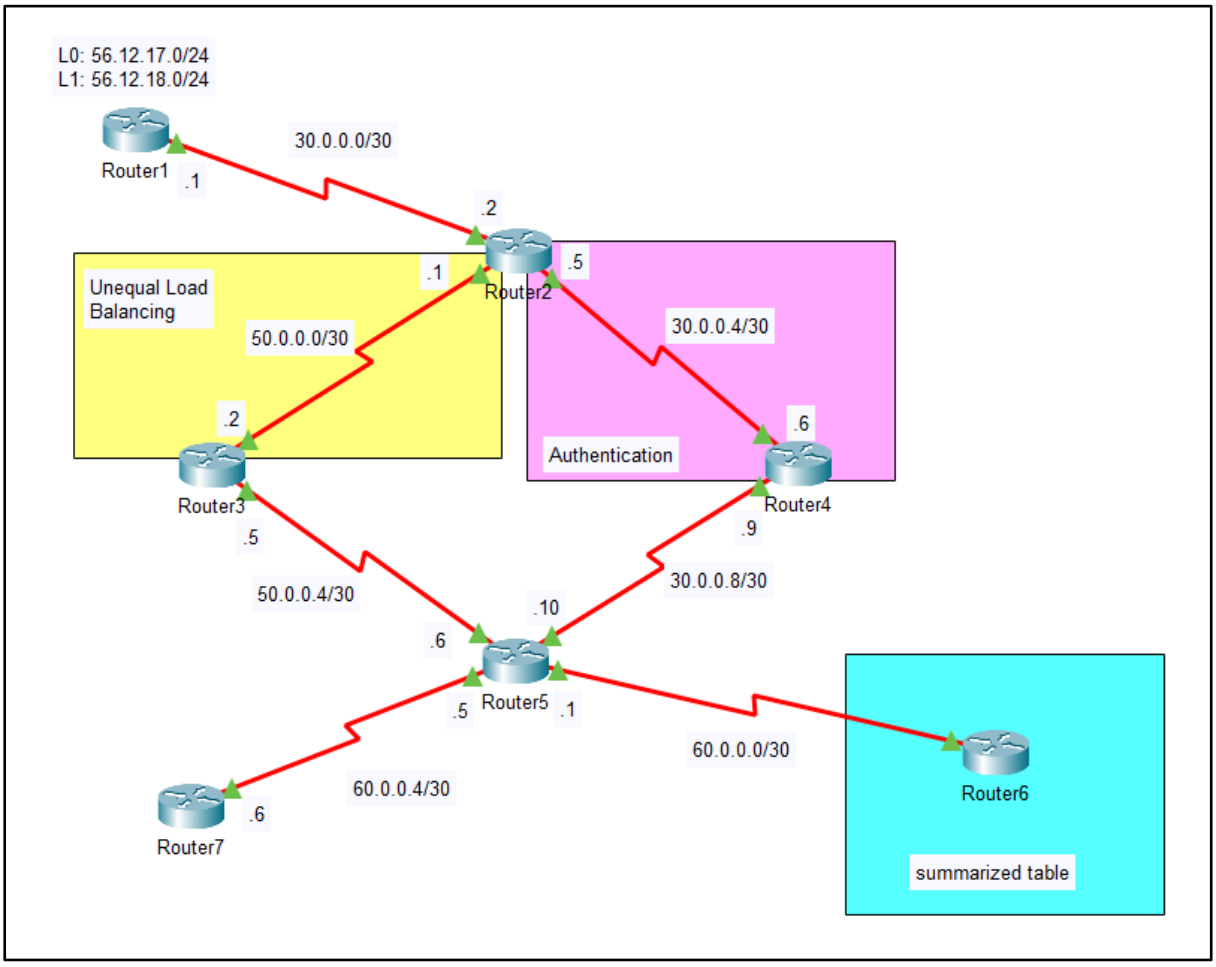
EIGRP routing project



Objective

The objective of this project is to design and implement an EIGRP-based routing environment to demonstrate key advanced routing concepts, including manual route summarization, EIGRP authentication, and unequal load balancing. The project focuses on controlling route advertisement, securing router adjacencies, and optimizing traffic flow through metric manipulation and variance, using a loopback-based topology to emphasize routing behaviour over end-host connectivity.

1. Configure Router IP

Router1:

R1> en

R1# conf t

```
R1(config)# int l0
R1(config-if)# ip addr 56.12.17.1 255.255.255.0
R1(config-if)# int l1
R1(config-if)# ip addr 56.12.18.1 255.255.255.0
R1(config-if)# int s 0/1/0
R1(config-if)# ip addr 30.0.0.1 255.255.255.252
R1(config-if)# no shut
ctrl+z
wr
```

Router2:

```
R2> en
R2# conf t
R2(config)# int s 0/1/0
R2(config-if)# ip addr 30.0.0.2 255.255.255.252
R2(config-if)# no shut
R2(config-if)# int s 0/2/0
R2(config-if)# ip addr 30.0.0.5 255.255.255.252
R2(config-if)# no shut
R2(config-if)# int s 0/2/1
R2(config-if)# ip addr 50.0.0.1 255.255.255.252
R2(config-if)# no shut
ctrl+z
wr
```

Router3

```
R3> en
R3# conf t
R3(config)# int s 0/1/0
R3(config-if)# ip addr 50.0.0.2 255.255.255.252
R3(config-if)# no shut
R3(config-if)# int s 0/1/1
R3(config-if)# ip addr 50.0.0.5 255.255.255.252
R3(config-if)# no shut
ctrl+z
wr
```

Router4

```
R4> en
R4# conf t
R4(config)# int s 0/1/0
R4(config-if)# ip addr 30.0.0.6 255.255.255.252
R4(config-if)# no shut
```

R4(config-if)# int s 0/1/1
R4(config-if)# ip addr 30.0.0.9 255.255.255.252
R4(config-if)# no shut
ctrl+z
wr

Router5

R5> en
R5# conf t
R5(config)# int s 0/1/0
R5(config-if)# ip addr 30.0.0.10 255.255.255.252
R5(config-if)# no shut
R5(config-if)# int s 0/1/1
R5(config-if)# ip addr 50.0.0.6 255.255.255.252
R5(config-if)# no shut
R5(config-if)# int s 0/2/0
R5(config-if)# ip addr 60.0.0.1 255.255.255.252
R5(config-if)# no shut
R5(config-if)# int s 0/2/1
R5(config-if)# ip addr 60.0.0.5 255.255.255.252
R5(config-if)# no shut
ctrl+z
wr

Router6

R6> en
R6# conf t
R6(config)# int s 0/1/0
R6(config-if)# ip addr 60.0.0.2 255.255.255.252
R6(config-if)# no shut
ctrl+z
wr

Router7

R7> en
R7# conf t
R7(config)# int s 0/1/0
R7(config-if)# ip addr 60.0.0.6 255.255.255.252
R7(config-if)# no shut
ctrl+z
wr

2. EIGRP Configuration

Router1:

```
R1(config)# router eigrp 1
R1(config-router)# eigrp router-id 1.1.1.1
R1(config-router)# network 56.12.17.0 0.0.0.255
R1(config-router)# network 56.12.18.0 0.0.0.255
R1(config-router)# network 30.0.0.0 0.0.0.3
R1(config-router)# no auto-summary
ctrl+z
wr
```

Router2:

```
R2(config)# router eigrp 1
R2(config-router)# eigrp router-id 2.2.2.2
R2(config-router)# network 30.0.0.0 0.0.0.3
R2(config-router)# network 30.0.0.4 0.0.0.3
R2(config-router)# network 50.0.0.0 0.0.0.3
R2(config-router)# no auto-summary
ctrl+z
wr
```

Router3:

```
R3(config)# router eigrp 1
R3(config-router)# eigrp router-id 3.3.3.3
R3(config-router)# network 50.0.0.0 0.0.0.3
R3(config-router)# network 50.0.0.4 0.0.0.3
R3(config-router)# no auto-summary
ctrl+z
wr
```

Router4:

```
R4(config)# router eigrp 1
R4(config-router)# eigrp router-id 4.4.4.4
R4(config-router)# network 30.0.0.4 0.0.0.3
R4(config-router)# network 30.0.0.8 0.0.0.3
R4(config-router)# no auto-summary
ctrl+z
wr
```

Router5:

```
R5(config)# router eigrp 1
R5(config-router)# eigrp router-id 5.5.5.5
R5(config-router)# network 30.0.0.8 0.0.0.3
```

```
R5(config-router)# network 50.0.0.4 0.0.0.3
R5(config-router)# network 60.0.0.0 0.0.0.3
R5(config-router)# network 60.0.0.4 0.0.0.3
R5(config-router)# no auto-summary
ctrl+z
wr
```

Router6:

```
R6(config)# router eigrp 1
R6(config-router)# eigrp router-id 6.6.6.6
R6(config-router)# network 60.0.0.0 0.0.0.3
R6(config-router)# no auto-summary
ctrl+z
wr
```

Router7:

```
R7(config)# router eigrp 1
R7(config-router)# eigrp router-id 7.7.7.7
R7(config-router)# network 60.0.0.4 0.0.0.3
R7(config-router)# no auto-summary
ctrl+z
wr
```

3. Manual Route Summarization

We will perform route summarization on the outbound link in with we want to see the change. Like in this scenario I want R6 to have smaller routing table, after route summarization, we will compare it with R7.

Router5:

```
R5(config)# int s 0/2/0
R5(config-if)# ip summary-address eigrp 1 56.12.16.0 255.255.252.0
R5(config-if)# ip summary-address eigrp 1 30.0.0.0 255.255.255.240
R5(config-if)# ip summary-address eigrp 1 50.0.0.0 255.255.255.248
R5(config-if)# ip summary-address eigrp 1 60.0.0.0 255.255.255.248
ctrl+z
wr
```

Verification

Router7: Routing table without manual summarization.

```
Router>sh 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, E - EGP
       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

     30.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
D       30.0.0.0/8 [90/3705856] via 60.0.0.5, 02:16:49, Serial0/1/0
D       30.0.0.0/30 [90/3705856] via 60.0.0.5, 02:16:49, Serial0/1/0
D       30.0.0.4/30 [90/3193856] via 60.0.0.5, 02:16:51, Serial0/1/0
D       30.0.0.8/30 [90/2681856] via 60.0.0.5, 02:16:51, Serial0/1/0
     50.0.0.0/30 is subnetted, 2 subnets
D       50.0.0.0/30 [90/3193856] via 60.0.0.5, 02:16:49, Serial0/1/0
D       50.0.0.4/30 [90/2681856] via 60.0.0.5, 02:16:50, Serial0/1/0
     56.0.0.0/24 is subnetted, 2 subnets
D       56.12.17.0/24 [90/3833856] via 60.0.0.5, 02:16:49, Serial0/1/0
D       56.12.18.0/24 [90/3833856] via 60.0.0.5, 02:16:49, Serial0/1/0
     60.0.0.0/8 is variably subnetted, 4 subnets, 3 masks
D       60.0.0.0/8 [90/3705856] via 60.0.0.5, 02:16:49, Serial0/1/0
D       60.0.0.0/30 [90/2681856] via 60.0.0.5, 02:16:53, Serial0/1/0
C       60.0.0.4/30 is directly connected, Serial0/1/0
L       60.0.0.6/32 is directly connected, Serial0/1/0
```

Router6: The routing table has got smaller compare to R7.

```
Router>sh 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, E - EGP
       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

     30.0.0.0/28 is subnetted, 1 subnets
D       30.0.0.0/28 [90/2681856] via 60.0.0.1, 00:01:54, Serial0/1/0
     50.0.0.0/29 is subnetted, 1 subnets
D       50.0.0.0/29 [90/2681856] via 60.0.0.1, 00:01:54, Serial0/1/0
     56.0.0.0/22 is subnetted, 1 subnets
D       56.12.16.0/22 [90/2681856] via 60.0.0.1, 00:01:52, Serial0/1/0
     60.0.0.0/8 is variably subnetted, 3 subnets, 3 masks
D       60.0.0.0/29 [90/2681856] via 60.0.0.1, 00:01:54, Serial0/1/0
C       60.0.0.0/30 is directly connected, Serial0/1/0
L       60.0.0.2/32 is directly connected, Serial0/1/0
```

4. Authentication

Router Authentication between R2 and R4.

Router2:
R2(config)# key chain R2_Auth
R2(config-keychain)# key 1
R2(config-keychain-key)# key-string pass@123
R2(config-keychain-key)# exit
R2(config-keychain)# exit
R2(config)# int s 0/2/0
R2(config-if)# ip authentication key-chain eigrp 1 R2_Auth
R2(config-if)# ip authentication mode eigrp 1 md5
ctrl+z
wr

```
%DUAL-5-NBRCHANGE: IP-EIGRP(0) 1: Neighbor 30.0.0.5 (Serial0/1/0) is down: authentication mode
changed
```

Router4:
R4(config)# key chain R4_Auth
R4(config-keychain)# key 1
R4(config-keychain-key)# key-string pass@123
R4(config-keychain-key)# exit
R4(config-keychain)# exit
R4(config)# int s 0/1/0
R4(config-if)# ip authentication key-chain eigrp 1 R4_Auth
R4(config-if)# ip authentication mode eigrp 1 md5
ctrl+z
wr

```
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 30.0.0.5 (Serial0/1/0) is up: new adjacency
```

Verification

Use commands like:
“show ip eigrp neighbor” OR “show run”

Router2:
R2# show ip eigrp neighbor

```
Router#sh ip eigrp neighbors
IP-EIGRP neighbors for process 1
H   Address         Interface       Hold Uptime    SRTT   RTO   Q   Seq
                                    (sec)          (ms)       Cnt Num
0   30.0.0.1        Se0/1/0         13   00:15:51  40     1000  0   34
1   50.0.0.2        Se0/2/1         13   00:15:51  40     1000  0   42
2   30.0.0.6        Se0/2/0         14   00:02:20  40     1000  0   64
```

R2# show run

```
interface Serial0/2/0
 ip address 30.0.0.5 255.255.255.252
 ip authentication mode eigrp 1 md5
 ip authentication key-chain eigrp 1 R2_Auth
!
```

Router4:

R4# show ip eigrp neighbor

```
Router#sh ip eigrp nei
IP-EIGRP neighbors for process 1
H   Address         Interface       Hold Uptime    SRTT   RTO   Q   Seq
                                    (sec)          (ms)       Cnt Num
0   30.0.0.10       Se0/1/1         11   00:05:55  40     1000  0   39
1   30.0.0.5        Se0/1/0         13   00:01:18  40     1000  0   29
```

R4# show run

```
interface Serial0/1/0
 ip address 30.0.0.6 255.255.255.252
 ip authentication mode eigrp 1 md5
 ip authentication key-chain eigrp 1 R4_Auth
 clock rate 2000000
!
```

5. Unequal Load Balance

Unequal Load Balancing at Router2 between authenticated and alternate paths

Router2:

R2(config)# int s 0/2/1

R2(config-if)# delay 20000

ctrl+z

wr

Router3:
R3(config)# int s 0/1/0
R3(config-if)# delay 20000
ctrl+z
wr

After this the topology table of Router2 will look like:

```
Router#sh ip eigrp topology
IP-EIGRP Topology Table for AS 1/ID(2.2.2.2)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - Reply status

P 30.0.0.0/8, 1 successors, FD is 4217856
         via 30.0.0.6 (4217856/3705856), Serial0/2/0
         via 50.0.0.2 (7801856/2681856), Serial0/2/1
P 30.0.0.0/30, 1 successors, FD is 2169856
         via Connected, Serial0/1/0
P 30.0.0.4/30, 1 successors, FD is 2169856
         via Connected, Serial0/2/0
P 30.0.0.8/30, 1 successors, FD is 2681856
         via 30.0.0.6 (2681856/2169856), Serial0/2/0
P 50.0.0.0/30, 1 successors, FD is 6777856
         via Connected, Serial0/2/1
P 50.0.0.4/30, 1 successors, FD is 3193856
         via 30.0.0.6 (3193856/2681856), Serial0/2/0
         via 50.0.0.2 (7289856/2169856), Serial0/2/1
P 56.12.17.0/24, 1 successors, FD is 2297856
         via 30.0.0.1 (2297856/128256), Serial0/1/0
P 56.12.18.0/24, 1 successors, FD is 2297856
         via 30.0.0.1 (2297856/128256), Serial0/1/0
P 60.0.0.0/8, 1 successors, FD is 4217856
         via 30.0.0.6 (4217856/3705856), Serial0/2/0
         via 50.0.0.2 (7801856/2681856), Serial0/2/1
P 60.0.0.0/30, 1 successors, FD is 3193856
         via 30.0.0.6 (3193856/2681856), Serial0/2/0
         via 50.0.0.2 (7801856/2681856), Serial0/2/1
P 60.0.0.4/30, 1 successors, FD is 3193856
         via 30.0.0.6 (3193856/2681856), Serial0/2/0
         via 50.0.0.2 (7801856/2681856), Serial0/2/1
```

After increasing the delay on the alternate path, the authenticated path became the EIGRP successor. The topology table confirms this by showing the lowest Feasible Distance (FD) on the authenticated link.

Router2:
R2(config)# router eigrp 1
R2(config-router)# variance 2
ctrl+z

wr

Verification

Router2:

```
Router#sh 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, E - EGP
       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

     30.0.0.0/8 is variably subnetted, 6 subnets, 3 masks
D       30.0.0.0/8 [90/4217856] via 30.0.0.6, 00:00:23, Serial0/2/0
                   [90/7801856] via 50.0.0.2, 00:00:24, Serial0/2/1
C       30.0.0.0/30 is directly connected, Serial0/1/0
L       30.0.0.2/32 is directly connected, Serial0/1/0
C       30.0.0.4/30 is directly connected, Serial0/2/0
L       30.0.0.5/32 is directly connected, Serial0/2/0
D       30.0.0.8/30 [90/2681856] via 30.0.0.6, 00:00:23, Serial0/2/0
     50.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       50.0.0.0/30 is directly connected, Serial0/2/1
L       50.0.0.1/32 is directly connected, Serial0/2/1
D       50.0.0.4/30 [90/3193856] via 30.0.0.6, 00:00:23, Serial0/2/0
     56.0.0.0/24 is subnetted, 2 subnets
D       56.12.17.0/24 [90/2297856] via 30.0.0.1, 00:00:22, Serial0/1/0
D       56.12.18.0/24 [90/2297856] via 30.0.0.1, 00:00:22, Serial0/1/0
     60.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
D       60.0.0.0/8 [90/4217856] via 30.0.0.6, 00:00:23, Serial0/2/0
                   [90/7801856] via 50.0.0.2, 00:00:24, Serial0/2/1
D       60.0.0.0/30 [90/3193856] via 30.0.0.6, 00:00:23, Serial0/2/0
D       60.0.0.4/30 [90/3193856] via 30.0.0.6, 00:00:23, Serial0/2/0
```

After applying the variance command, unequal load balancing is achieved, allowing traffic to be distributed across both paths while favoring the preferred path.