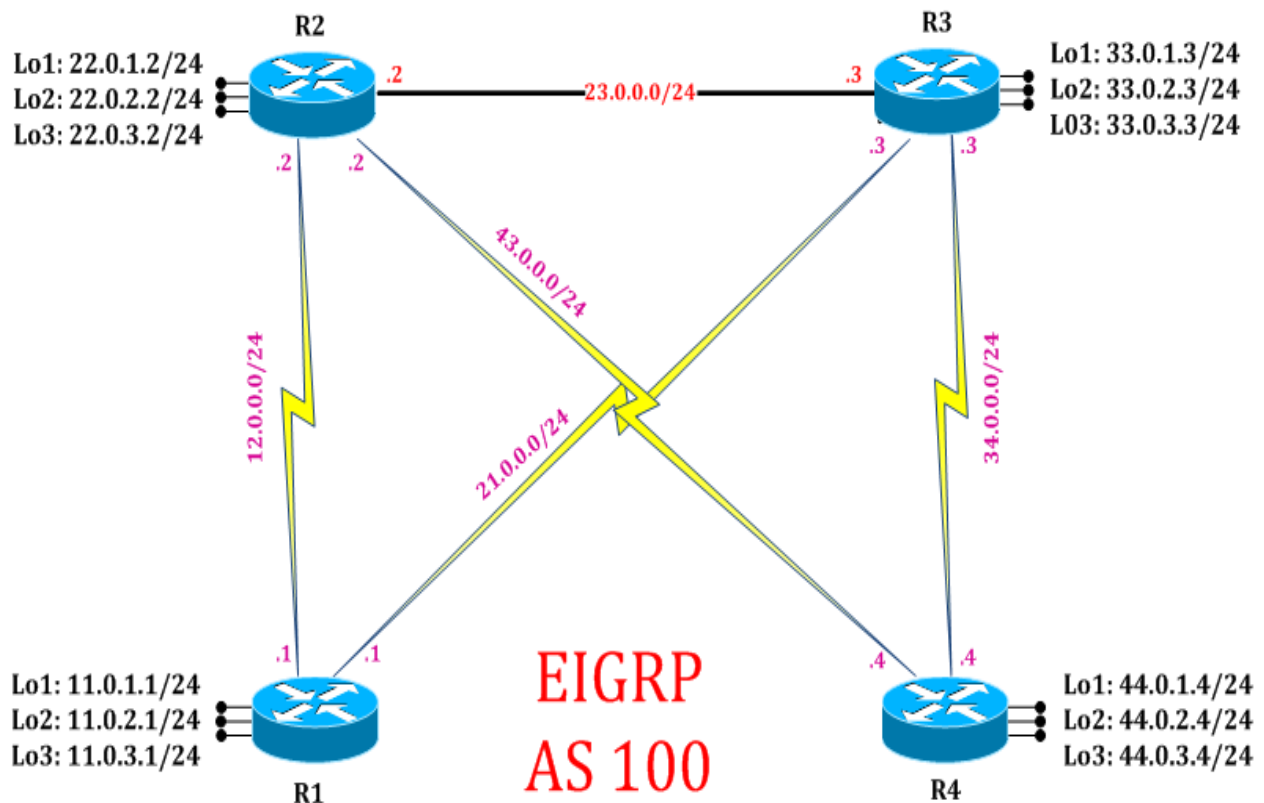# LAB15: EIGRP – IPv4

Disclaimer

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LAB 15: Diagram

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

LAB 15: EIGRP Load balancing and Variance

Task 1: Configure EIGRP Load balancing and variance

Step 1   Configure redundant path between two routers

R1:
interface Serial 2/0
ip address 12.0.0.1 255.255.255.0
no shutdown
interface Serial 2/3
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 Ethernet 0/0
ip address 23.0.0.2 255.255.255.0
no shutdown
interface Serial 2/0
ip address 12.0.0.2 255.255.255.0
no shutdown
interface Serial 2/3
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 Ethernet 0/0
ip address 23.0.0.3 255.255.255.0
no shutdown
interface Serial 2/0
ip address 34.0.0.3 255.255.255.0
no shutdown
interface Serial 2/3

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 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 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 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 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 Dual Diffusion algorithm's rule:

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 409600
         via 23.0.0.2 (409600/128256), 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 2297856.
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 (2297856) is not less than 2 times current FD (2 X 409600 = 819200) 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 33.0.2.0/24, 1 successors, FD is 2297856
           via 21.0.0.3 (2297856/128256), Serial2/3
           via 12.0.0.2 (2323456/409600), Serial2/0

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 409600 that is less than current FD 2297856 hence is will be considered as FS.)

R1#show ip eigrp topology

P 33.0.2.0/24, 1 successors, FD is 2297856
     via 21.0.0.3 (2297856/128256), Serial2/3
     via 12.0.0.2 (2323456/409600), Serial2/0

Step 4 Verify that only best routes are reflecting in routing table.

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 not set

       11.0.0.0/24 is subnetted, 3 subnets
D   11.0.1.0 [90/2297856] via 21.0.0.1, 03:53:18, Serial2/3
D   11.0.2.0 [90/2297856] via 21.0.0.1, 03:53:18, Serial2/3
D   11.0.3.0 [90/2297856] via 21.0.0.1, 03:53:18, Serial2/3
       12.0.0.0/24 is subnetted, 1 subnets
D   12.0.0.0 [90/2195456] via 23.0.0.2, 03:53:17, Ethernet0/0
       21.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C   21.0.0.0/24 is directly connected, Serial2/3
L   21.0.0.3/32 is directly connected, Serial2/3
       22.0.0.0/24 is subnetted, 3 subnets
D   22.0.1.0 [90/409600] via 23.0.0.2, 03:53:18, Ethernet0/0
D   22.0.2.0 [90/409600] via 23.0.0.2, 03:53:18, Ethernet0/0
D   22.0.3.0 [90/409600] via 23.0.0.2, 03:53:18, Ethernet0/0
       23.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C   23.0.0.0/24 is directly connected, Ethernet0/0
L   23.0.0.3/32 is directly connected, Ethernet0/0
       33.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
C   33.0.1.0/24 is directly connected, Loopback1
L   33.0.1.3/32 is directly connected, Loopback1
C   33.0.2.0/24 is directly connected, Loopback2
L   33.0.2.3/32 is directly connected, Loopback2
C   33.0.3.0/24 is directly connected, Loopback3
L   33.0.3.3/32 is directly connected, Loopback3
       34.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C   34.0.0.0/24 is directly connected, Serial2/0
L   34.0.0.3/32 is directly connected, Serial2/0
       43.0.0.0/24 is subnetted, 1 subnets
D   43.0.0.0 [90/2195456] via 23.0.0.2, 03:57:46, Ethernet0/0
       44.0.0.0/24 is subnetted, 3 subnets
D   44.0.1.0 [90/2297856] via 34.0.0.4, 03:57:47, Serial2/0
D   44.0.2.0 [90/2297856] via 34.0.0.4, 03:57:47, Serial2/0
D   44.0.3.0 [90/2297856] via 34.0.0.4, 03:57:47, Serial2/0

R3:
router eigrp 100
variance 2
exit

(EIGRP supports Unequal Metric Path Load Balancing with the help of Variance.)

Step 5 Verify that multiple path are reflecting in routers routing table

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 not set

      11.0.0.0/24 is subnetted, 3 subnets
D   11.0.1.0 [90/2323456] via 23.0.0.2, 00:00:07, Ethernet0/0
             [90/2297856] via 21.0.0.1, 00:00:07, Serial2/3
D   11.0.2.0 [90/2323456] via 23.0.0.2, 00:00:07, Ethernet0/0
             [90/2297856] via 21.0.0.1, 00:00:07, Serial2/3
D   11.0.3.0 [90/2323456] via 23.0.0.2, 00:00:07, Ethernet0/0
             [90/2297856] via 21.0.0.1, 00:00:07, Serial2/3
      12.0.0.0/24 is subnetted, 1 subnets
D   12.0.0.0 [90/3193856] via 34.0.0.4, 00:00:07, Serial2/0
             [90/2195456] via 23.0.0.2, 00:00:07, Ethernet0/0
             [90/2681856] via 21.0.0.1, 00:00:07, Serial2/3
      21.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C   21.0.0.0/24 is directly connected, Serial2/3
L   21.0.0.3/32 is directly connected, Serial2/3
      22.0.0.0/24 is subnetted, 3 subnets
D   22.0.1.0 [90/409600] via 23.0.0.2, 00:00:07, Ethernet0/0
D   22.0.2.0 [90/409600] via 23.0.0.2, 00:00:07, Ethernet0/0
D   22.0.3.0 [90/409600] via 23.0.0.2, 00:00:07, Ethernet0/0
      23.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C   23.0.0.0/24 is directly connected, Ethernet0/0
L   23.0.0.3/32 is directly connected, Ethernet0/0
      33.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
C   33.0.1.0/24 is directly connected, Loopback1
L   33.0.1.3/32 is directly connected, Loopback1
C   33.0.2.0/24 is directly connected, Loopback2
L   33.0.2.3/32 is directly connected, Loopback2
C   33.0.3.0/24 is directly connected, Loopback3

L   33.0.3.3/32 is directly connected, Loopback3
        34.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C   34.0.0.0/24 is directly connected, Serial2/0
L   34.0.0.3/32 is directly connected, Serial2/0
        43.0.0.0/24 is subnetted, 1 subnets
D   43.0.0.0 [90/2681856] via 34.0.0.4, 00:00:07, Serial2/0
             [90/2195456] via 23.0.0.2, 00:00:07, Ethernet0/0
             [90/3193856] via 21.0.0.1, 00:00:07, Serial2/3
        44.0.0.0/24 is subnetted, 3 subnets
D   44.0.1.0 [90/2297856] via 34.0.0.4, 00:00:07, Serial2/0
             [90/2323456] via 23.0.0.2, 00:00:07, Ethernet0/0
D   44.0.2.0 [90/2297856] via 34.0.0.4, 00:00:07, Serial2/0
             [90/2323456] via 23.0.0.2, 00:00:07, Ethernet0/0
D   44.0.3.0 [90/2297856] via 34.0.0.4, 00:00:07, Serial2/0
             [90/2323456] via 23.0.0.2, 00:00:07, Ethernet0/0

(Variance commands will set the benchmark and EIGRP Routers will Load Balancing the traffic between the paths within that benchmark which is reflected in router's routing table.)