# LAB16: Named EIGRP – IPv4

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## LAB 16: Diagram

Note: This Lab was developed on Cisco IOS Version15.2(4) M1 ADVENTERPRISEK9-M.
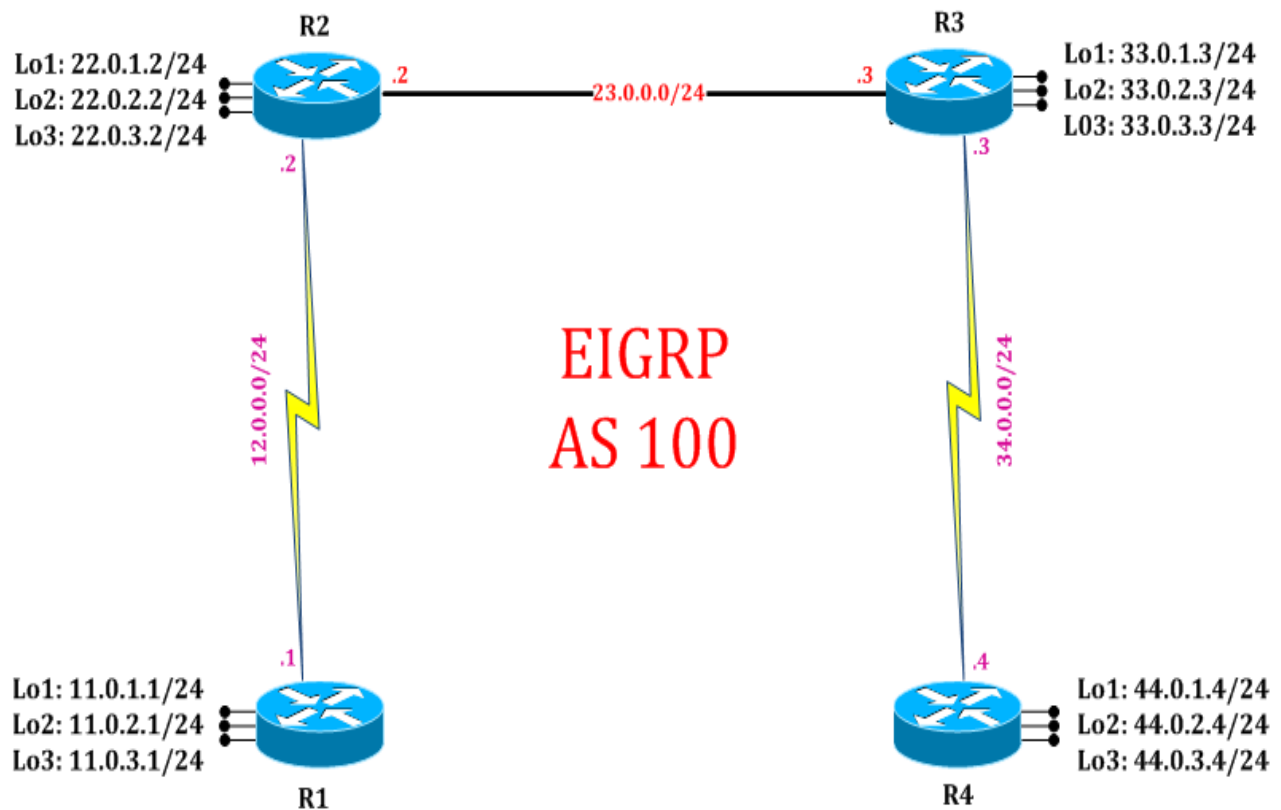
# LAB16: EIGRP Load balancing and Variance using named configuration

## Task 1: Configure EIGRP Load balancing and variance using named configuration

Step 1   Configure redundant path between two routers

R1:
interface Serial2/0
ip address 12.0.0.1 255.255.255.0
no shutdown
interface Serial2/3
ip address 21.0.0.1 255.255.255.0
no shutdown
interface loopback 1
ip address 11.0.1.1 255.255.255.0
interface loopback 2
ip address 11.0.2.1 255.255.255.0
interface loopback 3
ip address 11.0.3.1 255.255.255.0
exit

R2:
interface Ethernet0/0
ip address 23.0.0.2 255.255.255.0
no shut
interface Serial2/0
ip address 12.0.0.2 255.255.255.0
no shutdown
interface Serial2/3
ip address 43.0.0.2 255.255.255.0
no shutdown
interface loopback 1
ip address 22.0.1.2 255.255.255.0
interface loopback 2
ip address 22.0.2.2 255.255.255.0
interface loopback 3
ip address 22.0.3.2 255.255.255.0
exit

R3:
interface Ethernet0/0
ip address 23.0.0.3 255.255.255.0
no shutdown
interface Serial2/0
ip address 34.0.0.3 255.255.255.0

```
no shutdown
interface Serial2/3
ip address 21.0.0.3 255.255.255.0
no shutdown
interface loopback 1
ip address 33.0.1.3 255.255.255.0
interface loopback 2
ip address 33.0.2.3 255.255.255.0
interface loopback 3
ip address 33.0.3.3 255.255.255.0
exit
```

R4:
```
interface Serial2/3
ip address 43.0.0.4 255.255.255.0
no shutdown
interface Serial2/0
ip address 34.0.0.4 255.255.255.0
no shutdown
interface loopback 1
ip address 44.0.1.4 255.255.255.0
interface loopback 2
ip address 44.0.2.4 255.255.255.0
interface loopback 3
ip address 44.0.3.4 255.255.255.0
exit
```

Step 2   Configure EIGRP to learn routes over multiple paths

R1:
```
router eigrp cisco
address-family ipv4 autonomous-system 100
 network 11.0.1.1 255.255.255.0
 network 11.0.2.1 255.255.255.0
 network 11.0.3.1 255.255.255.0
 network 12.0.0.1 255.255.255.0
 network 21.0.0.1 255.255.255.0
exit
```

R2:
```
router eigrp cisco
address-family ipv4 autonomous-system 100
 network 12.0.0.2 255.255.255.0
 network 22.0.1.2 255.255.255.0
 network 22.0.2.2 255.255.255.0
 network 22.0.3.2 255.255.255.0
 network 23.0.0.2 255.255.255.0
 network 43.0.0.2 255.255.255.0
exit
```

R3:
router eigrp cisco
address-family ipv4 autonomous-system 100
network 21.0.0.3 255.255.255.0
network 23.0.0.3 255.255.255.0
network 33.0.1.3 255.255.255.0
network 33.0.2.3 255.255.255.0
network 33.0.3.3 255.255.255.0
network 34.0.0.3 255.255.255.0
exit

R4:
router eigrp cisco
address-family ipv4 autonomous-system 100
network 34.0.0.4 255.255.255.0
network 43.0.0.4 255.255.255.0
network 44.0.1.4 255.255.255.0
network 44.0.2.4 255.255.255.0
network 44.0.3.4 255.255.255.0
exit

Step 3   Verify that routes are learnt from multiple path in topology table.

R2#show ip eigrp topology

EIGRP-IPv4 VR(cisco) Topology Table for AS(100)/ID(22.0.3.2)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
    r - reply Status, s - sia Status

P 11.0.1.0/24, 1 successors, FD is 1735257878
    via 12.0.0.1 (1735257878/163840), Serial2/0
P 11.0.2.0/24, 1 successors, FD is 1735257878
    via 12.0.0.1 (1735257878/163840), Serial2/0
P 11.0.3.0/24, 1 successors, FD is 1735257878
    via 12.0.0.1 (1735257878/163840), Serial2/0
P 12.0.0.0/24, 1 successors, FD is 1735175958
    via Connected, Serial2/0
P 21.0.0.0/24, 1 successors, FD is 1800711958
    via 23.0.0.3 (1800711958/1735175958), Ethernet0/0
    via 12.0.0.1 (3045895958/1735175958), Serial2/0
P 22.0.1.0/24, 1 successors, FD is 163840
    via Connected, Loopback1
P 22.0.2.0/24, 1 successors, FD is 163840
    via Connected, Loopback2
P 22.0.3.0/24, 1 successors, FD is 163840
    via Connected, Loopback3
P 23.0.0.0/24, 1 successors, FD is 131072000
    via Connected, Ethernet0/0

P 33.0.1.0/24, 1 successors, FD is 131153920
    via 23.0.0.3 (131153920/163840), Ethernet0/0
P 33.0.2.0/24, 1 successors, FD is 131153920
    via 23.0.0.3 (131153920/163840), Ethernet0/0
P 33.0.3.0/24, 1 successors, FD is 131153920
    via 23.0.0.3 (131153920/163840), Ethernet0/0
P 34.0.0.0/24, 1 successors, FD is 1800711958
    via 23.0.0.3 (1800711958/1735175958), Ethernet0/0
    via 43.0.0.4 (3045895958/1735175958), Serial2/3
P 43.0.0.0/24, 1 successors, FD is 1735175958
    via Connected, Serial2/3
P 44.0.1.0/24, 1 successors, FD is 1735257878
    via 43.0.0.4 (1735257878/163840), Serial2/3
P 44.0.2.0/24, 1 successors, FD is 1735257878
    via 43.0.0.4 (1735257878/163840), Serial2/3
P 44.0.3.0/24, 1 successors, FD is 1735257878
    via 43.0.0.4 (1735257878/163840), Serial2/3

Step 4   Analyze topology table and verify rules of DUAL

Rules of Diffusion Algorithm (DUAL)

1)     For a path to be even considering as a valid path its Advertise Distance (AD) should be less than 2 times current Feasible Distance (FD).

Valid path = AD < 2*current FD

Example:

(NOTE: On R3 Router there are 3 paths to reach 22.0.2.0/24 network: 1) Via 23.0.0.2, 2) Via 21.0.0.1, 3) via 34.0.0.4, but as seen below in the Topology Table of R3 there is only one path seen to reach 22.0.2.0/24 network.)

R3#show ip eigrp topology

P 22.0.2.0/24, 1 successors, FD is 131153920
    via 23.0.0.2 (131153920/163840), Ethernet0/0

(This is because of the rule that says "For a path to become a valid path its Advertised Distance (AD) should be less than 2 times current Feasible Distance (FD).
Valid path = AD < 2*current FD
As seen below in the Topology Table of R1 Router, its FD to reach 22.0.2.0/24 is 1735257878
This is the FD that R1 is advertising to R3 router, which becomes AD to Reach 22.0.2.0/24.

Now because this AD (1735257878) is not less than 2 times current FD    ( 2 X 131153920 = 262307840) hence it is not reflecting in the topology table.
Similarly path via 34.0.0.4 is also not reflecting.)

R1#show ip eigrp topology

P 22.0.2.0/24, 1 successors, FD is 1735257878
        via 12.0.0.2 (1735257878/163840), Serial2/0
        via 21.0.0.3 (1800793878/131153920), Serial2/3


2)     For a path to become Feasible Successor (FS) its Advertise Distance (AD) should be less than current Feasible Distance (FD)

FS = AD < current FD

Example:

(NOTE: On R1 Router there are 2 paths to reach 33.0.2.0/24 network: 1) Via 12.0.0.2, 2) Via 21.0.0.3,
As seen below in the Topology Table of R1 Router, path via 21.0.0.2 is successor, as its FD (2297856) is lower compared to the FD provided by path via 12.0.0.2

Now the 2nd path via 12.0.0.2 will considered as Feasible successor if it meets the following criteria  FS = AD < current FD

For a path to become Feasible Successor (FS) its Advertise Distance (AD) should be less than current Feasible Distance (FD)

Path Via 12.0.0.2 has AD 131153920 that is less than current FD 1735257878 hence is will be considered as FS. )


R1#show ip eigrp topology

P 33.0.3.0/24, 1 successors, FD is 1735257878
        via 21.0.0.3 (1735257878/163840), Serial2/3
        via 12.0.0.2 (1800793878/131153920), Serial2/0


Step 5  Verify that only best routes are reflecting in routing table

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 not set

```
        11.0.0.0/24 is subnetted, 3 subnets
D       11.0.1.0 [90/13556702] via 12.0.0.1, 00:17:35, Serial2/0
D       11.0.2.0 [90/13556702] via 12.0.0.1, 00:17:35, Serial2/0
D       11.0.3.0 [90/13556702] via 12.0.0.1, 00:17:35, Serial2/0
        12.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       12.0.0.0/24 is directly connected, Serial2/0
L       12.0.0.2/32 is directly connected, Serial2/0
        21.0.0.0/24 is subnetted, 1 subnets
D       21.0.0.0 [90/14068062] via 23.0.0.3, 00:17:35, Ethernet0/0
        22.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
C       22.0.1.0/24 is directly connected, Loopback1
L       22.0.1.2/32 is directly connected, Loopback1
C       22.0.2.0/24 is directly connected, Loopback2
L       22.0.2.2/32 is directly connected, Loopback2
C       22.0.3.0/24 is directly connected, Loopback3
L       22.0.3.2/32 is directly connected, Loopback3
        23.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       23.0.0.0/24 is directly connected, Ethernet0/0
L       23.0.0.2/32 is directly connected, Ethernet0/0
        33.0.0.0/24 is subnetted, 3 subnets
D       33.0.1.0 [90/1024640] via 23.0.0.3, 00:17:35, Ethernet0/0
D       33.0.2.0 [90/1024640] via 23.0.0.3, 00:17:35, Ethernet0/0
D       33.0.3.0 [90/1024640] via 23.0.0.3, 00:17:35, Ethernet0/0
        34.0.0.0/24 is subnetted, 1 subnets
D       34.0.0.0 [90/14068062] via 23.0.0.3, 00:17:35, Ethernet0/0
        43.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       43.0.0.0/24 is directly connected, Serial2/3
L       43.0.0.2/32 is directly connected, Serial2/3
        44.0.0.0/24 is subnetted, 3 subnets
D       44.0.1.0 [90/13556702] via 43.0.0.4, 00:17:35, Serial2/3
D       44.0.2.0 [90/13556702] via 43.0.0.4, 00:17:35, Serial2/3
D       44.0.3.0 [90/13556702] via 43.0.0.4, 00:17:35, Serial2/3
```

Step 6  Enter topology base mode for manipulation set & configure variance command in EIGRP process

```
R1:
router eigrp cisco
address-family ipv4 autonomous-system 100
 topology base
 variance 2
 exit
```

Step 7   Verify that multiple path are reflecting in routers routing table

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 not set

      11.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
C        11.0.1.0/24 is directly connected, Loopback1
L        11.0.1.1/32 is directly connected, Loopback1
C        11.0.2.0/24 is directly connected, Loopback2
L        11.0.2.1/32 is directly connected, Loopback2
C        11.0.3.0/24 is directly connected, Loopback3
L        11.0.3.1/32 is directly connected, Loopback3
      12.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        12.0.0.0/24 is directly connected, Serial2/0
L        12.0.0.1/32 is directly connected, Serial2/0
      21.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        21.0.0.0/24 is directly connected, Serial2/3
L        21.0.0.1/32 is directly connected, Serial2/3
      22.0.0.0/24 is subnetted, 3 subnets
D        22.0.1.0 [90/14068702] via 21.0.0.3, 00:00:11, Serial2/3
                  [90/13556702] via 12.0.0.2, 00:00:11, Serial2/0
D        22.0.2.0 [90/14068702] via 21.0.0.3, 00:00:11, Serial2/3
                  [90/13556702] via 12.0.0.2, 00:00:11, Serial2/0
D        22.0.3.0 [90/14068702] via 21.0.0.3, 00:00:11, Serial2/3
                  [90/13556702] via 12.0.0.2, 00:00:11, Serial2/0
      23.0.0.0/24 is subnetted, 1 subnets
D        23.0.0.0 [90/14068062] via 21.0.0.3, 00:00:11, Serial2/3
                  [90/14068062] via 12.0.0.2, 00:00:11, Serial2/0
      33.0.0.0/24 is subnetted, 3 subnets
D        33.0.1.0 [90/13556702] via 21.0.0.3, 00:00:11, Serial2/3
                  [90/14068702] via 12.0.0.2, 00:00:11, Serial2/0
D        33.0.2.0 [90/13556702] via 21.0.0.3, 00:00:11, Serial2/3
                  [90/14068702] via 12.0.0.2, 00:00:11, Serial2/0
D        33.0.3.0 [90/13556702] via 21.0.0.3, 00:00:11, Serial2/3
                  [90/14068702] via 12.0.0.2, 00:00:11, Serial2/0
      34.0.0.0/24 is subnetted, 1 subnets
D        34.0.0.0 [90/23796062] via 21.0.0.3, 00:00:11, Serial2/3
                  [90/24308062] via 12.0.0.2, 00:00:11, Serial2/0
      43.0.0.0/24 is subnetted, 1 subnets
D        43.0.0.0 [90/24308062] via 21.0.0.3, 00:00:11, Serial2/3

```
                 [90/23796062] via 12.0.0.2, 00:00:11, Serial2/0
            44.0.0.0/24 is subnetted, 3 subnets
D       44.0.1.0 [90/23796702] via 21.0.0.3, 00:00:11, Serial2/3
                 [90/23796702] via 12.0.0.2, 00:00:11, Serial2/0
D       44.0.2.0 [90/23796702] via 21.0.0.3, 00:00:11, Serial2/3
                 [90/23796702] via 12.0.0.2, 00:00:11, Serial2/0
D       44.0.3.0 [90/23796702] via 21.0.0.3, 00:00:11, Serial2/3
                 [90/23796702] via 12.0.0.2, 00:00:11, Serial2/0
```