

LAB15: EIGRP – IPv4

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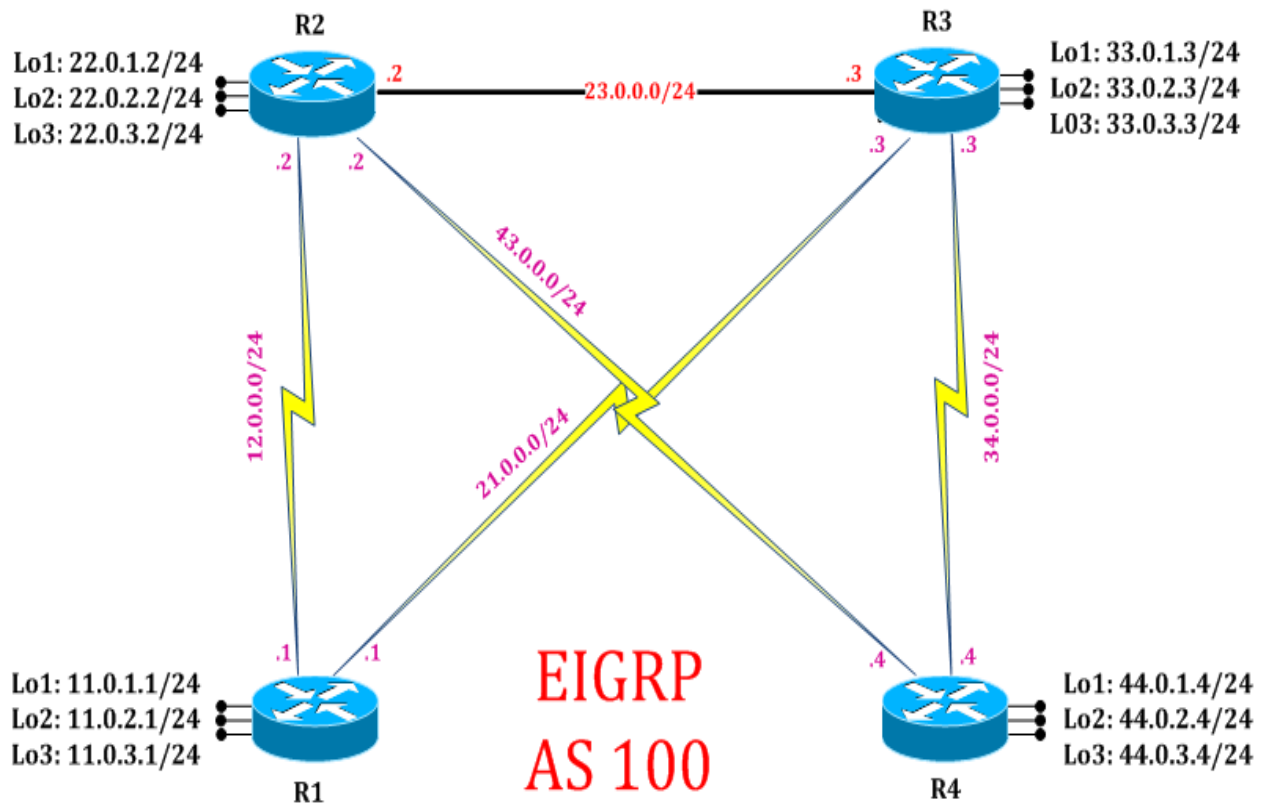
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EIGRP: Load Balancing

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LAB 15: Diagram

Note: This Lab was developed on Cisco IOS Version 15.2(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 = $AD < 2 * \text{current FD}$

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).

$$\text{Valid path} = \text{AD} < 2 * \text{current FD}$$

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)

$$\text{FS} = \text{AD} < \text{current FD}$$

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

$$\text{FS} = \text{AD} < \text{current FD}$$

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

```

```

R1:
router eigrp 100
variance 2
exit

```

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

Step 3 Verify that multiple path are reflecting in routers routing table

```
R2#show ip route
```

```

EIGRP-IPv4 Topology Table for AS(100)/ID(11.0.3.1)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

```

```

P 11.0.2.0/24, 1 successors, FD is 128256
   via Connected, Loopback2
P 11.0.1.0/24, 1 successors, FD is 128256
   via Connected, Loopback1
P 21.0.0.0/24, 1 successors, FD is 2169856
   via Connected, Serial2/3
P 22.0.1.0/24, 2 successors, FD is 2297856
   via 12.0.0.2 (2297856/128256), Serial2/0
   via 21.0.0.3 (2323456/409600), Serial2/3
P 34.0.0.0/24, 2 successors, FD is 2681856
   via 21.0.0.3 (2681856/2169856), Serial2/3
   via 12.0.0.2 (2707456/2195456), Serial2/0
P 22.0.2.0/24, 2 successors, FD is 2297856
   via 12.0.0.2 (2297856/128256), Serial2/0
   via 21.0.0.3 (2323456/409600), Serial2/3
P 12.0.0.0/24, 1 successors, FD is 2169856
   via Connected, Serial2/0
P 22.0.3.0/24, 2 successors, FD is 2297856
   via 12.0.0.2 (2297856/128256), Serial2/0
   via 21.0.0.3 (2323456/409600), Serial2/3
P 23.0.0.0/24, 2 successors, FD is 2195456
   via 12.0.0.2 (2195456/281600), Serial2/0
   via 21.0.0.3 (2195456/281600), Serial2/3

```


P 44.0.2.0/24, 2 successors, FD is 2809856
via 12.0.0.2 (2809856/2297856), Serial2/0
via 21.0.0.3 (2809856/2297856), Serial2/3
P 44.0.3.0/24, 2 successors, FD is 2809856
via 12.0.0.2 (2809856/2297856), Serial2/0
via 21.0.0.3 (2809856/2297856), Serial2/3
P 33.0.2.0/24, 2 successors, FD is 2297856
via 21.0.0.3 (2297856/128256), Serial2/3
via 12.0.0.2 (2323456/409600), Serial2/0
P 33.0.1.0/24, 2 successors, FD is 2297856
via 21.0.0.3 (2297856/128256), Serial2/3
via 12.0.0.2 (2323456/409600), Serial2/0
P 33.0.3.0/24, 2 successors, FD is 2297856
via 21.0.0.3 (2297856/128256), Serial2/3
via 12.0.0.2 (2323456/409600), Serial2/0
P 43.0.0.0/24, 2 successors, FD is 2681856
via 12.0.0.2 (2681856/2169856), Serial2/0
via 21.0.0.3 (2707456/2195456), Serial2/3
P 44.0.1.0/24, 2 successors, FD is 2809856
via 12.0.0.2 (2809856/2297856), Serial2/0
via 21.0.0.3 (2809856/2297856), Serial2/3
P 11.0.3.0/24, 1 successors, FD is 128256
via Connected, Loopback3

(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.)