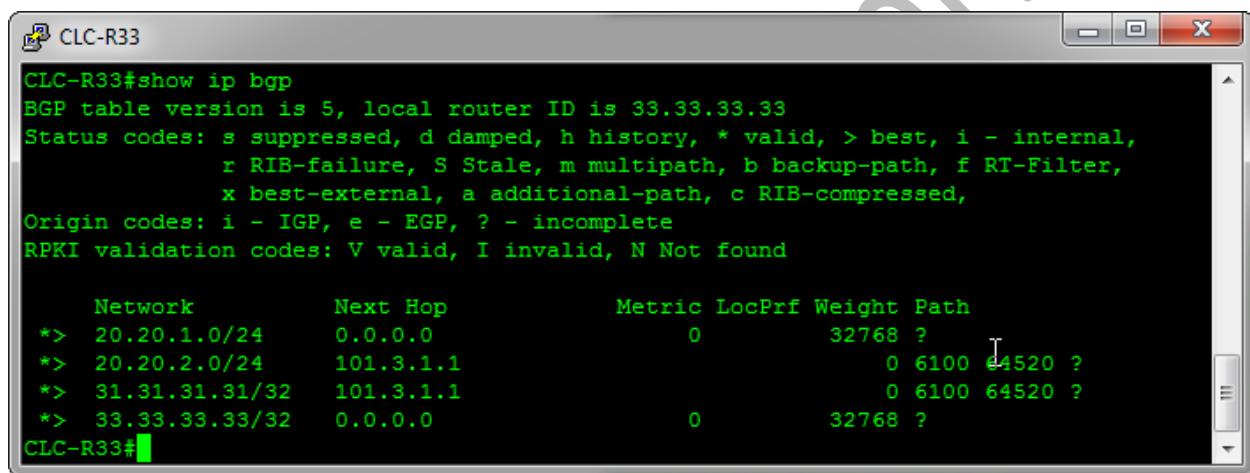
On CLC-R33



```
CLC-R33#show ip route ospf
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
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is not set

CLC-R33#
```

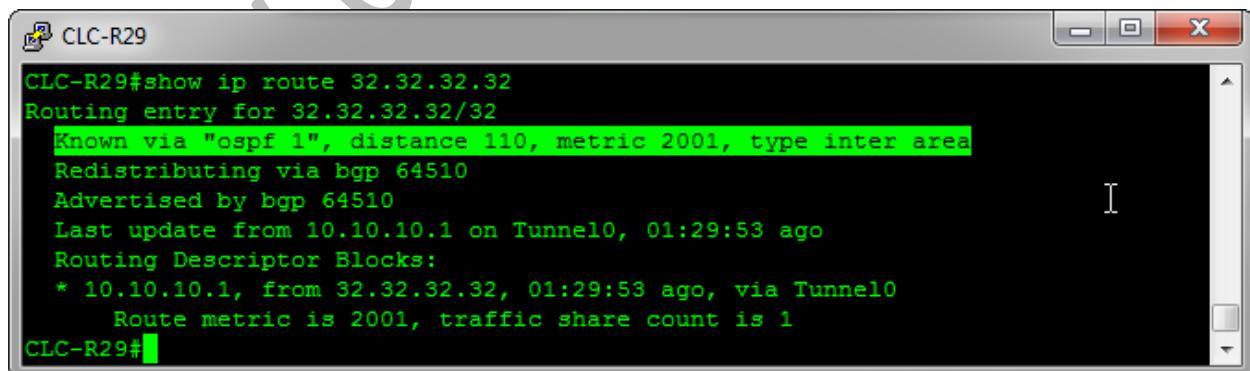


```
CLC-R33#show ip bgp
BGP table version is 5, local router ID is 33.33.33.33
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
               x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

      Network          Next Hop           Metric LocPrf Weight Path
* > 20.20.1.0/24    0.0.0.0            0        32768 ? 
* > 20.20.2.0/24    101.3.1.1          0       6100 44520 ? 
* > 31.31.31.31/32  101.3.1.1          0       6100 64520 ? 
* > 33.33.33.33/32  0.0.0.0            0        32768 ? 

CLC-R33#
```

On CLC-R29



```
CLC-R29#show ip route 32.32.32.32
Routing entry for 32.32.32.32/32
  Known via "ospf 1", distance 110, metric 2001, type inter area
  Redistributing via bgp 64510
  Advertised by bgp 64510
  Last update from 10.10.10.1 on Tunnel0, 01:29:53 ago
  Routing Descriptor Blocks:
  * 10.10.10.1, from 32.32.32.32, 01:29:53 ago, via Tunnel0
    Route metric is 2001, traffic share count is 1

CLC-R29#
```

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```
CLC-R29#show ip route 34.34.34.34
Routing entry for 34.34.34.34/32
Known via "ospf 1", distance 110, metric 1001, type intra area
Redistributing via bgp 64510
Advertised by bgp 64510
Last update from 10.10.10.1 on Tunnel0, 01:31:22 ago
Routing Descriptor Blocks:
* 10.10.10.1, from 34.34.34.34, 01:31:22 ago, via Tunnel0
    Route metric is 1001, traffic share count is 1
CLC-R29#
```

```
CLC-R29#show ip route ospf
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
        a - application route
        + - replicated route, % - next hop override

Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
O       10.10.1.0/24 [110/1010] via 10.10.10.1, 01:21:54, Tunnel0
O IA     10.10.3.0/24 [110/2010] via 10.10.10.1, 01:21:54, Tunnel0
O       10.10.10.1/32 [110/1000] via 10.10.10.1, 01:21:54, Tunnel0
O       10.10.10.3/32 [110/2000] via 10.10.10.1, 01:21:54, Tunnel0
          32.0.0.0/32 is subnetted, 1 subnets
O IA     32.32.32.32 [110/2001] via 10.10.10.1, 01:21:54, Tunnel0
          34.0.0.0/32 is subnetted, 1 subnets
O       34.34.34.34 [110/1001] via 10.10.10.1, 01:21:54, Tunnel0
          35.0.0.0/32 is subnetted, 1 subnets
O       35.35.35.35 [110/1011] via 10.10.10.1, 01:21:54, Tunnel0
          42.0.0.0/32 is subnetted, 1 subnets
O       42.42.42.42 [110/1011] via 10.10.10.1, 01:21:54, Tunnel0
          101.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O E2     101.3.2.0/30 [110/1] via 10.10.10.1, 00:56:58, Tunnel0
CLC-R29#
```

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```
CLC-R29#show ip bgp
BGP table version is 34, local router ID is 29.29.29.29
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
               x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

      Network          Next Hop            Metric LocPrf Weight Path
* > 10.10.1.0/24    10.10.10.1        1010   32768 ? 
*                  101.2.1.1          0       6100  64510 ? 
* > 10.10.2.0/24    0.0.0.0           0       32768 ? 
* > 10.10.3.0/24    10.10.10.1        2010   32768 ? 
* > 10.10.10.0/24   0.0.0.0           0       32768 ? 
* > 10.10.10.1/32   10.10.10.1        1000   32768 ? 
r> 10.10.10.2/32   101.2.1.1          0       6100  64510 ? 
* 10.10.10.3/32    101.2.1.1          0       6100  64510 ? 
*>                 10.10.10.1         2000   32768 ? 
* > 29.29.29.29/32  0.0.0.0           0       32768 ? 
* > 32.32.32.32/32  10.10.10.1        2001   32768 ? 
* > 34.34.34.34/32  10.10.10.1        1001   32768 ? 
*                  101.2.1.1          0       6100  64510 ? 
* 35.35.35.35/32   101.2.1.1          0       6100  64510 ? 
*>                 10.10.10.1         1011   32768 ? 
* > 42.42.42.42/32  101.2.1.1          0       6100  64510 ? 
*>                 10.10.10.1         1011   32768 ? 
*> 101.2.1.0/30     0.0.0.0           0       32768 ? 
*> 102.2.2.0/30     101.2.1.1          0       6100  64510 ? 

CLC-R29#
```

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On CLC-R32

```

CLC-R32#show ip route 29.29.29.29
Routing entry for 29.29.29.29/32
    Known via "ospf 1", distance 110, metric 2001, type inter area
    Redistributing via bgp 64510
    Advertised by bgp 64510
    Last update from 10.10.10.1 on Tunnel0, 01:08:27 ago
    Routing Descriptor Blocks:
        * 10.10.10.1, from 29.29.29.29, 01:08:27 ago, via Tunnel0
            Route metric is 2001, traffic share count is 1
CLC-R32#
```



```

CLC-R32#show ip route 34.34.34.34
Routing entry for 34.34.34.34/32
    Known via "ospf 1", distance 110, metric 1001, type intra area
    Redistributing via bgp 64510
    Advertised by bgp 64510
    Last update from 10.10.10.1 on Tunnel0, 01:08:42 ago
    Routing Descriptor Blocks:
        * 10.10.10.1, from 34.34.34.34, 01:08:42 ago, via Tunnel0
            Route metric is 1001, traffic share count is 1
CLC-R32#
```



```

CLC-R32
CLC-R32#show ip route ospf
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
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is not set

          10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
O     10.10.1.0/24 [110/1010] via 10.10.10.1, 04:08:36, Tunnel0
O IA   10.10.2.0/24 [110/2010] via 10.10.10.1, 04:07:58, Tunnel0
O     10.10.10.1/32 [110/1000] via 10.10.10.1, 04:08:36, Tunnel0
O     10.10.10.2/32 [110/2000] via 10.10.10.1, 04:07:58, Tunnel0
          29.0.0.0/32 is subnetted, 1 subnets
O IA   29.29.29.29 [110/2001] via 10.10.10.1, 04:07:58, Tunnel0
          34.0.0.0/32 is subnetted, 1 subnets
O     34.34.34.34 [110/1001] via 10.10.10.1, 04:08:36, Tunnel0
          35.0.0.0/32 is subnetted, 1 subnets
O     35.35.35.35 [110/1011] via 10.10.10.1, 04:08:36, Tunnel0
          42.0.0.0/32 is subnetted, 1 subnets
O     42.42.42.42 [110/1011] via 10.10.10.1, 04:08:36, Tunnel0
          101.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O E2   101.2.1.0/30 [110/1] via 10.10.10.1, 04:08:36, Tunnel0
CLC-R32#

```

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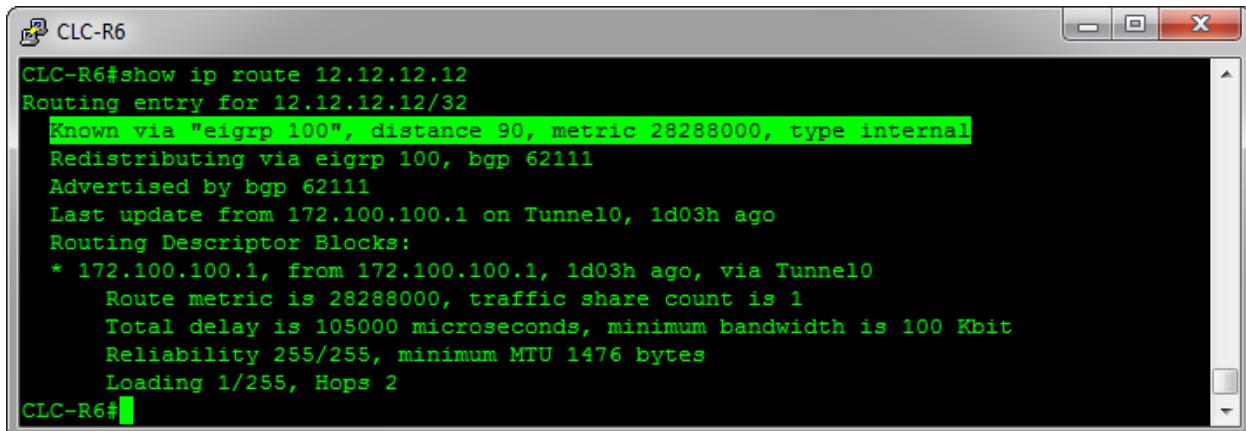
```
CLC-R32#show ip bgp
BGP table version is 30, local router ID is 32.32.32.32
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
               x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

      Network          Next Hop            Metric LocPrf Weight Path
* > 10.10.1.0/24    10.10.10.1        1010   32768 ? 
*                  101.3.2.1          0       6100  64510 ? 
* > 10.10.2.0/24    10.10.10.1        2010   32768 ? 
* > 10.10.3.0/24    0.0.0.0           0       32768 ? 
* > 10.10.10.0/24   0.0.0.0           0       32768 ? 
* > 10.10.10.1/32   10.10.10.1        1000   32768 ? 
* > 10.10.10.2/32   10.10.10.1        2000   32768 ? 
*                  101.3.2.1          0       6100  64510 ? 
r> 10.10.10.3/32   101.3.2.1          0       6100  64510 ? 
* > 29.29.29.29/32  10.10.10.1        2001   32768 ? 
* > 32.32.32.32/32  0.0.0.0           0       32768 ? 
* > 34.34.34.34/32  10.10.10.1        1001   32768 ? 
*                  101.3.2.1          0       6100  64510 ? 
* > 35.35.35.35/32  10.10.10.1        1011   32768 ? 
*                  101.3.2.1          0       6100  64510 ? 
* > 42.42.42.42/32  10.10.10.1        1011   32768 ? 
*                  101.3.2.1          0       6100  64510 ? 
* > 101.3.2.0/30    0.0.0.0           0       32768 ? 
* > 102.2.2.0/30    101.3.2.1          0       6100  64510 ? 

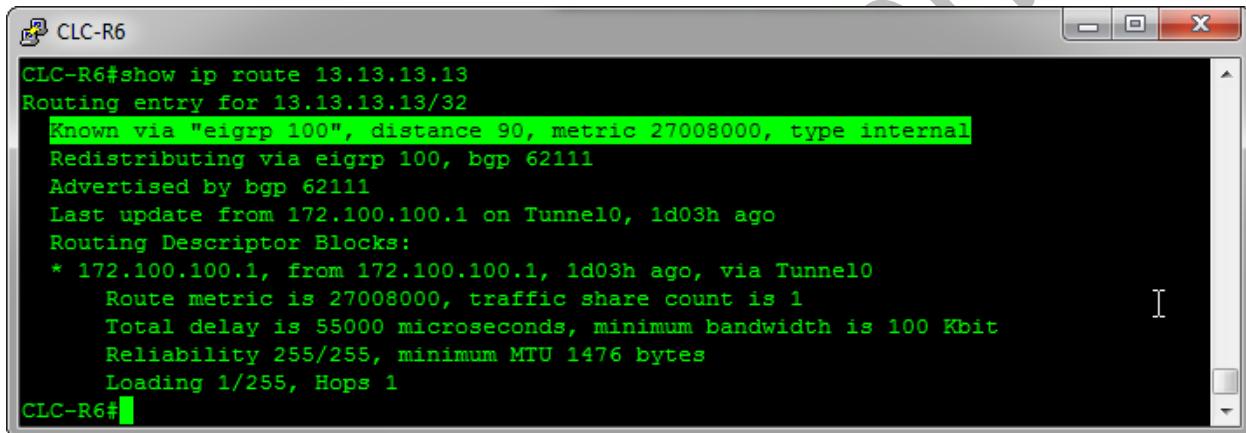
CLC-R32#
```

CCIE Lab Center

On CLC-R6



```
CLC-R6#show ip route 12.12.12.12
Routing entry for 12.12.12.12/32
Known via "eigrp 100", distance 90, metric 28288000, type internal
  Redistributing via eigrp 100, bgp 62111
  Advertised by bgp 62111
  Last update from 172.100.100.1 on Tunnel0, 1d03h ago
  Routing Descriptor Blocks:
    * 172.100.100.1, from 172.100.100.1, 1d03h ago, via Tunnel0
      Route metric is 28288000, traffic share count is 1
      Total delay is 105000 microseconds, minimum bandwidth is 100 Kbit
      Reliability 255/255, minimum MTU 1476 bytes
      Loading 1/255, Hops 2
CLC-R6#
```



```
CLC-R6#show ip route 13.13.13.13
Routing entry for 13.13.13.13/32
Known via "eigrp 100", distance 90, metric 27008000, type internal
  Redistributing via eigrp 100, bgp 62111
  Advertised by bgp 62111
  Last update from 172.100.100.1 on Tunnel0, 1d03h ago
  Routing Descriptor Blocks:
    * 172.100.100.1, from 172.100.100.1, 1d03h ago, via Tunnel0
      Route metric is 27008000, traffic share count is 1
      Total delay is 55000 microseconds, minimum bandwidth is 100 Kbit
      Reliability 255/255, minimum MTU 1476 bytes
      Loading 1/255, Hops 1
CLC-R6#
```

CCIE Lab Center

```
CLC-R6#show ip route eigrp
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
      a - application route
      + - replicated route, # - next hop override

Gateway of last resort is not set

      12.0.0.0/32 is subnetted, 1 subnets
D        12.12.12.12 [90/28288000] via 172.100.100.1, 1d02h, Tunnel0
      13.0.0.0/32 is subnetted, 1 subnets
D        13.13.13.13 [90/27008000] via 172.100.100.1, 1d02h, Tunnel0
      14.0.0.0/32 is subnetted, 1 subnets
D        14.14.14.14 [90/27033600] via 172.100.100.1, 1d02h, Tunnel0
      15.0.0.0/32 is subnetted, 1 subnets
D        15.15.15.15 [90/27033600] via 172.100.100.1, 1d02h, Tunnel0
      16.0.0.0/32 is subnetted, 1 subnets
D        16.16.16.16 [90/27059200] via 172.100.100.1, 1d02h, Tunnel0
      172.10.0.0/16 is variably subnetted, 3 subnets, 2 masks
D        172.10.3.0/24 [90/28185600] via 172.100.100.1, 1d02h, Tunnel0
        172.30.0.0/30 is subnetted, 4 subnets
D          172.30.1.0 [90/26905600] via 172.100.100.1, 1d02h, Tunnel0
D          172.30.1.4 [90/26931200] via 172.100.100.1, 1d02h, Tunnel0
D          172.30.1.8 [90/26905600] via 172.100.100.1, 1d02h, Tunnel0
D          172.30.1.12 [90/26931200] via 172.100.100.1, 1d02h, Tunnel0
CLC-R6#
```

CCIE Lab Center

```
CLC-R6#show ip bgp
BGP table version is 32, local router ID is 6.6.6.6
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
               x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

      Network          Next Hop           Metric LocPrf Weight Path
*->  6.6.6.6/32        0.0.0.0            0       32768  ?
*->  12.12.12.12/32    172.100.100.1     28288000   32768  ?
*->  13.13.13.13/32    172.100.100.1     27008000   32768  ?
*          101.1.1.1          0       6100 62111 ?
*->  14.14.14.14/32    172.100.100.1     27033600   32768  ?
*          101.1.1.1          0       6100 62111 ?
*->  15.15.15.15/32    172.100.100.1     27033600   32768  ?
*          101.1.1.1          0       6100 62111 ?
*->  16.16.16.16/32    172.100.100.1     27059200   32768  ?
*          101.1.1.1          0       6100 62111 ?
*->  101.1.1.0/30       0.0.0.0            0       32768  ?
*->  102.1.1.0/30       101.1.1.1          0       6100 62111 ?
*->  172.10.2.0/24       0.0.0.0            0       32768  ?
*->  172.10.3.0/24       172.100.100.1     28185600   32768  ?
*->  172.30.1.0/30       172.100.100.1     26905600   32768  ?
*          101.1.1.1          0       6100 62111 ?
*->  172.30.1.4/30       172.100.100.1     26931200   32768  ?
*          101.1.1.1          0       6100 62111 ?
*->  172.30.1.8/30       172.100.100.1     26905600   32768  ?
*          101.1.1.1          0       6100 62111 ?
*->  172.30.1.12/30      172.100.100.1     26931200   32768  ?
*          101.1.1.1          0       6100 62111 ?
*->  172.100.100.0/24    0.0.0.0            0       32768  ?
CLC-R6#
```

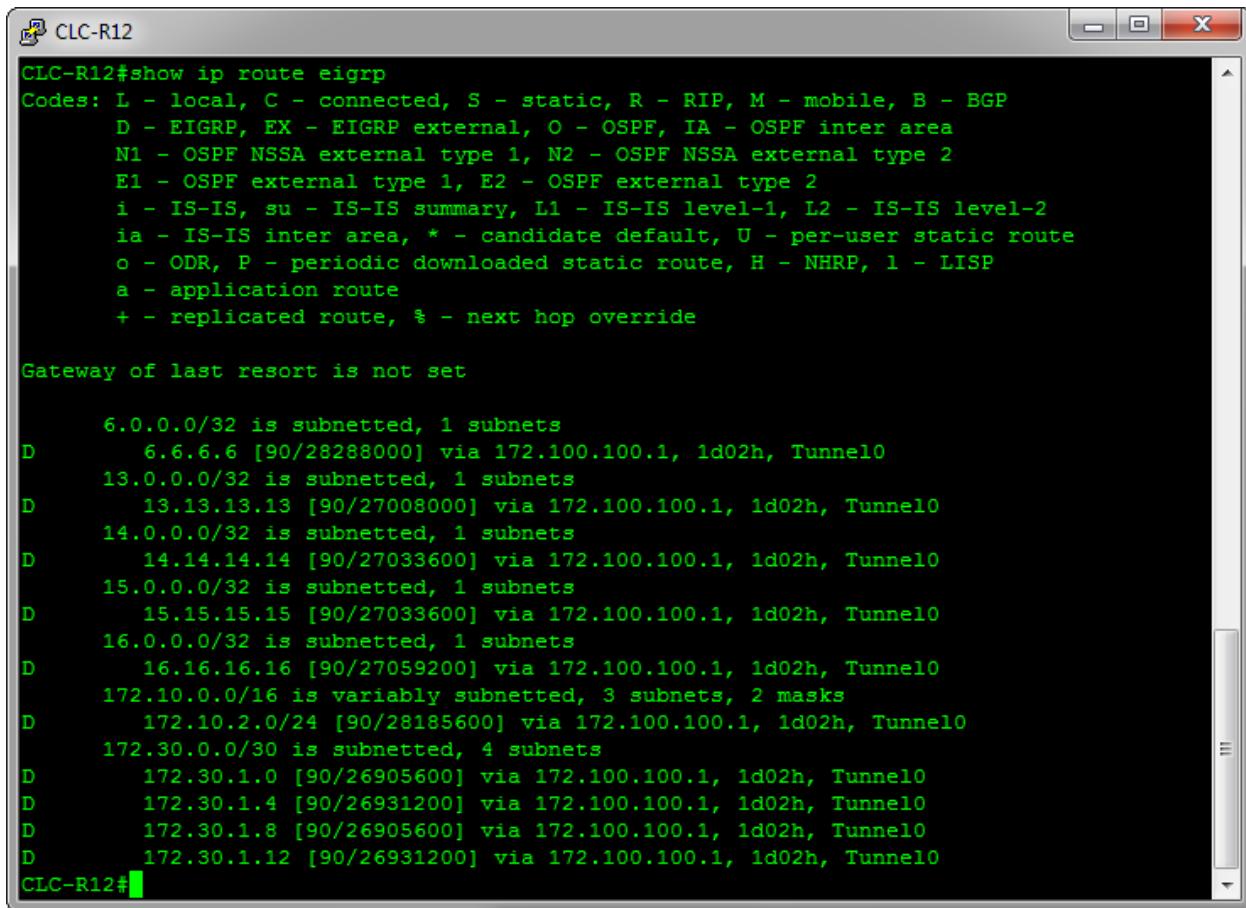
CCIE Lab Center

On CLC-R12

```
CLC-R12#show ip route 6.6.6.6
Routing entry for 6.6.6.6/32
Known via "eigrp 100", distance 90, metric 28288000, type internal
Redistributing via eigrp 100, bgp 62111
Advertised by bgp 62111
Last update from 172.100.100.1 on Tunnel0, 1d03h ago
Routing Descriptor Blocks:
* 172.100.100.1, from 172.100.100.1, 1d03h ago, via Tunnel0
  Route metric is 28288000, traffic share count is 1
  Total delay is 105000 microseconds, minimum bandwidth is 100 Kbit
  Reliability 255/255, minimum MTU 1476 bytes
  Loading 1/255, Hops 2
CLC-R12#
```

```
CLC-R12#show ip route 13.13.13.13
Routing entry for 13.13.13.13/32
Known via "eigrp 100", distance 90, metric 27008000, type internal
Redistributing via eigrp 100, bgp 62111
Advertised by bgp 62111
Last update from 172.100.100.1 on Tunnel0, 1d03h ago
Routing Descriptor Blocks:
* 172.100.100.1, from 172.100.100.1, 1d03h ago, via Tunnel0
  Route metric is 27008000, traffic share count is 1
  Total delay is 55000 microseconds, minimum bandwidth is 100 Kbit
  Reliability 255/255, minimum MTU 1476 bytes
  Loading 1/255, Hops 1
CLC-R12#
```

CCIE Lab Center



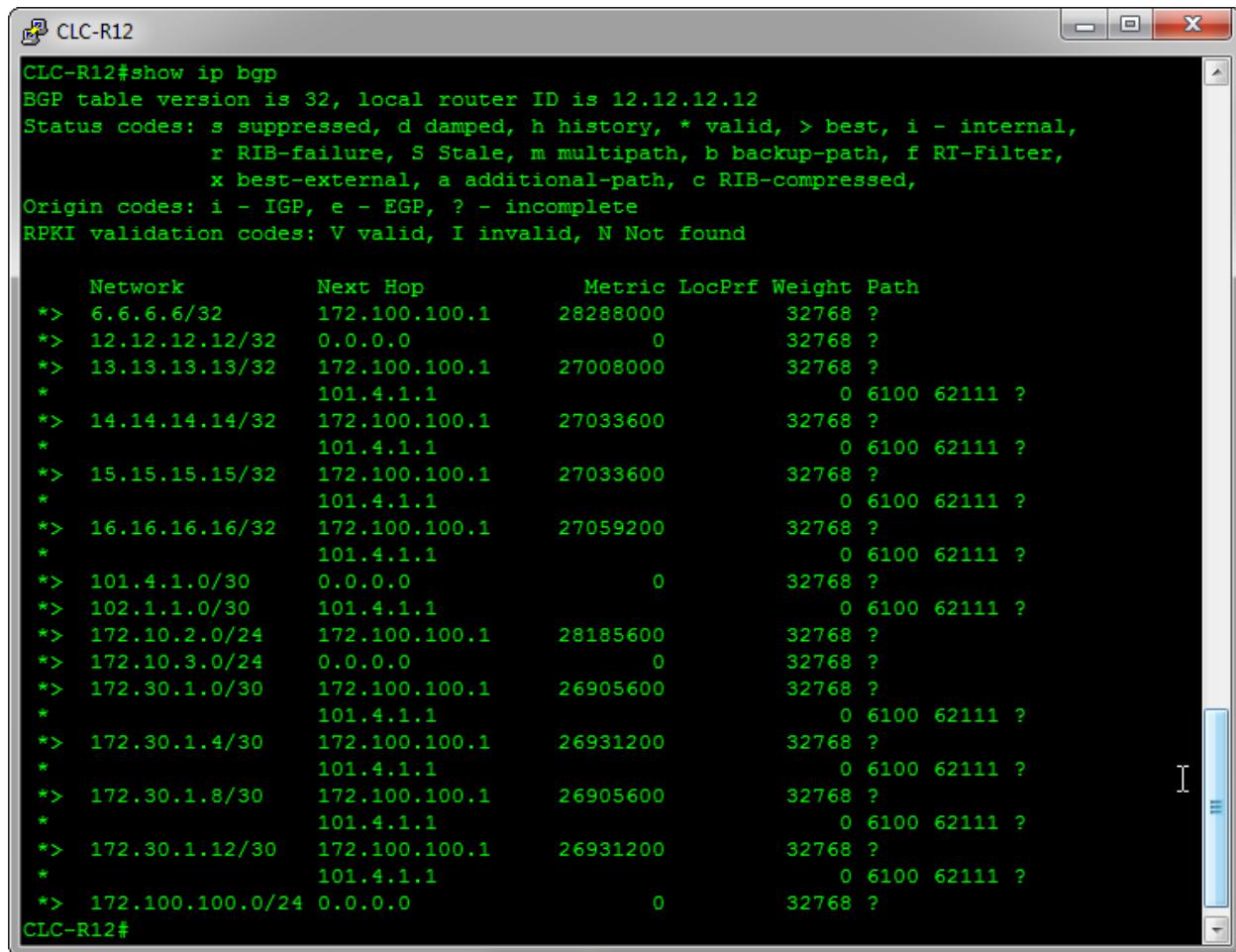
A terminal window titled "CLC-R12" displaying the output of the command "show ip route eigrp". The window shows a detailed list of routes learned via EIGRP, including their subnet information and next-hop details.

```
CLC-R12#show ip route eigrp
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
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is not set

      6.0.0.0/32 is subnetted, 1 subnets
D        6.6.6.6 [90/28288000] via 172.100.100.1, 1d02h, Tunnel0
      13.0.0.0/32 is subnetted, 1 subnets
D        13.13.13.13 [90/27008000] via 172.100.100.1, 1d02h, Tunnel0
      14.0.0.0/32 is subnetted, 1 subnets
D        14.14.14.14 [90/27033600] via 172.100.100.1, 1d02h, Tunnel0
      15.0.0.0/32 is subnetted, 1 subnets
D        15.15.15.15 [90/27033600] via 172.100.100.1, 1d02h, Tunnel0
      16.0.0.0/32 is subnetted, 1 subnets
D        16.16.16.16 [90/27059200] via 172.100.100.1, 1d02h, Tunnel0
      172.10.0.0/16 is variably subnetted, 3 subnets, 2 masks
D        172.10.2.0/24 [90/28185600] via 172.100.100.1, 1d02h, Tunnel0
      172.30.0.0/30 is subnetted, 4 subnets
D        172.30.1.0 [90/26905600] via 172.100.100.1, 1d02h, Tunnel0
D        172.30.1.4 [90/26931200] via 172.100.100.1, 1d02h, Tunnel0
D        172.30.1.8 [90/26905600] via 172.100.100.1, 1d02h, Tunnel0
D        172.30.1.12 [90/26931200] via 172.100.100.1, 1d02h, Tunnel0
CLC-R12#
```

CCIE Lab Center

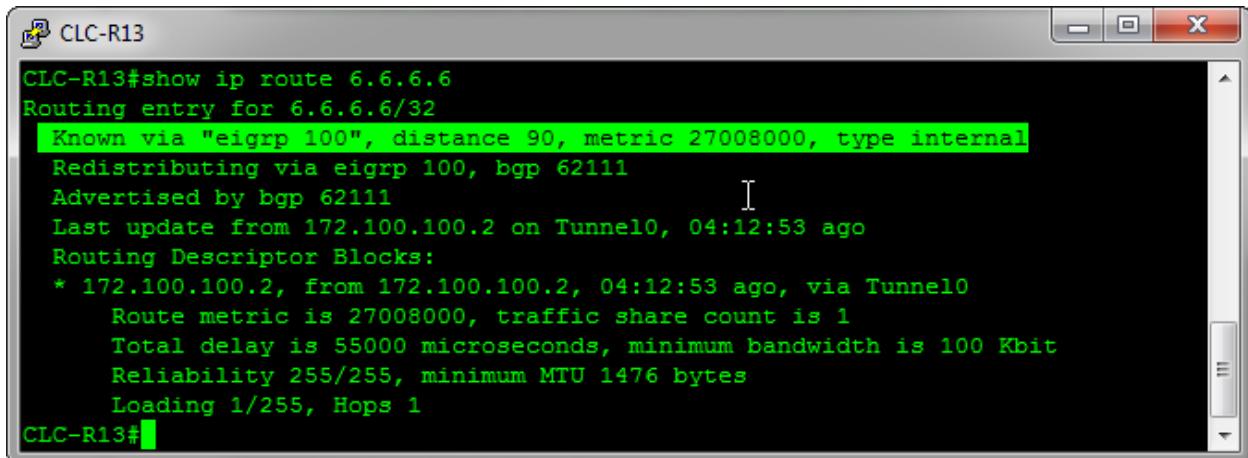


```
CLC-R12#show ip bgp
BGP table version is 32, local router ID is 12.12.12.12
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
               x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

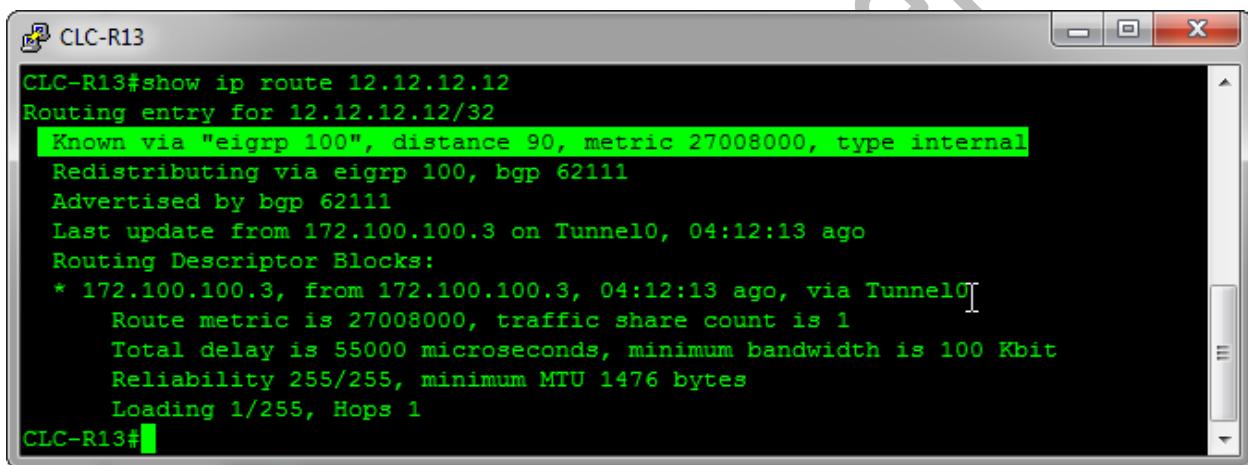
      Network          Next Hop        Metric LocPrf Weight Path
*-> 6.6.6.6/32      172.100.100.1   28288000    32768 ?
*-> 12.12.12.12/32 0.0.0.0           0          32768 ?
*-> 13.13.13.13/32 172.100.100.1   27008000    32768 ?
*          101.4.1.1          0          6100 62111 ?
*-> 14.14.14.14/32 172.100.100.1   27033600    32768 ?
*          101.4.1.1          0          6100 62111 ?
*-> 15.15.15.15/32 172.100.100.1   27033600    32768 ?
*          101.4.1.1          0          6100 62111 ?
*-> 16.16.16.16/32 172.100.100.1   27059200    32768 ?
*          101.4.1.1          0          6100 62111 ?
*-> 101.4.1.0/30    0.0.0.0           0          32768 ?
*-> 102.1.1.0/30    101.4.1.1          0          6100 62111 ?
*-> 172.10.2.0/24   172.100.100.1   28185600    32768 ?
*-> 172.10.3.0/24   0.0.0.0           0          32768 ?
*-> 172.30.1.0/30   172.100.100.1   26905600    32768 ?
*          101.4.1.1          0          6100 62111 ?
*-> 172.30.1.4/30   172.100.100.1   26931200    32768 ?
*          101.4.1.1          0          6100 62111 ?
*-> 172.30.1.8/30   172.100.100.1   26905600    32768 ?
*          101.4.1.1          0          6100 62111 ?
*-> 172.30.1.12/30  172.100.100.1   26931200    32768 ?
*          101.4.1.1          0          6100 62111 ?
*-> 172.100.100.0/24 0.0.0.0           0          32768 ?
CLC-R12#
```

CCIE Lab Center

On CLC-R13



```
CLC-R13#show ip route 6.6.6.6
Routing entry for 6.6.6.6/32
| Known via "eigrp 100", distance 90, metric 27008000, type internal
| Redistributing via eigrp 100, bgp 62111
| Advertised by bgp 62111
| Last update from 172.100.100.2 on Tunnel0, 04:12:53 ago
| Routing Descriptor Blocks:
* 172.100.100.2, from 172.100.100.2, 04:12:53 ago, via Tunnel0
  Route metric is 27008000, traffic share count is 1
  Total delay is 55000 microseconds, minimum bandwidth is 100 Kbit
  Reliability 255/255, minimum MTU 1476 bytes
  Loading 1/255, Hops 1
CLC-R13#
```



```
CLC-R13#show ip route 12.12.12.12
Routing entry for 12.12.12.12/32
| Known via "eigrp 100", distance 90, metric 27008000, type internal
| Redistributing via eigrp 100, bgp 62111
| Advertised by bgp 62111
| Last update from 172.100.100.3 on Tunnel0, 04:12:13 ago
| Routing Descriptor Blocks:
* 172.100.100.3, from 172.100.100.3, 04:12:13 ago, via Tunnel0
  Route metric is 27008000, traffic share count is 1
  Total delay is 55000 microseconds, minimum bandwidth is 100 Kbit
  Reliability 255/255, minimum MTU 1476 bytes
  Loading 1/255, Hops 1
CLC-R13#
```

CCIE Lab Center

```
CLC-R13#show ip route eigrp
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 - LISPs
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is not set

      6.0.0.0/32 is subnetted, 1 subnets
D        6.6.6.6 [90/27008000] via 172.100.100.2, 04:13:27, Tunnel0
      12.0.0.0/32 is subnetted, 1 subnets
D        12.12.12.12 [90/27008000] via 172.100.100.3, 04:13:17, Tunnel0
      14.0.0.0/32 is subnetted, 1 subnets
D        14.14.14.14 [90/409600] via 172.30.1.2, 04:15:20, Ethernet0/0
      15.0.0.0/32 is subnetted, 1 subnets
D        15.15.15.15 [90/409600] via 172.30.1.10, 04:15:20, Ethernet0/1
      16.0.0.0/32 is subnetted, 1 subnets
D        16.16.16.16 [90/435200] via 172.30.1.10, 04:15:20, Ethernet0/1
                  [90/435200] via 172.30.1.2, 04:15:20, Ethernet0/0
      172.10.0.0/24 is subnetted, 2 subnets
D        172.10.2.0 [90/26905600] via 172.100.100.2, 04:13:27, Tunnel0
D        172.10.3.0 [90/26905600] via 172.100.100.3, 04:13:17, Tunnel0
      172.30.0.0/16 is variably subnetted, 6 subnets, 2 masks
D        172.30.1.4/30 [90/307200] via 172.30.1.10, 04:15:20, Ethernet0/1
D        172.30.1.12/30 [90/307200] via 172.30.1.2, 04:15:20, Ethernet0/0
CLC-R13#
```

CCIE Lab Center

```
CLC-R13#show ip bgp
BGP table version is 25, local router ID is 13.13.13.13
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
               x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

      Network          Next Hop        Metric LocPrf Weight Path
*-> 6.6.6.6/32      172.100.100.2    27008000      32768 ?
*          102.1.1.1           0       6100 62111 ?
*-> 12.12.12.12/32  172.100.100.3    27008000      32768 ?
*          102.1.1.1           0       6100 62111 ?
*-> 13.13.13.13/32  0.0.0.0          0       I      32768 ?
*-> 14.14.14.14/32  172.30.1.2       409600      32768 ?
*-> 15.15.15.15/32  172.30.1.10      409600      32768 ?
*-> 16.16.16.16/32  172.30.1.2       435200      32768 ?
*-> 101.1.1.0/30    102.1.1.1           0       6100 62111 ?
*-> 101.4.1.0/30    102.1.1.1           0       6100 62111 ?
*-> 102.1.1.0/30    0.0.0.0          0       32768 ?
*-> 172.10.2.0/24   172.100.100.2    26905600      32768 ?
*          102.1.1.1           0       6100 62111 ?
*-> 172.10.3.0/24   172.100.100.3    26905600      32768 ?
*          102.1.1.1           0       6100 62111 ?
*-> 172.30.1.0/30   0.0.0.0          0       32768 ?
*-> 172.30.1.4/30   172.30.1.10      307200      32768 ?
*-> 172.30.1.8/30   0.0.0.0          0       32768 ?
*-> 172.30.1.12/30  172.30.1.2       307200      32768 ?
*-> 172.100.100.0/24 0.0.0.0          0       32768 ?

CLC-R13#
```

CCIE Lab Center

On CLC-R34

```
CLC-R34#show ip route 29.29.29.29
Routing entry for 29.29.29.29/32
Known via "ospf 1", distance 110, metric 1001, type inter area
Redistributing via bgp 64510
Advertised by bgp 64510
Last update from 10.10.10.2 on Tunnel0, 01:12:27 ago
Routing Descriptor Blocks:
* 10.10.10.2, from 29.29.29.29, 01:12:27 ago, via Tunnel0
    Route metric is 1001, traffic share count is 1
CLC-R34#
```

```
CLC-R34#show ip route 32.32.32.32
Routing entry for 32.32.32.32/32
Known via "ospf 1", distance 110, metric 1001, type inter area
Redistributing via bgp 64510
Advertised by bgp 64510
Last update from 10.10.10.3 on Tunnel0, 01:12:54 ago
Routing Descriptor Blocks:
* 10.10.10.3, from 32.32.32.32, 01:12:54 ago, via Tunnel0
    Route metric is 1001, traffic share count is 1
CLC-R34#
```

```
CLC-R34#show ip route os
CLC-R34#show ip route ospf
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
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is 10.10.1.2 to network 0.0.0.0

O*E2  0.0.0.0/0 [110/1] via 10.10.1.2, 01:02:27, Ethernet0/0
      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
O  IA   10.10.2.0/24 [110/1010] via 10.10.10.2, 01:02:27, Tunnel0
O  IA   10.10.3.0/24 [110/1010] via 10.10.10.3, 01:02:27, Tunnel0
O      10.10.10.2/32 [110/1000] via 10.10.10.2, 01:02:27, Tunnel0
O      10.10.10.3/32 [110/1000] via 10.10.10.3, 01:02:27, Tunnel0
      29.0.0.0/32 is subnetted, 1 subnets
O  IA   29.29.29.29 [110/1001] via 10.10.10.2, 01:02:27, Tunnel0
      32.0.0.0/32 is subnetted, 1 subnets
O  IA   32.32.32.32 [110/1001] via 10.10.10.3, 01:02:27, Tunnel0
      35.0.0.0/32 is subnetted, 1 subnets
O      35.35.35.35 [110/11] via 10.10.1.2, 01:02:27, Ethernet0/0
      42.0.0.0/32 is subnetted, 1 subnets
O      42.42.42.42 [110/11] via 10.10.1.3, 01:02:27, Ethernet0/0
CLC-R34#
```

CCIE Lab Center

```
CLC-R34#show ip bgp
BGP table version is 98, local router ID is 34.34.34.34
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
               x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

      Network          Next Hop            Metric LocPrf Weight Path
*-> 10.10.1.0/24    0.0.0.0              0        32768 ? 
*-> 10.10.2.0/24   10.10.10.2          1010     32768 ? 
*           102.2.2.1
*-> 10.10.3.0/24   10.10.10.3          1010     32768 ? 
*           102.2.2.1
*-> 10.10.10.0/24  0.0.0.0              0        32768 ? 
r-> 10.10.10.1/32  102.2.2.1
*-> 10.10.10.2/32  10.10.10.2          1000     32768 ? 
*-> 10.10.10.3/32  10.10.10.3          1000     32768 ? 
*-> 29.29.29.29/32 10.10.10.2          1001     32768 ? 
*           102.2.2.1
*-> 32.32.32.32/32 10.10.10.3          1001     32768 ? 
*           102.2.2.1
*-> 34.34.34.34/32 0.0.0.0              0        32768 ? 
*-> 35.35.35.35/32 10.10.1.2            11       32768 ? 
*-> 42.42.42.42/32 10.10.1.3            11       32768 ? 
*-> 101.2.1.0/30   102.2.2.1
*-> 101.3.2.0/30   102.2.2.1
*-> 102.2.2.0/30   0.0.0.0              0        32768 ? 

CLC-R34#
```

CCIE Lab Center

On CLC-R36

```
CLC-R36#show ip route 37.37.37.37
Routing entry for 37.37.37.37/32
Known via "ospf 3", distance 110, metric 1001, type intra area
Redistributing via bgp 64530
Advertised by bgp 64530
Last update from 30.30.30.2 on Tunnel0, 1d03h ago
Routing Descriptor Blocks:
* 30.30.30.2, from 37.37.37.37, 1d03h ago, via Tunnel0
    Route metric is 1001, traffic share count is 1
CLC-R36#
```

```
CLC-R36#show ip route ospf
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
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is not set

      30.0.0.0/8 is variably subnetted, 5 subnets, 3 masks
O        30.30.2.0/24 [110/1010] via 30.30.30.2, 1d03h, Tunnel0
      37.0.0.0/32 is subnetted, 1 subnets
O        37.37.37.37 [110/1001] via 30.30.30.2, 1d03h, Tunnel0
CLC-R36#
```

```
CLC-R36#show ip bgp
BGP table version is 12, local router ID is 36.36.36.36
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

      Network          Next Hop           Metric LocPrf Weight Path
*>  30.30.1.0/24    0.0.0.0                  0       32768 ? 
*>  30.30.2.0/24    30.30.30.2            1010    32768 ? 
*   102.2.1.1          0.0.0.0                  0       6100 64530 ? 
*>  30.30.30.0/30   0.0.0.0                  0       32768 ? 
*>  36.36.36.36/32  0.0.0.0                  0       32768 ? 
*>  37.37.37.37/32  30.30.30.2            1001    32768 ? 
*   102.2.1.1          0.0.0.0                  0       6100 64530 ? 
*>  102.2.1.0/30   0.0.0.0                  0       32768 ? 
*>  102.3.2.0/30   102.2.1.1                0       6100 64530 ? 
CLC-R36#
```

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On CLC-R37

```
CLC-R37#show ip route 36.36.36.36
Routing entry for 36.36.36.36/32
Known via "ospf 3", distance 110, metric 1001, type intra area
Redistributing via bgp 64530
Advertised by bgp 64530
Last update from 30.30.30.1 on Tunnel0, 1d03h ago
Routing Descriptor Blocks:
* 30.30.30.1, from 36.36.36.36, 1d03h ago, via Tunnel0
    Route metric is 1001, traffic share count is 1
CLC-R37#
```

```
CLC-R37#show ip route ospf
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
      a - application route
      + - replicated route, % - next hop override

Gateway of last resort is not set

      30.0.0.0/8 is variably subnetted, 5 subnets, 3 masks
O        30.30.1.0/24 [110/1010] via 30.30.30.1, 1d03h, Tunnel0
      36.0.0.0/32 is subnetted, 1 subnets
O        36.36.36.36 [110/1001] via 30.30.30.1, 1d03h, Tunnel0
CLC-R37#
```

```
CLC-R37#show ip bgp
BGP table version is 12, local router ID is 37.37.37.37
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

      Network          Next Hop           Metric LocPrf Weight Path
*>  30.30.1.0/24    30.30.30.1         1010      32768  ? 
*          102.3.2.1
*>  30.30.2.0/24    0.0.0.0            0        32768  ?
*>  30.30.30.0/30   0.0.0.0            0        32768  ?
*>  36.36.36.36/32 30.30.30.1         1001      32768  ?
*          102.3.2.1
*>  37.37.37.37/32 0.0.0.0            0        32768  ?
*>  102.2.1.0/30    102.3.2.1          0        32768  ?
*>  102.3.2.0/30    0.0.0.0            0        32768  ?
CLC-R37#
```

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SECTION 7: Internet Services

SECTION 7.1: Internet Services for Sydney-Group

QUESTION

Configuring Internet Services for Sydney-Group site as per the following requirements:

1. You must establish an EBGP peering for the Internet WAN link on device R35
2. Device R35 must receive a default route from Internet Router (PE) in its BGP routing table for getting Internet access from Sydney-Group-Hub site.
3. Configure Internet Router in such a way that only Sydney-Group gets access to Internet Service.
4. You are allowed to use a standard access-list.
5. You are allowed to use any method to accomplish this task.

Solution

On CLC-R35

```
CLC-R35(config)#router bgp 64510
CLC-R35(config-router)#bgp router-id 35.35.35.35
CLC-R35(config-router)#no bgp default ipv4-unicast
CLC-R35(config-router)#neighbor 102.3.1.1 remote-as 6100
CLC-R35(config-router)#

```

```
CLC-R35(config-router)# address-family ipv4
CLC-R35(config-router-af)#neighbor 102.3.1.1 activate
CLC-R35(config-router-af)#exit-address-family
CLC-R35(config-router)#exit
CLC-R35(config)#

```

On CLC-Internet

```
CLC-Internet(config)#router bgp 6100
CLC-Internet(config-router)#neighbor 102.3.1.2 remote-as 64510
CLC-Internet(config-router)#

```

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```
CLC-Internet(config-router)#address-family ipv4
CLC-Internet(config-router-af)#neighbor 102.3.1.2 activate
CLC-Internet(config-router-af)#neighbor 102.3.1.2 default originate
CLC-Internet(config-router-af)#exit-address-family
CLC-Internet(config-router)#exit
CLC-Internet(config)#

CLC-Internet(config)#interface ethernet 0/3
CLC-Internet(config-if)#ip nat inside
CLC-Internet(config-if)#exit
CLC-Internet(config)#

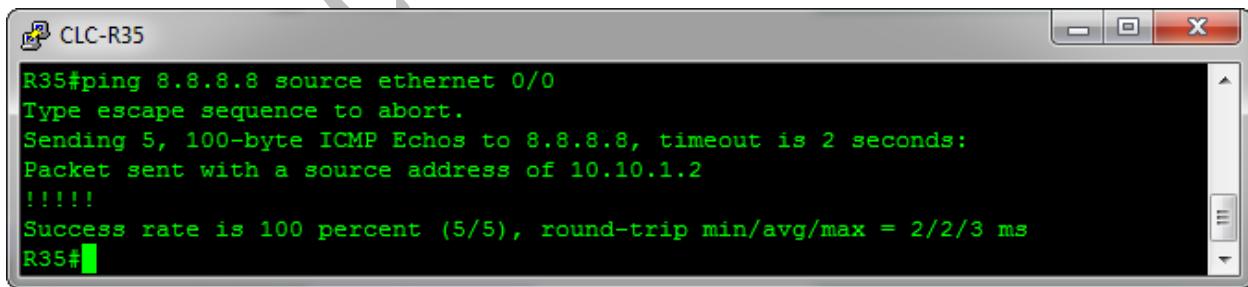
CLC-Internet(config)#interface ethernet 0/2
CLC-Internet(config-if)#ip nat outside
CLC-Internet(config-if)#exit
CLC-Internet(config)#

CLC-Internet(config)#ip access-list standard Internet
CLC-Internet(config-std-nacl)# permit 10.10.0.0 0.0.255.255
CLC-Internet(config-std-nacl)# permit 102.3.1.0 0.0.0.3
CLC-Internet(config-std-nacl)#deny any
CLC-Internet(config-std-nacl)#exit
CLC-Internet(config)#

CLC-Internet(config)#ip nat inside source list Internet interface Ethernet0/2 overload
```

Verification

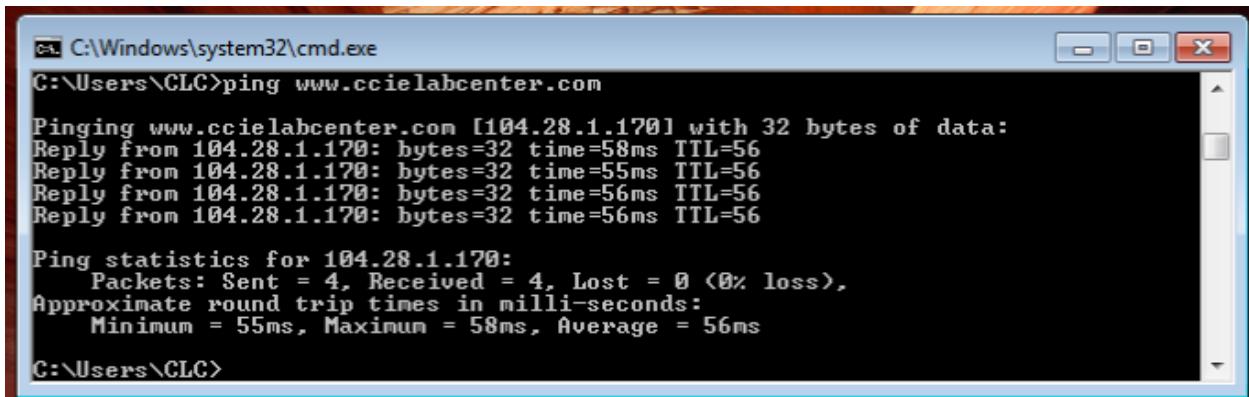
On CLC-R35



```
R35#ping 8.8.8.8 source ethernet 0/0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 8.8.8.8, timeout is 2 seconds:
Packet sent with a source address of 10.10.1.2
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/2/3 ms
R35#
```

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On CLC-Internet-User

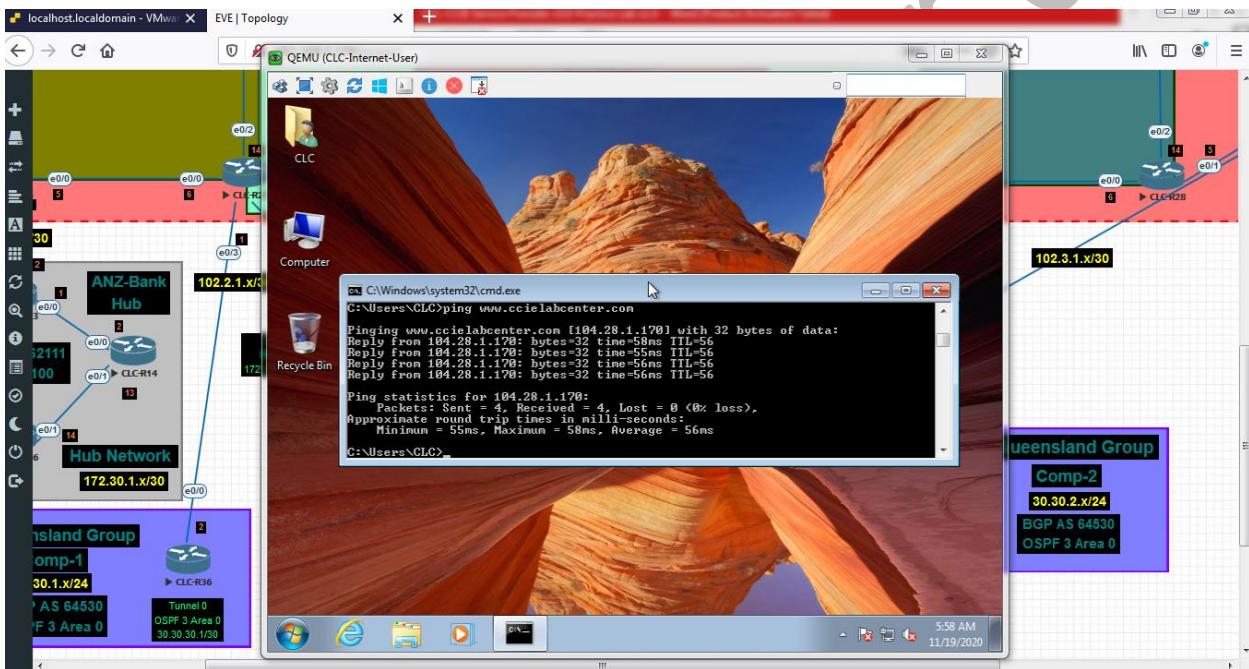


```
C:\Windows\system32\cmd.exe
C:\Users\CLC>ping www.ccielabcenter.com

Pinging www.ccielabcenter.com [104.28.1.170] with 32 bytes of data:
Reply from 104.28.1.170: bytes=32 time=58ms TTL=56
Reply from 104.28.1.170: bytes=32 time=55ms TTL=56
Reply from 104.28.1.170: bytes=32 time=56ms TTL=56
Reply from 104.28.1.170: bytes=32 time=56ms TTL=56

Ping statistics for 104.28.1.170:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 55ms, Maximum = 58ms, Average = 56ms

C:\Users\CLC>
```



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A screenshot of a Windows Command Prompt window titled "cmd.exe" with the path "C:\Windows\system32\cmd.exe". The command "tracert www.ccielabcenter.com" is run, resulting in the following output:

```
C:\Users\CLC>tracert www.ccielabcenter.com

Tracing route to www.ccielabcenter.com [104.28.1.170]
over a maximum of 30 hops:

 1  <1 ms    <1 ms    <1 ms  10.10.1.2
 2  <1 ms    <1 ms    <1 ms  102.3.1.1
 3  1 ms    <1 ms    <1 ms  192.168.0.1
 4  2 ms    3 ms    2 ms  [REDACTED]
 5  2 ms    2 ms    1 ms  [REDACTED]
 6  4 ms    4 ms    3 ms  [REDACTED]
 7  53 ms   54 ms   53 ms  [REDACTED]
 8  57 ms   *        *      [REDACTED]
 9  57 ms   57 ms   56 ms  104.28.1.170

Trace complete.

C:\Users\CLC>
```

The traceroute shows the path from the user's machine to the CCIE Lab Center website, passing through several intermediate routers and the final destination at 104.28.1.170.

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