LAB 3: DMVPN – EIGRP

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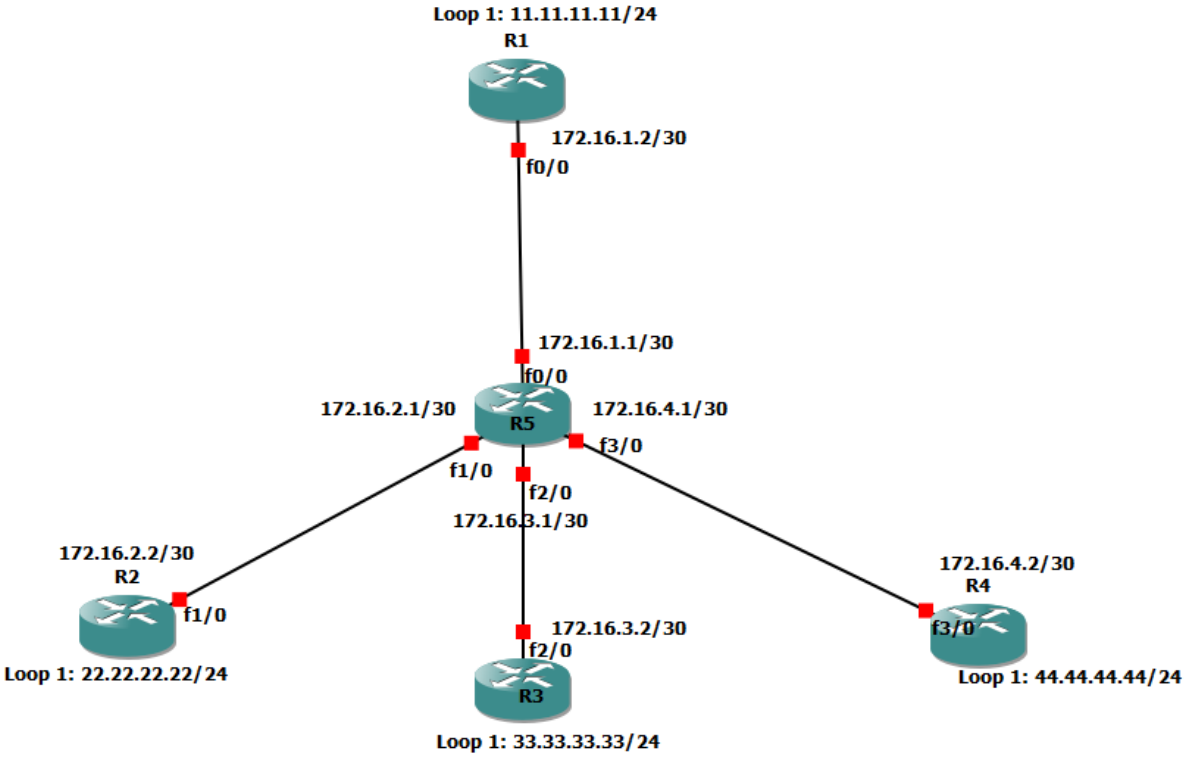
LAB 3: Diagram

Note: This Lab was developed on Cisco IOS Version15.2(4) M1 ADVENTERPRISEK9-M.



LAB 3: Configure EIGRP over DMVPN Configuration

Step 1: Enable loopback and physical interfaces on R1, R2, R3, R4 and R5.

R1:

```
interface FastEthernet0/0
ip address 172.16.1.2 255.255.255.252
no shutdown
exit

interface Loopback1
ip address 11.11.11.11 255.255.255.0
exit
```

R2:

```
interface FastEthernet1/0
ip address 172.16.2.2 255.255.255.252
no shutdown
exit

interface Loopback1
ip address 22.22.22.22 255.255.255.0
exit
```

R3:

```
interface FastEthernet2/0
ip address 172.16.3.2 255.255.255.252
no shutdown
exit

interface Loopback1
ip address 33.33.33.33 255.255.255.0
exit
```

R4:

```
interface FastEthernet3/0
ip address 172.16.4.2 255.255.255.252
no shutdown
exit
interface Loopback1
```

ip address 44.44.44.44 255.255.255.0
exit

R5:
interface FastEthernet0/0
ip address 172.16.1.1 255.255.255.252
no shutdown
exit

interface FastEthernet1/0
ip address 172.16.2.1 255.255.255.252
no shutdown
exit

interface FastEthernet2/0
ip address 172.16.3.1 255.255.255.252
no shutdown
exit

interface FastEthernet3/0
ip address 172.16.4.1 255.255.255.252
no shutdown
exit

Step 2: Assign default route pointing towards internet.

R1:
ip route 0.0.0.0 0.0.0.0 172.16.1.1

R2:
ip route 0.0.0.0 0.0.0.0 172.16.2.1

R3:
ip route 0.0.0.0 0.0.0.0 172.16.3.1

R4:
ip route 0.0.0.0 0.0.0.0 172.16.4.1

Step 3: Configure DMVPN

R1:
interface Tunnel 0
ip address 192.168.0.1 255.255.255.0 !(logical ip address)

```
ip nhrp map multicast dynamic  !(enable multicast traffic)
ip nhrp network-id 5                !(assign same network-id else tunnel will not form)
tunnel source 172.16.1.2          !(physical address of HUB interface)
tunnel mode gre multipoint          !(select gre mode)
ip mtu 1400                         !(change mtu for DMVPN header)
exit
```

R2:

```
interface Tunnel 0
ip address 192.168.0.2 255.255.255.0
ip nhrp network-id 5
tunnel source 172.16.2.2
ip nhrp map 192.168.0.1 172.16.1.2    !(pointing towards NHS server)
ip nhrp map multicast 172.16.1.2      !(allow multicast traffic from R2 (spoke) to R1 (Hub))
ip nhrp nhs 192.168.0.1           !(designates R1 as the NHS)
tunnel mode gre multipoint
ip mtu 1400
exit
```

R3:

```
interface Tunnel 0
ip address 192.168.0.3 255.255.255.0
ip nhrp network-id 5
tunnel source 172.16.3.2
ip nhrp map 192.168.0.1 172.16.1.2
ip nhrp map multicast 172.16.1.2
ip nhrp nhs 192.168.0.1
tunnel mode gre multipoint
ip mtu 1400
exit
```

R4:

```
interface Tunnel 0
ip address 192.168.0.4 255.255.255.0
ip nhrp network-id 5
tunnel source 172.16.4.2
ip nhrp map 192.168.0.1 172.16.1.2
ip nhrp map multicast 172.16.1.2
ip nhrp nhs 192.168.0.1
tunnel mode gre multipoint
ip mtu 1400
exit
```

Step 4: Configure EIGRP on router.

R1:
```
router eigrp 100
network 192.168.0.1 255.255.255.0
network 11.11.11.11 255.255.255.0
exit
```

R2:
```
router eigrp 100
network 192.168.0.2 255.255.255.0
network 22.22.22.22 255.255.255.0
exit
```

R3:
```
router eigrp 100
network 192.168.0.3 255.255.255.0
network 33.33.33.33 255.255.255.0
exit
```

R4:
```
router eigrp 100
network 192.168.0.4 255.255.255.0
network 44.44.44.44 255.255.255.0
exit
```

Step 5: Verification

```
R1#show ip route
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
       + - replicated route, % - next hop override

Gateway of last resort is 172.16.1.1 to network 0.0.0.0
```

```
S*    0.0.0.0/0 [1/0] via 172.16.1.1
      11.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        11.11.11.0/24 is directly connected, Loopback1
L        11.11.11.11/32 is directly connected, Loopback1
      22.0.0.0/24 is subnetted, 1 subnets
D        22.22.22.0 [90/27008000] via 192.168.0.2, 00:20:28, Tunnel0
      33.0.0.0/24 is subnetted, 1 subnets
D        33.33.33.0 [90/27008000] via 192.168.0.3, 00:19:53, Tunnel0
      44.0.0.0/24 is subnetted, 1 subnets
D        44.44.44.0 [90/27008000] via 192.168.0.4, 00:19:27, Tunnel0
      172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.1.0/30 is directly connected, FastEthernet0/0
L        172.16.1.2/32 is directly connected, FastEthernet0/0
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/24 is directly connected, Tunnel0
L        192.168.0.1/32 is directly connected, Tunnel0

R2#show ip route
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
       + - replicated route, % - next hop override

Gateway of last resort is 172.16.2.1 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 172.16.2.1
      11.0.0.0/24 is subnetted, 1 subnets
D        11.11.11.0 [90/27008000] via 192.168.0.1, 00:24:32, Tunnel0
      22.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        22.22.22.0/24 is directly connected, Loopback1
L        22.22.22.22/32 is directly connected, Loopback1
      172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.2.0/30 is directly connected, FastEthernet1/0
L        172.16.2.2/32 is directly connected, FastEthernet1/0
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/24 is directly connected, Tunnel0
L        192.168.0.2/32 is directly connected, Tunnel0

R3#show ip route
```

```
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
       + - replicated route, % - next hop override

Gateway of last resort is 172.16.3.1 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 172.16.3.1
      11.0.0.0/24 is subnetted, 1 subnets
D        11.11.11.0 [90/27008000] via 192.168.0.1, 00:24:39, Tunnel0
      33.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        33.33.33.0/24 is directly connected, Loopback1
L        33.33.33.33/32 is directly connected, Loopback1
      172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.3.0/30 is directly connected, FastEthernet2/0
L        172.16.3.2/32 is directly connected, FastEthernet2/0
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/24 is directly connected, Tunnel0
L        192.168.0.3/32 is directly connected, Tunnel0

R4#show ip route
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
       + - replicated route, % - next hop override

Gateway of last resort is 172.16.4.1 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 172.16.4.1
      11.0.0.0/24 is subnetted, 1 subnets
D        11.11.11.0 [90/27008000] via 192.168.0.1, 00:26:44, Tunnel0
      44.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        44.44.44.0/24 is directly connected, Loopback1
L        44.44.44.44/32 is directly connected, Loopback1
      172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.4.0/30 is directly connected, FastEthernet3/0
```

```
L       172.16.4.2/32 is directly connected, FastEthernet3/0
     192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.0.0/24 is directly connected, Tunnel0
L       192.168.0.4/32 is directly connected, Tunnel0
```

(Spoke R2, R3 and R4 are not receiving routes from other spoke routers. This is due to ip split-horizon enable on hub router, thus not allowing the hub to send routes via same interface.)

Step 6: Disable split-horizon on hub ie R1 router.

R1:

```
! (To receive routes from one spoke router to other spoke router.)
interface tunnel 0
no ip split-horizon eigrp 100
exit
```

Step 7: Verification

```
R2#show ip route
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
       + - replicated route, % - next hop override

Gateway of last resort is 172.16.2.1 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 172.16.2.1
      11.0.0.0/24 is subnetted, 1 subnets
D        11.11.11.0 [90/27008000] via 192.168.0.1, 00:39:50, Tunnel0
      22.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        22.22.22.0/24 is directly connected, Loopback1
L        22.22.22.22/32 is directly connected, Loopback1
      33.0.0.0/24 is subnetted, 1 subnets
D        33.33.33.0 [90/28288000] via 192.168.0.1, 00:00:16, Tunnel0
      44.0.0.0/24 is subnetted, 1 subnets
D        44.44.44.0 [90/28288000] via 192.168.0.1, 00:00:16, Tunnel0
      172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.2.0/30 is directly connected, FastEthernet1/0
L        172.16.2.2/32 is directly connected, FastEthernet1/0
```

```
     192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.0.0/24 is directly connected, Tunnel0
L       192.168.0.2/32 is directly connected, Tunnel0

R3#show ip route
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
       + - replicated route, % - next hop override

Gateway of last resort is 172.16.3.1 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 172.16.3.1
      11.0.0.0/24 is subnetted, 1 subnets
D        11.11.11.0 [90/27008000] via 192.168.0.1, 00:39:30, Tunnel0
      22.0.0.0/24 is subnetted, 1 subnets
D        22.22.22.0 [90/28288000] via 192.168.0.1, 00:02:40, Tunnel0
      33.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        33.33.33.0/24 is directly connected, Loopback1
L        33.33.33.33/32 is directly connected, Loopback1
      44.0.0.0/24 is subnetted, 1 subnets
D        44.44.44.0 [90/28288000] via 192.168.0.1, 00:02:40, Tunnel0
      172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.3.0/30 is directly connected, FastEthernet2/0
L        172.16.3.2/32 is directly connected, FastEthernet2/0
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/24 is directly connected, Tunnel0
L        192.168.0.3/32 is directly connected, Tunnel0

R4#show ip route
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
       + - replicated route, % - next hop override

Gateway of last resort is 172.16.4.1 to network 0.0.0.0
```

```
S*    0.0.0.0/0 [1/0] via 172.16.4.1
      11.0.0.0/24 is subnetted, 1 subnets
D        11.11.11.0 [90/27008000] via 192.168.0.1, 00:41:06, Tunnel0
      22.0.0.0/24 is subnetted, 1 subnets
D        22.22.22.0 [90/28288000] via 192.168.0.1, 00:03:16, Tunnel0
      33.0.0.0/24 is subnetted, 1 subnets
D        33.33.33.0 [90/28288000] via 192.168.0.1, 00:03:16, Tunnel0
      44.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        44.44.44.0/24 is directly connected, Loopback1
L        44.44.44.44/32 is directly connected, Loopback1
      172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.4.0/30 is directly connected, FastEthernet3/0
L        172.16.4.2/32 is directly connected, FastEthernet3/0
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/24 is directly connected, Tunnel0
L        192.168.0.4/32 is directly connected, Tunnel0
```

(Now all routes learned from hub as well as every spoke router dynamically using EIGRP.)

Step 8: Verify DMVPN tunnels.

```
R1#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
      N - NATed, L - Local, X - No Socket
      # Ent --> Number of NHRP entries with same NBMA peer
      NHS Status: E --> Expecting Replies, R --> Responding, W --> Waiting
      UpDn Time --> Up or Down Time for a Tunnel
==========================================================
Interface: Tunnel0, IPv4 NHRP Details
Type:Hub, NHRP Peers:3,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
    1 172.16.2.2          192.168.0.2    UP 00:52:46     D
    1 172.16.3.2          192.168.0.3    UP 00:52:12     D
    1 172.16.4.2          192.168.0.4    UP 00:51:43     D

R2#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
      N - NATed, L - Local, X - No Socket
      # Ent --> Number of NHRP entries with same NBMA peer
```

```
        NHS Status: E --> Expecting Replies, R --> Responding, W --> Waiting
        UpDn Time --> Up or Down Time for a Tunnel
==========================================================
==========================
Interface: Tunnel0, IPv4 NHRP Details
Type:Spoke, NHRP Peers:2,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
     1 172.16.1.2          192.168.0.1    UP 00:53:37     S

R3#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
        N - NATed, L - Local, X - No Socket
        # Ent --> Number of NHRP entries with same NBMA peer
        NHS Status: E --> Expecting Replies, R --> Responding, W --> Waiting
        UpDn Time --> Up or Down Time for a Tunnel
==========================================================
==========================
Interface: Tunnel0, IPv4 NHRP Details
Type:Spoke, NHRP Peers:1,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
     1 172.16.1.2          192.168.0.1    UP 00:51:41     S

R4#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
        N - NATed, L - Local, X - No Socket
        # Ent --> Number of NHRP entries with same NBMA peer
        NHS Status: E --> Expecting Replies, R --> Responding, W --> Waiting
        UpDn Time --> Up or Down Time for a Tunnel
==========================================================
==========================
Interface: Tunnel0, IPv4 NHRP Details
Type:Spoke, NHRP Peers:2,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
     1 172.16.1.2          192.168.0.1    UP 00:52:45     S

R4#traceroute 192.168.0.2 source loopback 1
Type escape sequence to abort.
Tracing the route to 192.168.0.2
```

```
VRF info: (vrf in name/id, vrf out name/id)
  1 192.168.0.1 120 msec 148 msec
  2 192.168.0.2  140 msec 150 msec
```

(Spoke router R4 ia able to reach R2 via hub router. A packet destined from R4 to R2 would need to be routed through R1 to exit R4 tunnel and the get re-encapsulated to enter R2 tunnel.)

```
R4#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
        N - NATed, L - Local, X - No Socket
        # Ent --> Number of NHRP entries with same NBMA peer
        NHS Status: E --> Expecting Replies, R --> Responding, W --> Waiting
        UpDn Time --> Up or Down Time for a Tunnel
==========================================================
========================
Interface: Tunnel0, IPv4 NHRP Details
Type:Spoke, NHRP Peers:2,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
     1 172.16.1.2          192.168.0.1    UP 00:52:45     S
     1 172.16.2.2          192.168.0.2    UP 00:42:43     D
```

(Notice that the tunnel to R4 has been flagged as dynamic in contrast to the static tunnel to the hub/NHS.)

```
R4#traceroute 192.168.0.2 source loopback 1
Type escape sequence to abort.
Tracing the route to 192.168.0.2
VRF info: (vrf in name/id, vrf out name/id)
  1 192.168.0.2 120 msec 148 msec
```

(Once the dynamically tunnel is formed is formed between spoke to spoke router, DMVPN allows to spoke to spoke directly communication at next hop thus bypassing the hub router completely.)