CCIE PRACTICE LAB: EIGRP

WRITTEN BY:

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CCIE # 8877

CCIE Practice Lab: EIGRP

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3.   Log any changes in EIGRP.
4.   Do not summarize the routes.
5.   Test your configuration by pinging each of the VLANs.

ANSWER

Router1

```
Interface f0/0
        Ip address 137.1.1.1 255.255.255.0

interface s0/0
        ip address 137.1.200.1 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.2 101 broadcast
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.1.0 0.0.0.255
```

Router2

```
Interface e0/0
        Ip address 137.1.2.2 255.255.255.0

interface s0/0
        ip address 137.1.200.2 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 110 broadcast

Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.2.0 0.0.0.255
```

The following shows what happens when an EIGRP relationship has been formed between the two routers.

!Router1 logs when the neighbor relationship with Router2 comes up
```
router1#
*Mar  1 10:40:14.453 UTC: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 100: Neighbor 137.1.200
.2 (Serial0/0) is up: new adjacency
```

!Router2 logs when the neighbor relationship with Router1 comes up
```
router2#
*Mar  1 10:39:11.447 UTC: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 100: Neighbor 137.1.200
.1 (Serial0/0) is up: new adjacency
```

!Router1 has an EIGRP neighbor relationship with Router2
```
router1#sh ip eigrp nei
IP-EIGRP neighbors for process 100
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq Typ
e
                                            (sec)         (ms)        Cnt Num
0   137.1.200.2             Se0/0           164 00:01:13  252   1512  0  1
```

!Router2 has an EIGRP neighbor relationship with Router1
```
router2#sh ip eigrp nei
IP-EIGRP neighbors for process 100
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq Typ
e
                                            (sec)         (ms)        Cnt Num
0   137.1.200.1             Se0/0           128 00:02:45    1   5000  0  1
```

!Router1's routing table includes VLAN 22. It has learnt this via EIGRP from Router2
```
router1#sh ip route
Codes: 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, 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

Gateway of last resort is not set

      137.1.0.0/24 is subnetted, 3 subnets
C        137.1.200.0 is directly connected, Serial0/0
C        137.1.1.0 is directly connected, FastEthernet0/0
D        137.1.2.0 [90/2195456] via 137.1.200.2, 00:00:16, Serial0/0


!Router2's routing table includes VLAN 11. It has learnt this via EIGRP from Router1
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set

      137.1.0.0/24 is subnetted, 3 subnets
C        137.1.200.0 is directly connected, Serial0/0
D        137.1.1.0 [90/2172416] via 137.1.200.1, 00:00:29, Serial0/0
C        137.1.2.0 is directly connected, Ethernet0/0

!Router1's EIGRP topology database contains VLAN22 information
router1#sh ip eigrp topology
IP-EIGRP Topology Table for AS(100)/ID(137.1.200.1)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 137.1.200.0/24, 1 successors, FD is 2169856
        via Connected, Serial0/0
P 137.1.1.0/24, 1 successors, FD is 28160
        via Connected, FastEthernet0/0
P 137.1.2.0/24, 1 successors, FD is 2195456
        via 137.1.200.2 (2195456/281600), Serial0/0
```

2.0   ROUTE SUMMARIZATION
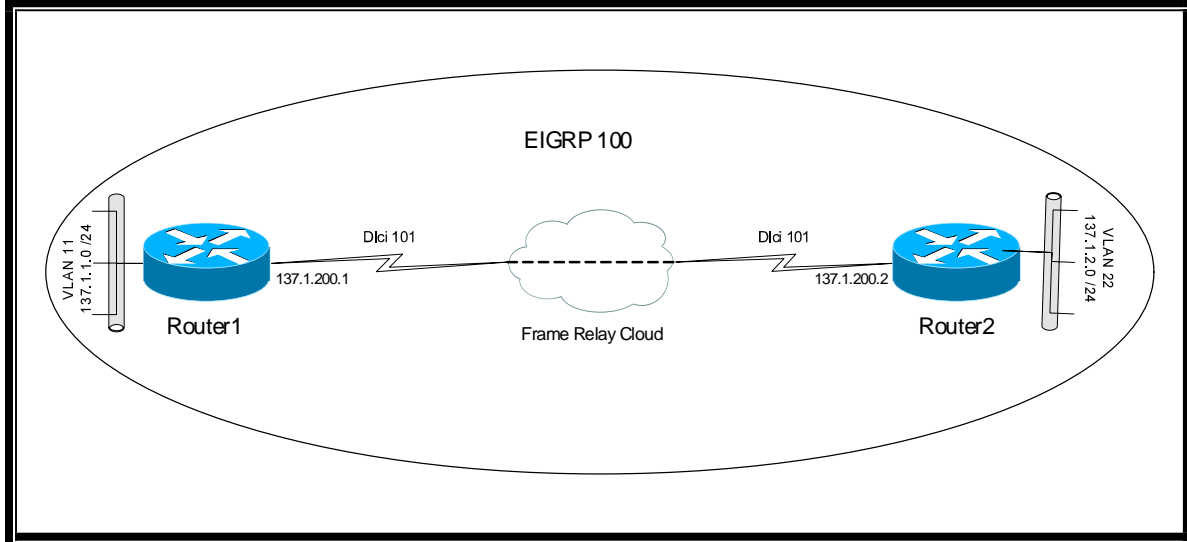
1. Configure EIGRP process 100 between Router1 and Router2.
2. Ensure VLAN 22 and VLAN 11 are included in the EIGRP routing process.
3. Create the following loopbacks on Router1:
    a. Loopback address 1 - 172.16.32.0 /24
    b. Loopback address 2 – 172.16.33.0 /24
    c. Loopback address 3 – 172.16.48.0 /24
    d. Loopback address 4 – 172.16.58.0 /24
4. Summarize the above routes so that only a single route appears in Router2.
5. Test your configuration by pinging each of the loopback address from Router2 and ensure only a single summarized route appears in that router.

ANSWER

Router1

```
Interface loopback 1
        Ip address 172.16.32.1 255.255.255.0
!
interface loopback 2
        ip address 172.16.33.1 255.255.255.0
!
interface loopback 3
        ip address 172.16.48.1 255.255.255.0
!
interface loopback 4
        ip address 172.16.58.1 255.255.255.0
!
Interface f0/0
        Ip address 137.1.1.1 255.255.255.0

interface s0/0
        ip address 137.1.200.1 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.2 101 broadcast
        ip summary-address eigrp 100 172.16.32.0 255.255.224.0
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.1.0 0.0.0.255
        Network 172.16.32.0 0.0.0.255
        Network 172.16.33.0 00.0.0.255
        Network 172.16.48.0 0.0.0.255
        Network 172.16.58.0 0.0.0.255
```

Router2

```
Interface e0/0
        Ip address 137.1.2.2 255.255.255.0

interface s0/0
        ip address 137.1.200.2 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 110 broadcast

Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.2.0 0.0.0.255
```

```
The following shows the Routing tables before the Route summarization is carried out

!Router1 is advertising all the loopbacks to Router2
router1#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 3 subnets
```

```
C       137.1.200.0 is directly connected, Serial0/0
C       137.1.1.0 is directly connected, FastEthernet0/0
D       137.1.2.0 [90/2195456] via 137.1.200.2, 00:00:18, Serial0/0
     172.16.0.0/24 is subnetted, 4 subnets
C       172.16.58.0 is directly connected, Loopback4
C       172.16.48.0 is directly connected, Loopback3
C       172.16.32.0 is directly connected, Loopback1
C       172.16.33.0 is directly connected, Loopback2

!Router2 is receiving all the individual routes from Router2
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 3 subnets
C       137.1.200.0 is directly connected, Serial0/0
D       137.1.1.0 [90/2172416] via 137.1.200.1, 00:00:03, Serial0/0
C       137.1.2.0 is directly connected, Ethernet0/0
     172.16.0.0/24 is subnetted, 4 subnets
D       172.16.58.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D       172.16.48.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D       172.16.32.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D       172.16.33.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0

!Router2's EIGRP topology database also contains all the individual routes
router2#sh ip eigrp topology
IP-EIGRP Topology Table for AS(100)/ID(137.1.200.2)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 137.1.200.0/24, 1 successors, FD is 2169856
          via Connected, Serial0/0
P 172.16.58.0/24, 1 successors, FD is 2297856
          via 137.1.200.1 (2297856/128256), Serial0/0
P 137.1.1.0/24, 1 successors, FD is 2172416
          via 137.1.200.1 (2172416/28160), Serial0/0
P 137.1.2.0/24, 1 successors, FD is 281600
          via Connected, Ethernet0/0
P 172.16.48.0/24, 1 successors, FD is 2297856
          via 137.1.200.1 (2297856/128256), Serial0/0
P 172.16.32.0/24, 1 successors, FD is 2297856
          via 137.1.200.1 (2297856/128256), Serial0/0
P 172.16.33.0/24, 1 successors, FD is 2297856
          via 137.1.200.1 (2297856/128256), Serial0/0
```

```
The following shows the Routing tables after the Route summarization is carried out

!Router1 is advertising all the loopbacks to Router2 and the summarized route
router1#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 3 subnets
C       137.1.200.0 is directly connected, Serial0/0
```

```
C        137.1.1.0 is directly connected, FastEthernet0/0
D        137.1.2.0 [90/2195456] via 137.1.200.2, 00:07:54, Serial0/0
      172.16.0.0/16 is variably subnetted, 5 subnets, 2 masks
C        172.16.58.0/24 is directly connected, Loopback4
C        172.16.48.0/24 is directly connected, Loopback3
C        172.16.32.0/24 is directly connected, Loopback1
D        172.16.32.0/19 is a summary, 00:08:45, Null0
C        172.16.33.0/24 is directly connected, Loopback2

!Router2 is receiving only the summarized route from Router2
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set

      137.1.0.0/24 is subnetted, 3 subnets
C        137.1.200.0 is directly connected, Serial0/0
D        137.1.1.0 [90/2172416] via 137.1.200.1, 00:08:16, Serial0/0
C        137.1.2.0 is directly connected, Ethernet0/0
      172.16.0.0/19 is subnetted, 1 subnets
D        172.16.32.0 [90/2297856] via 137.1.200.1, 00:08:16, Serial0/0

!Router2's EIGRP topology database only contains the summarized route
router2#sh ip eigrp topology
IP-EIGRP Topology Table for AS(100)/ID(137.1.200.2)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 137.1.200.0/24, 1 successors, FD is 2169856
         via Connected, Serial0/0
P 137.1.1.0/24, 1 successors, FD is 2172416
         via 137.1.200.1 (2172416/28160), Serial0/0
P 137.1.2.0/24, 1 successors, FD is 281600
         via Connected, Ethernet0/0
P 172.16.32.0/19, 1 successors, FD is 2297856
         via 137.1.200.1 (2297856/128256), Serial0/0
```

3.0   EIGRP – ROUTE AUTHENTICATION – PLAIN TEXT
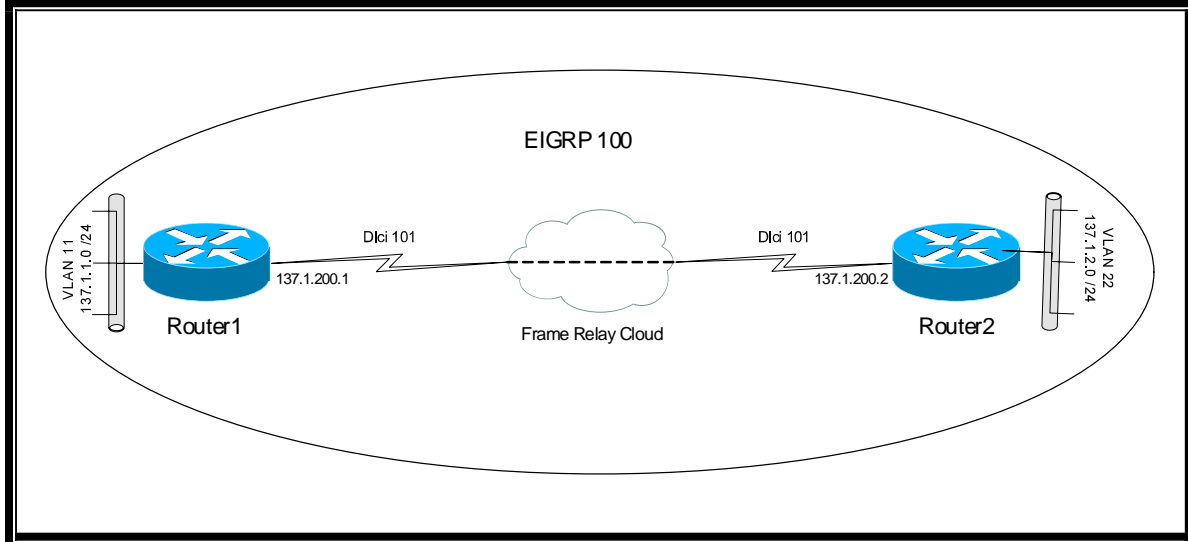
1. Configure EIGRP process 100 between Router1 and Router2.
2. Ensure VLAN 22 and VLAN 11 is included in the EIGRP routing process.
3. Create the following loopbacks on Router1 and include them in the EIGRP process:
    a. Loopback address 1 - 172.16.32.0 /24
    b. Loopback address 2 – 172.16.33.0 /24
    c. Loopback address 3 – 172.16.48.0 /24
    d. Loopback address 4 – 172.16.58.0 /24
4. Configure Plain Text authentication between the two routers. Use key **eigrpkey.**
5. Test your configuration by pinging VLAN 11 from Router2 and ensure the eigrp neighbor relationship is up.

ANSWER

Router1

```
Key chain ccie
        Key 1
                  Key-string eigrpkey
!
Interface loopback 1
        Ip address 172.16.32.1 255.255.255.0
!
interface loopback 2
        ip address 172.16.33.1 255.255.255.0
!
interface loopback 3
        ip address 172.16.48.1 255.255.255.0
!
interface loopback 4
        ip address 172.16.58.1 255.255.255.0
!
Interface f0/0
        Ip address 137.1.1.1 255.255.255.0

interface s0/0
        ip address 137.1.200.1 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.2 101 broadcast
        ip authentication key-chain eigrp 100 ccie
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.1.0 0.0.0.255
        Network 172.16.32.0 0.0.0.255
        Network 172.16.33.0 00.0.0.255
        Network 172.16.48.0 0.0.0.255
        Network 172.16.58.0 0.0.0.255
```

Router2

```
Key chain ccie
        Key 1
                  Key-string eigrpkey
I
Interface e0/0
        Ip address 137.1.2.2 255.255.255.0

interface s0/0
        ip address 137.1.200.2 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 110 broadcast
        ip authentication key-chain eigrp 100 ccie

Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.2.0 0.0.0.255
```

**The following shows EIGRP relationship has been formed after the Plain text
authentication**

```
!Router1 has an EIGRP neighbor relationship with Router2
router1#sh ip eigrp nei
IP-EIGRP neighbors for process 100
H    Address                  Interface        Hold Uptime    SRTT    RTO   Q   Seq Typ
e
                                               (sec)          (ms)          Cnt Num
0    137.1.200.2              Se0/0            159 00:01:16    56      336   0   17


!Router2 has an EIGRP neighbor relationship with Router1
router2#sh ip eigrp nei
IP-EIGRP neighbors for process 100
H    Address                  Interface        Hold Uptime    SRTT    RTO   Q   Seq Typ
e
                                               (sec)          (ms)          Cnt Num
0    137.1.200.1              Se0/0            171 00:01:07    64      384   0   2
```

!Router2 is receiving all the routes from Router1
```
router2#sh ip route
Codes: 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, 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


Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 3 subnets
C       137.1.200.0 is directly connected, Serial0/0
D       137.1.1.0 [90/2172416] via 137.1.200.1, 00:00:03, Serial0/0
C       137.1.2.0 is directly connected, Ethernet0/0
     172.16.0.0/24 is subnetted, 4 subnets
D       172.16.58.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D       172.16.48.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D       172.16.32.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D       172.16.33.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
```
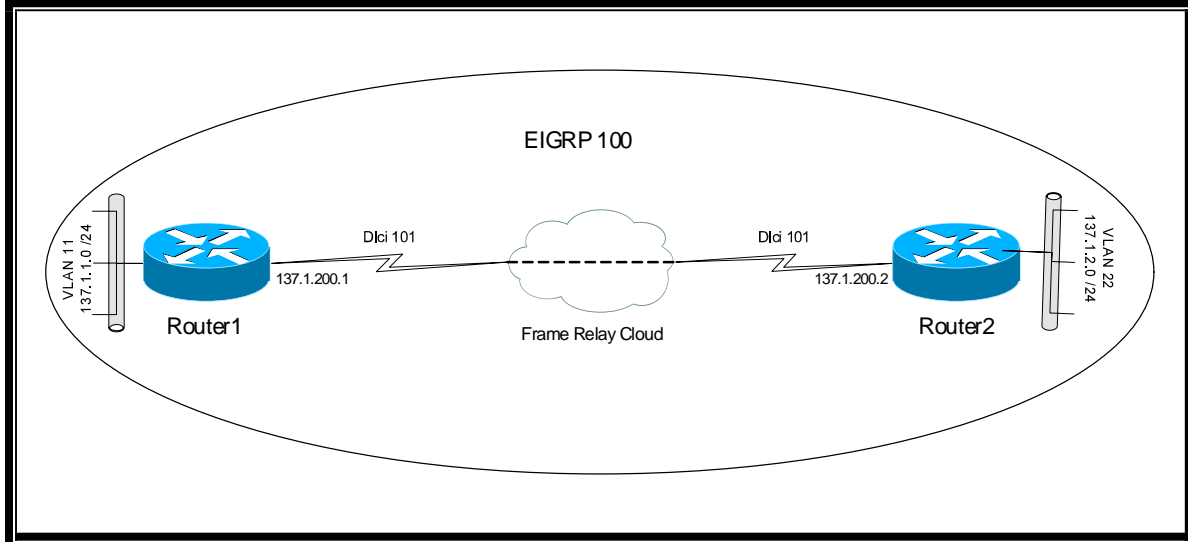
4.0 MD5 ROUTE AUTHENTICATION

1. Configure EIGRP process 100 between Router1 and Router2.
2. Ensure VLAN 22 and VLAN 11 is included in the EIGRP routing process.
3. Create the following loopbacks on Router1 and include them in the EIGRP process:
    a. Loopback address 1 - 172.16.32.0 /24
    b. Loopback address 2 – 172.16.33.0 /24
    c. Loopback address 3 – 172.16.48.0 /24
    d. Loopback address 4 – 172.16.58.0 /24
4. Configure MD5 authentication between the two routers. Use key **eigrpkey.**
5. Test your configuration by pinging VLAN 11 from Router2 and ensure the eigrp neighbor relationship is up.

ANSWER

Router1

```
Key chain ccie
        Key 1
                    Key-string eigrpkey
!
Interface loopback 1
        Ip address 172.16.32.1 255.255.255.0
!
interface loopback 2
        ip address 172.16.33.1 255.255.255.0
!
interface loopback 3
        ip address 172.16.48.1 255.255.255.0
!
interface loopback 4
        ip address 172.16.58.1 255.255.255.0
!
Interface f0/0
        Ip address 137.1.1.1 255.255.255.0

interface s0/0
        ip address 137.1.200.1 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.2 101 broadcast
        ip authentication mode eigrp 100 md5
        ip authentication key-chain eigrp 100 ccie
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.1.0 0.0.0.255
        Network 172.16.32.0 0.0.0.255
        Network 172.16.33.0 00.0.0.255
        Network 172.16.48.0 0.0.0.255
        Network 172.16.58.0 0.0.0.255
```

Router2

```
Key chain ccie
        Key 1
                    Key-string eigrpkey
I
Interface e0/0
        Ip address 137.1.2.2 255.255.255.0

interface s0/0
        ip address 137.1.200.2 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 110 broadcast
        ip authentication mode eigrp 100 md5
        ip authentication key-chain eigrp 100 ccie

Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.2.0 0.0.0.255
        ip authentication mode eigrp 100 md5
        ip authentication key-chain eigrp 100 ccie
```

The following shows EIGRP relationship has been formed after the MD5 authentication

```
!Router1 has an EIGRP neighbor relationship with Router2
router1#sh ip eigrp nei
IP-EIGRP neighbors for process 100
H   Address                    Interface       Hold Uptime    SRTT   RTO  Q  Seq Typ
e
                                               (sec)          (ms)      Cnt Num
0   137.1.200.2                Se0/0           159 00:01:16    56    336  0  17

!Router2 has an EIGRP neighbor relationship with Router1
router2#sh ip eigrp nei
IP-EIGRP neighbors for process 100
H   Address                    Interface       Hold Uptime    SRTT   RTO  Q  Seq Typ
e
                                               (sec)          (ms)      Cnt Num
0   137.1.200.1                Se0/0           171 00:01:07    64    384  0  2

!Router2 is receiving all the routes from Router1
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 3 subnets
C       137.1.200.0 is directly connected, Serial0/0
D       137.1.1.0 [90/2172416] via 137.1.200.1, 00:00:03, Serial0/0
C       137.1.2.0 is directly connected, Ethernet0/0
     172.16.0.0/24 is subnetted, 4 subnets
D       172.16.58.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D       172.16.48.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D       172.16.32.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D       172.16.33.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
```
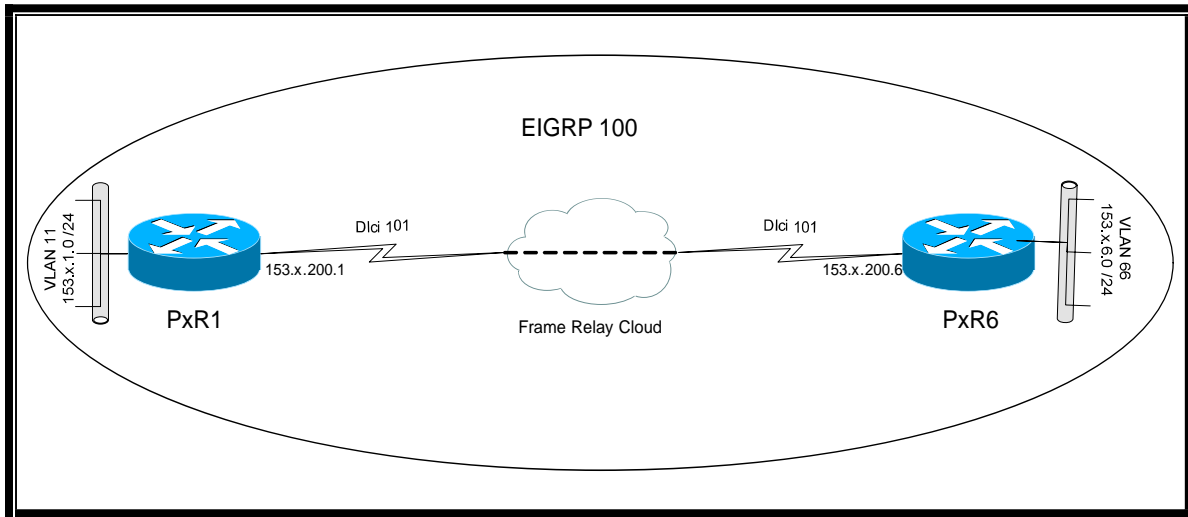
5.0   ROTATING KEYS FOR ROUTE AUTHENTICATION

LAB SETUP

1. Configure EIGRP process 100 between Router1 and Router2.
2. Ensure VLAN 22 and VLAN 11 is included in the EIGRP routing process.
3. Create the following loopbacks on Router1 and include them in the EIGRP process:
    a. Loopback address 1 - 172.16.32.0 /24
    b. Loopback address 2 – 172.16.33.0 /24
    c. Loopback address 3 – 172.16.48.0 /24
    d. Loopback address 4 – 172.16.58.0 /24
4. Configure MD5 authentication between the two routers.
5. Configure 4 keys with the following configuring :

Key No	Start Time	Start Date	Stop Time	End Date	EIGRP key
1	0:00:00	1st January 2003	23:59:59	31st March 2003	Eigrpkey1
2	0:00:00	1st April 2003	23:59:59	30th June 2003	Eigrpkey2
3	0:00:00	1st July 2003	23:59:59	30th September 2003	Eigrpkey3
4	0:00:00	1st October 2003	23:59:59	31st December 2003	Eigrpkey4

6. Test your configuration by pinging VLAN 11 from Router2 and ensure the eigrp neighbor relationship is up.

ANSWER

Router1

```
Key chain ccie
        Key 1
                    Accept-lifetime local 00:00:00 1 Jan 2003 23:59:59 31 Mar 2003
                    Key-string eigrpkey1
!
Key chain ccie
        Key 2
                    Accept-lifetime local 00:00:00 1 Apr 2003 23:59:59 30 June 2003
                    Key-string eigrpkey2
!
Key chain ccie
        Key 3
                    Accept-lifetime local 00:00:00 1 Jul 2003 23:59:59 30 Sep 2003
                    Key-string eigrpkey3
!
Key chain ccie
        Key 4
                    Accept-lifetime local 00:00:00 1 Oct 2003 23:59:59 31 Dec 2003
                    Key-string eigrpkey4
!
Interface loopback 1
        Ip address 172.16.32.1 255.255.255.0
!
interface loopback 2
        ip address 172.16.33.1 255.255.255.0
!
interface loopback 3
        ip address 172.16.48.1 255.255.255.0
!
interface loopback 4
        ip address 172.16.58.1 255.255.255.0
!
Interface f0/0
        Ip address 137.1.1.1 255.255.255.0

interface s0/0
        ip address 137.1.200.1 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.2 101 broadcast
        ip authentication mode eigrp 100 md5
        ip authentication key-chain eigrp 100 ccie
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.1.0 0.0.0.255
        Network 172.16.32.0 0.0.0.255
        Network 172.16.33.0 00.0.0.255
        Network 172.16.48.0 0.0.0.255
        Network 172.16.58.0 0.0.0.255
```

Router2

```
Key chain ccie
        Key 1
                    Accept-lifetime local 00:00:00 1 Jan 2003 23:59:59 31 Mar 2003
                    Key-string eigrpkey1
!
Key chain ccie
        Key 2
                    Accept-lifetime local 00:00:00 1 Apr 2003 23:59:59 30 June 2003
                    Key-string eigrpkey2
!
```

```
Key chain ccie
        Key 3
                Accept-lifetime local 00:00:00 1 Jul 2003 23:59:59 30 Sep 2003
                Key-string eigrpkey3
!
Key chain ccie
        Key 4
                Accept-lifetime local 00:00:00 1 Oct 2003 23:59:59 31 Dec 2003
                Key-string eigrpkey4
I
Interface e0/0
        Ip address 137.1.2.2 255.255.255.0

interface s0/0
        ip address 137.1.200.2 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 110 broadcast
        ip authentication mode eigrp 100 md5
        ip authentication key-chain eigrp 100 ccie

Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.2.0 0.0.0.255
```

```
The following shows that you can have rotating EIGRP keys to ensure route security

!The clock on both the routers are incorrect and not in line with the EIGRP keys
router1#show clock
*11:39:58.109 UTC Mon Mar 1 1993

!Both the routers will give an EIGRP authentication error as the routers are not sending
the right key to established the neighbor relationship as the dates do not fall in the
range of the EIGRP keys
router2#
*Mar  1 11:39:49.515 UTC: EIGRP: interface Serial0/0, No live authentication key
s
*Mar  1 11:39:49.515 UTC: EIGRP: Serial0/0: ignored packet from 137.1.200.1, opc
ode = 5 (invalid authentication)

!Choose a Date in 2003 and set the clock on both the routers to be the same
clock set 09:42:00 30 september 2003
!Router1 has an EIGRP neighbor relationship with Router2
router1#sh ip eigrp nei
IP-EIGRP neighbors for process 100
H    Address                 Interface        Hold Uptime    SRTT    RTO   Q   Seq Typ
e
                                              (sec)          (ms)        Cnt Num
0    137.1.200.2             Se0/0            159 00:01:16    56      336   0   17

!Router2 has an EIGRP neighbor relationship with Router1
router2#sh ip eigrp nei
IP-EIGRP neighbors for process 100
H    Address                 Interface        Hold Uptime    SRTT    RTO   Q   Seq Typ
e
                                              (sec)          (ms)        Cnt Num
0    137.1.200.1             Se0/0            171 00:01:07    64      384   0   2

!Router2 is receiving all the routes from Router1
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set
```

```
      137.1.0.0/24 is subnetted, 3 subnets
C        137.1.200.0 is directly connected, Serial0/0
D        137.1.1.0 [90/2172416] via 137.1.200.1, 00:00:03, Serial0/0
C        137.1.2.0 is directly connected, Ethernet0/0
      172.16.0.0/24 is subnetted, 4 subnets
D        172.16.58.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D        172.16.48.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D        172.16.32.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
D        172.16.33.0 [90/2297856] via 137.1.200.1, 00:00:03, Serial0/0
```

6.0   EIGRP - SPLIT-HORIZON
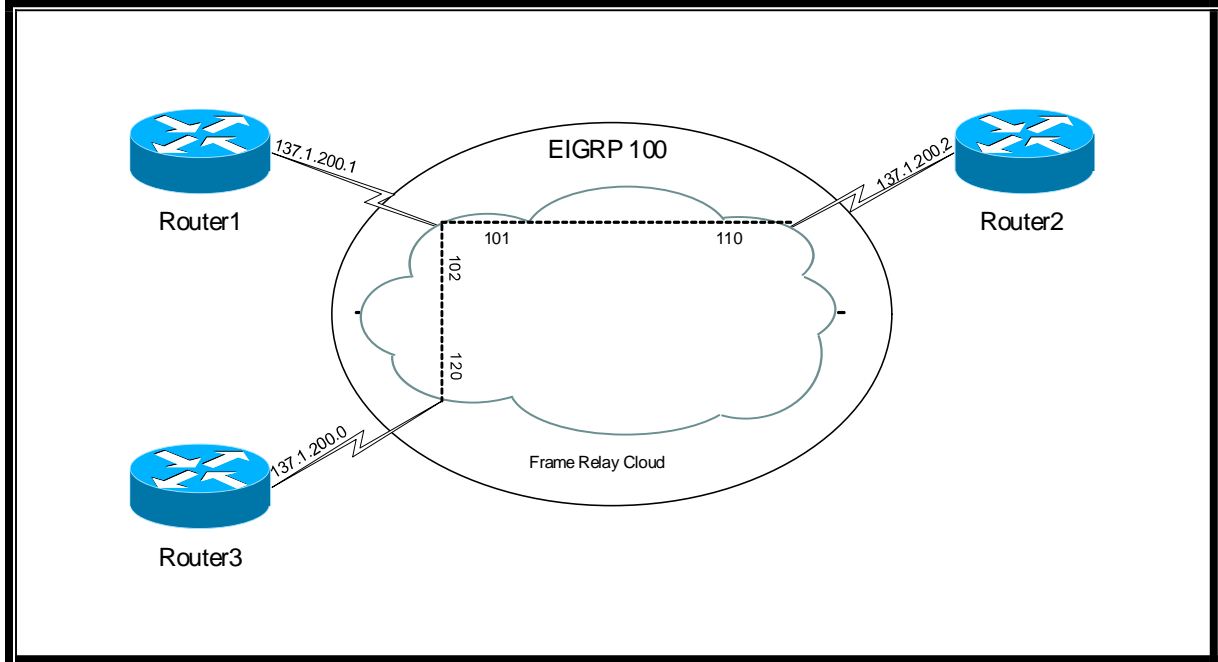
1. Configure the frame-relay network as per the above diagram. You are only allowed to use physical interfaces on each other routers.
2. Configure Router1, Router2 and Router3 to run EIGRP process 100.
3. Create the following loopback addresses on Router3 and include them in the EIGRP routing process:
    a. Loopback address 1 - 172.16.32.0 /24
    b. Loopback address 2 – 172.16.33.0 /24
    c. Loopback address 3 – 172.16.48.0 /24
    d. Loopback address 4 – 172.16.58.0 /24
4. Test your configuration to ensure that Router1 and Router2 received the loopback addresses and that they can be pinged..

ANSWER

Router1

```
interface s0/0
        ip address 137.1.200.1 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.2 101 broadcast
        frame-relay map ip 137.1.200.3 102 broadcast
        !This needs to be disabled when EIGRP is being used on a partial-mesh
frame-relay network.
        no ip split-horizon eigrp 100
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
```

Router2

```
interface s0/0
        ip address 137.1.200.2 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 110 broadcast

Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
```

Router3

```
Interface loopback 1
        Ip address 172.16.32.1 255.255.255.0
!
interface loopback 2
        ip address 172.16.33.1 255.255.255.0
!
interface loopback 3
        ip address 172.16.48.1 255.255.255.0
!
interface loopback 4
        ip address 172.16.58.1 255.255.255.0
!
interface s0/0
        ip address 137.1.200.3 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 120 broadcast

Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 172.16.32.0 0.0.0.255
        Network 172.16.33.0 00.0.0.255
        Network 172.16.48.0 0.0.0.255
        Network 172.16.58.0 0.0.0.255
```

```
The following shows the effect on the network before configuring split-horizon

!Router3 has the loopback interfaces in it's routing table and is advertising them via
EIGRP
router3#sh ip route
```

```
Codes: 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, 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

Gateway of last resort is not set


     137.1.0.0/24 is subnetted, 1 subnets
C       137.1.200.0 is directly connected, Serial0/0
     172.16.0.0/24 is subnetted, 4 subnets
C       172.16.58.0 is directly connected, Loopback4
C       172.16.48.0 is directly connected, Loopback3
C       172.16.32.0 is directly connected, Loopback1
C       172.16.33.0 is directly connected, Loopback2

!Router1 receives the loopbacks via EIGRP from Router3
router1#sh ip route
Codes: 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, 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

Gateway of last resort is not set


     137.1.0.0/24 is subnetted, 1 subnets
C       137.1.200.0 is directly connected, Serial0/0
     172.16.0.0/24 is subnetted, 4 subnets
D       172.16.58.0 [90/2297856] via 137.1.200.3, 00:00:31, Serial0/0
D       172.16.48.0 [90/2297856] via 137.1.200.3, 00:00:31, Serial0/0
D       172.16.32.0 [90/2297856] via 137.1.200.3, 00:00:31, Serial0/0
D       172.16.33.0 [90/2297856] via 137.1.200.3, 00:00:31, Serial0/0

!Router1 has split-horizon enabled by default
router1#sh ip int s0/0
Serial0/0 is up, line protocol is up
  Internet address is 137.1.200.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Multicast reserved groups joined: 224.0.0.9
  Outgoing access list is not set
  Inbound  access list is not set
  Proxy ARP is enabled
  Local Proxy ARP is disabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
  ICMP unreachables are always sent
  ICMP mask replies are never sent
  IP fast switching is enabled
  IP fast switching on the same interface is enabled
  IP Flow switching is disabled
  IP CEF switching is disabled
  IP Fast switching turbo vector
  IP multicast fast switching is enabled
  IP multicast distributed fast switching is disabled
  IP route-cache flags are Fast
  Router Discovery is disabled
  IP output packet accounting is disabled
  IP access violation accounting is disabled
  TCP/IP header compression is disabled
  RTP/IP header compression is disabled
  Policy routing is disabled
```

```
  Network address translation is disabled
  WCCP Redirect outbound is disabled
  WCCP Redirect inbound is disabled
  WCCP Redirect exclude is disabled
  BGP Policy Mapping is disabled

!As Split-horizon is enabled on Router1, it does not advertise the routes to Router2.
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 1 subnets
C       137.1.200.0 is directly connected, Serial0/0
```

```
The following shows the effect on the network after configuring split-horizon

!Disable Split-horizon on Router1
router1#sh ip int s0/0
Serial0/0 is up, line protocol is up
  Internet address is 137.1.200.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Multicast reserved groups joined: 224.0.0.9
  Outgoing access list is not set
  Inbound  access list is not set
  Proxy ARP is enabled
  Local Proxy ARP is disabled
  Security level is default
  Split horizon is disabled
  ICMP redirects are always sent
  ICMP unreachables are always sent
  ICMP mask replies are never sent
  IP fast switching is enabled
  IP fast switching on the same interface is enabled
  IP Flow switching is disabled
  IP CEF switching is disabled
  IP Fast switching turbo vector
  IP multicast fast switching is enabled
  IP multicast distributed fast switching is disabled
  IP route-cache flags are Fast
  Router Discovery is disabled
  IP output packet accounting is disabled
  IP access violation accounting is disabled
  TCP/IP header compression is disabled
  RTP/IP header compression is disabled
  Policy routing is disabled
  Network address translation is disabled
  WCCP Redirect outbound is disabled
  WCCP Redirect inbound is disabled
  WCCP Redirect exclude is disable


!Router2 now receives all the loopbacks from Router1
router2#sh ip route
Codes: 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, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
```
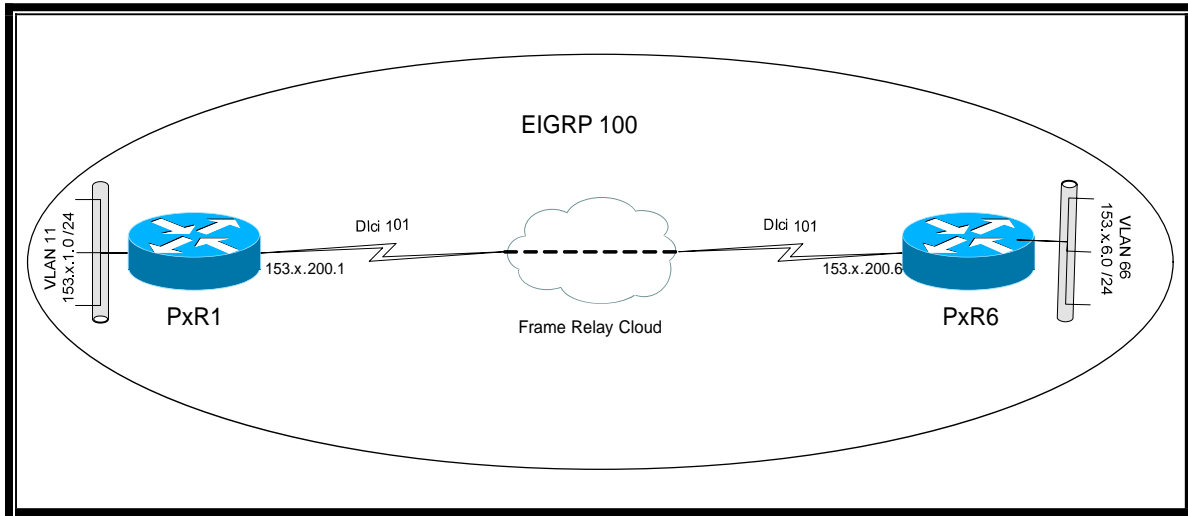
```
        P - periodic downloaded static route

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 1 subnets
C       137.1.200.0 is directly connected, Serial0/0
     172.16.0.0/24 is subnetted, 4 subnets
D       172.16.58.0 [90/2809856] via 137.1.200.1, 00:00:05, Serial0/0
D       172.16.48.0 [90/2809856] via 137.1.200.1, 00:00:05, Serial0/0
D       172.16.32.0 [90/2809856] via 137.1.200.1, 00:00:05, Serial0/0
D       172.16.33.0 [90/2809856] via 137.1.200.1, 00:00:05, Serial0/0
```

7.0   EIGRP – PASSIVE INTERFACE

1.   Configure Router1 and Router2 to run EIGRP process 100.
2.   Configure a loopback 0 of subnet 22.22.22.0 /24 in Router2.
3.   Create the following loopback addresses on Router1 and include them in EIGRP
   a.   Loopback address 1 - 172.16.32.0 /24
   b.   Loopback address 2 – 172.16.33.0 /24
   c.   Loopback address 3 – 172.16.48.0 /24
   d.   Loopback address 4 – 172.16.58.0 /24
4.   Configure Router2 so that it does not send or receive any updates from Router1.
5.   Test your configuration to ensure that Router2 has not formed an EIGRP relationship to Router1

ANSWER

Router1

```
Interface loopback 1
        Ip address 172.16.32.1 255.255.255.0
!
interface loopback 2
        ip address 172.16.33.1 255.255.255.0
!
interface loopback 3
        ip address 172.16.48.1 255.255.255.0
!
interface loopback 4
        ip address 172.16.58.1 255.255.255.0
!
Interface f0/0
        ip address 137.1.1.1 255.255.255.0
!
interface s0/0
        ip address 137.1.200.1 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.2 101 broadcast
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.1.0 0.0.0.255
        Network 172.16.32.0 0.0.0.255
        Network 172.16.33.0 00.0.0.255
        Network 172.16.48.0 0.0.0.255
        Network 172.16.58.0 0.0.0.255
```

Router2

```
Interface loopback 0
        Ip address 22.22.22.22 255.255.255.0
!
Interface e0/0
        Ip address 137.1.2.2 255.255.255.0

interface s0/0
        ip address 137.1.200.2 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 110 broadcast
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.2.0 0.0.0.255
        Network 22.22.22.0 0.0.0.255
        Passive-interface s0/0
```

```
The following shows the routing tables of both routers before the passive-interface
configuration

!Router1 sends it's loopbacks to Router2 and receives Router2's loopback 0
router1#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 2 subnets
C       137.1.200.0 is directly connected, Serial0/0
D       137.1.2.0 [90/2195456] via 137.1.200.2, 00:00:19, Serial0/0
     172.16.0.0/24 is subnetted, 4 subnets
C       172.16.58.0 is directly connected, Loopback4
C       172.16.48.0 is directly connected, Loopback3
C       172.16.32.0 is directly connected, Loopback1
C       172.16.33.0 is directly connected, Loopback2
     22.0.0.0/24 is subnetted, 1 subnets
D       22.22.22.0 [90/2297856] via 137.1.200.2, 00:00:19, Serial0/0

!Router2 sends its loopback to Router1 and receives all the loopbacks from Router1
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 2 subnets
C       137.1.200.0 is directly connected, Serial0/0
C       137.1.2.0 is directly connected, Ethernet0/0
     172.16.0.0/24 is subnetted, 4 subnets
D       172.16.58.0 [90/2297856] via 137.1.200.1, 00:00:06, Serial0/0
D       172.16.48.0 [90/2297856] via 137.1.200.1, 00:00:06, Serial0/0
D       172.16.32.0 [90/2297856] via 137.1.200.1, 00:00:06, Serial0/0
D       172.16.33.0 [90/2297856] via 137.1.200.1, 00:00:06, Serial0/0
     22.0.0.0/24 is subnetted, 1 subnets
C       22.22.22.0 is directly connected, Loopback0
```

The following shows the routing tables of both routers after the passive-interface configuration

```
!Router1 sends EIGRP updates to Router2. But as this router has a passive-interface
configured, it will not receive any updates from Router1.
router1#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 1 subnets
C       137.1.200.0 is directly connected, Serial0/0
     172.16.0.0/24 is subnetted, 4 subnets
C       172.16.58.0 is directly connected, Loopback4
C       172.16.48.0 is directly connected, Loopback3
C       172.16.32.0 is directly connected, Loopback1
C       172.16.33.0 is directly connected, Loopback2

!As Router2 has passive-interface configured it will not form an EIGRP neighbor
relationship
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 2 subnets
C        137.1.200.0 is directly connected, Serial0/0
C        137.1.2.0 is directly connected, Ethernet0/0
     22.0.0.0/24 is subnetted, 1 subnets
C        22.22.22.0 is directly connected, Loopback0
```

8.0   EIGRP - ADVERTISING A DEFAULT ROUTE
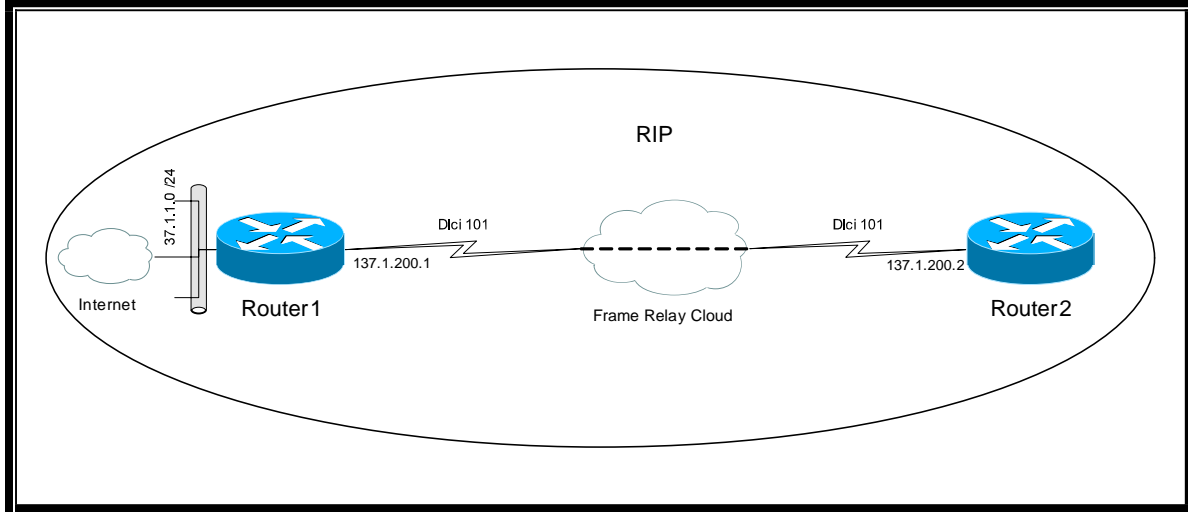
1. Router1 router is connected to the Internet.
2. Create the following loopback addresses on Router1 and DO NOT include them in the EIGRP routing
    process on Router1:
    a.   Loopback address 1 - 172.16.32.0 /24
    b.   Loopback address 2 – 172.16.33.0 /24
    c.   Loopback address 3 – 172.16.48.0 /24
    d.   Loopback address 4 – 172.16.58.0 /24
3. Create a static route on Router1 pointing out of f0/0.
4. Configure Router1 to advertise this default-route to the rest of the branch offices like Router2.
5. Test your configuration on Router2 and ensure you are receiving the default-route and that you can ping
    any of the individual loopbacks.

ANSWER

Router1

```
Interface loopback 1
        Ip address 172.16.32.1 255.255.255.0
!
interface loopback 2
        ip address 172.16.33.1 255.255.255.0
!
interface loopback 3
        ip address 172.16.48.1 255.255.255.0
!
interface loopback 4
        ip address 172.16.58.1 255.255.255.0
!
Interface f0/0
        ip address 137.1.1.1 255.255.255.0
!
interface s0/0
        ip address 137.1.200.1 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.2 101 broadcast
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.1.0 0.0.0.255
        Redistribute static route-map default-route

Route-map default-route permit 10
        Match ip address 1

Access-list 1 remark <<< Permit Default route>>>>
Access-list 1 permit host 0.0.0.0

Ip route 0.0.0.0 0.0.0.0 137.1.1.2
```

Router2

```
Interface e0/0
        Ip address 137.1.2.2 255.255.255.0

interface s0/0
        ip address 137.1.200.2 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 110 broadcast
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.2.0 0.0.0.255
```

The following shows the Routing table between the two routers

!Router1 contains all the individual subnets it is advertising using EIGRP. It also contains the default route

```
router1#sh ip route
Codes: 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, 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

Gateway of last resort is 137.1.1.2 to network 0.0.0.0

     137.1.0.0/16 is variably subnetted, 4 subnets, 2 masks
C       137.1.200.0/24 is directly connected, Serial0/0
S       137.1.0.0/16 [1/0] via 137.1.1.2
C       137.1.1.0/24 is directly connected, FastEthernet0/0
D       137.1.2.0/24 [90/2195456] via 137.1.200.2, 00:17:38, Serial0/0
     172.16.0.0/24 is subnetted, 4 subnets
C       172.16.58.0 is directly connected, Loopback4
C       172.16.48.0 is directly connected, Loopback3
C       172.16.32.0 is directly connected, Loopback1
C       172.16.33.0 is directly connected, Loopback2
S*   0.0.0.0/0 [1/0] via 137.1.1.2

!Router2 receives the default route from Router1.
router2#sh ip route
Codes: 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, 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

Gateway of last resort is 137.1.200.1 to network 0.0.0.0

     137.1.0.0/24 is subnetted, 3 subnets
C       137.1.200.0 is directly connected, Serial0/0
D       137.1.1.0 [90/2172416] via 137.1.200.1, 00:00:03, Serial0/0
C       137.1.2.0 is directly connected, Ethernet0/0
D*EX 0.0.0.0/0 [170/2172416] via 137.1.200.1, 00:00:03, Serial0/0

!The following shows the EIGRP database in Router2
router2#sh ip eigrp topology
IP-EIGRP Topology Table for AS(100)/ID(137.1.200.2)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 0.0.0.0/0, 1 successors, FD is 2172416
         via 137.1.200.1 (2172416/28160), Serial0/0
P 137.1.200.0/24, 1 successors, FD is 2169856
         via Connected, Serial0/0
P 137.1.1.0/24, 1 successors, FD is 2172416
         via 137.1.200.1 (2172416/28160), Serial0/0
P 137.1.2.0/24, 1 successors, FD is 281600
         via Connected, Ethernet0/0

!The following shows that even though Router2 does not have a route to the loopbacks, the
default route is Pointing to Router1, the pings are successful.
router2#ping 172.16.58.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.58.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/60 ms

router2#ping 172.16.48.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.48.1, timeout is 2 seconds:
!!!!!
```
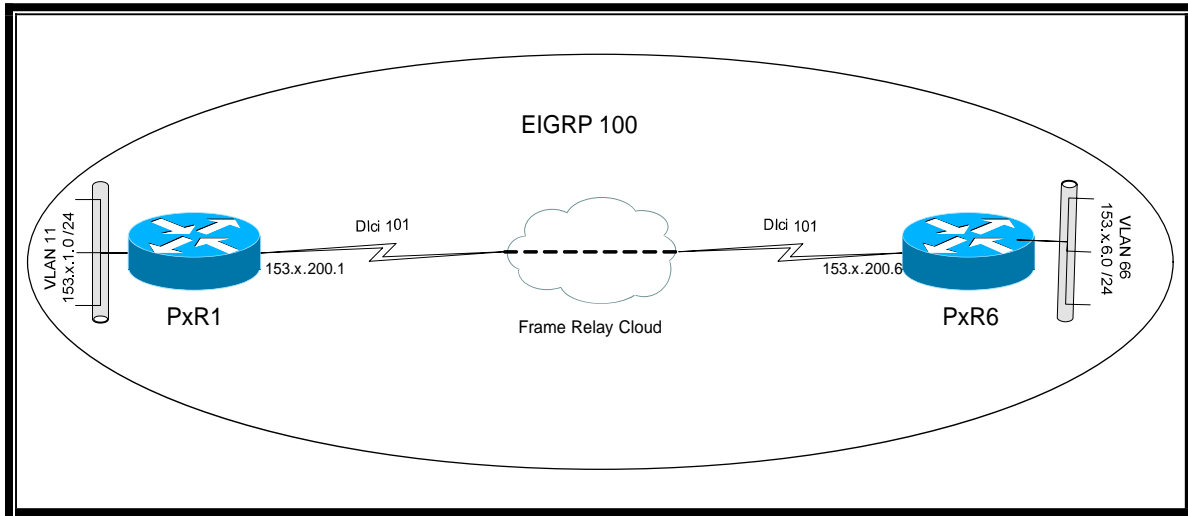
```
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/57/60 ms
```

9.0   EIGRP – ROUTE FILTERING

1.   Create the following loopback addresses on Router1 and include them in the RIP routing process on Router1:
     a.   Loopback address 1 - 172.16.32.0 /24
     b.   Loopback address 2 – 172.16.33.0 /24
     c.   Loopback address 3 – 172.16.48.0 /24
     d.   Loopback address 4 – 172.16.58.0 /24
2.   Configure Router2 to only receive all the routes except loopback 3 subnet.
3.   Test your configuration on Router2 and ensure you are receiving all the routes except loopback3 subnet.

ANSWER

Router1

Interface loopback 1

```
        Ip address 172.16.32.1 255.255.255.0
!
interface loopback 2
        ip address 172.16.33.1 255.255.255.0
!
interface loopback 3
        ip address 172.16.48.1 255.255.255.0
!
interface loopback 4
        ip address 172.16.58.1 255.255.255.0
!
Interface f0/0
        Ip address 137.1.1.1 255.255.255.0
!
interface s0/0
        ip address 137.1.200.1 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.2 101 broadcast
!
Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.1.0 0.0.0.255
        Network 172.16.32.0 0.0.0.255
        Network 172.16.33.0 00.0.0.255
        Network 172.16.48.0 0.0.0.255
        Network 172.16.58.0 0.0.0.255
```

Router2

```
Interface e0/0
        Ip address 137.1.2.2 255.255.255.0
!
interface s0/0
        ip address 137.1.200.2 255.255.255.0
        encapsulation frame-relay
        no frame-relay inverse-arp
        frame-relay map Ip 137.1.200.1 110 broadcast

Router eigrp 100
        No auto-summary
        Eigrp log-neighbor-changes
        Network 137.1.200.0 0.0.0.255
        Network 137.1.2.0 0.0.0.255
        !Prevents the route from coming into the local routing process.
        Distribute-list 1 in
!
access-list 1 remark <<<Allow all and prevent loopback3 to be received from Router1>>>
access-list 1 deny 172.16.48.0 0.0.0.255
access-list 1 permit any
```

The following shows the Routing table before the Distribute-lists have been applied

!Router1 is advertising all the loopbacks to Router2
```
router1#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 2 subnets
C       137.1.200.0 is directly connected, Serial0/0
C       137.1.1.0 is directly connected, FastEthernet0/0
     172.16.0.0/24 is subnetted, 4 subnets
C       172.16.58.0 is directly connected, Loopback4
C       172.16.48.0 is directly connected, Loopback3
C       172.16.32.0 is directly connected, Loopback1
C       172.16.33.0 is directly connected, Loopback2

!Router2 is learning all the loopbacks from Router1
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 3 subnets
C       137.1.200.0 is directly connected, Serial0/0
D       137.1.1.0 [90/2172416] via 137.1.200.1, 00:00:00, Serial0/0
C       137.1.2.0 is directly connected, Ethernet0/0
     172.16.0.0/24 is subnetted, 4 subnets
D       172.16.58.0 [90/2297856] via 137.1.200.1, 00:00:00, Serial0/0
D       172.16.48.0 [90/2297856] via 137.1.200.1, 00:00:00, Serial0/0
D       172.16.32.0 [90/2297856] via 137.1.200.1, 00:00:00, Serial0/0
D       172.16.33.0 [90/2297856] via 137.1.200.1, 00:00:00, Serial0/0
```

```
The following shows the Routing table after the Distribute-lists have been applied

!Router1 is advertising all the loopbacks to Router2
router1#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 3 subnets
C       137.1.200.0 is directly connected, Serial0/0
C       137.1.1.0 is directly connected, FastEthernet0/0
D       137.1.2.0 [90/2195456] via 137.1.200.2, 00:00:35, Serial0/0
     172.16.0.0/24 is subnetted, 4 subnets
C       172.16.58.0 is directly connected, Loopback4
C       172.16.48.0 is directly connected, Loopback3
C       172.16.32.0 is directly connected, Loopback1
C       172.16.33.0 is directly connected, Loopback2

!Router2 is learning all the loopbacks from Router1 except loopback3
router2#sh ip route
Codes: 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, 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

Gateway of last resort is not set

     137.1.0.0/24 is subnetted, 3 subnets
C       137.1.200.0 is directly connected, Serial0/0
D       137.1.1.0 [90/2172416] via 137.1.200.1, 00:00:04, Serial0/0
C       137.1.2.0 is directly connected, Ethernet0/0
     172.16.0.0/24 is subnetted, 3 subnets
D       172.16.58.0 [90/2297856] via 137.1.200.1, 00:00:04, Serial0/0
D       172.16.32.0 [90/2297856] via 137.1.200.1, 00:00:04, Serial0/0
D       172.16.33.0 [90/2297856] via 137.1.200.1, 00:00:04, Serial0/0

!Router2 does not have the loopback3 in it's EIGRP database either
router2#sh ip eigrp topology
IP-EIGRP Topology Table for AS(100)/ID(137.1.200.2)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 137.1.200.0/24, 1 successors, FD is 2169856
         via Connected, Serial0/0
P 172.16.58.0/24, 1 successors, FD is 2297856
         via 137.1.200.1 (2297856/128256), Serial0/0
P 137.1.1.0/24, 1 successors, FD is 2172416
         via 137.1.200.1 (2172416/28160), Serial0/0
P 137.1.2.0/24, 1 successors, FD is 281600
         via Connected, Ethernet0/0
P 172.16.32.0/24, 1 successors, FD is 2297856
         via 137.1.200.1 (2297856/128256), Serial0/0
P 172.16.33.0/24, 1 successors, FD is 2297856
         via 137.1.200.1 (2297856/128256), Serial0/0
```