CCNA Packet Tracer Lab Understanding EIGRP

This CCNA Packet Tracer lab has been provided to help you gain a better understanding of how to configure and troubleshoot EIGRP. In this lab we will configure a basic lab topology, enable EIGRP on the routers and configure them to advertise and summaries their subnet. We will also learn to use Cisco IOS show and debug commands to verify and troubleshoot our lab.

EIGRP (Enhanced Interior Gateway Routing Protocol) is a network protocol that allows routers exchange information more efficiently than earlier network protocols. EIGRP evolved from IGRP (Interior Gateway Routing Protocol) and routers using either EIGRP or IGRP can interoperate because the metric used with one protocol can be translated into the metrics of the other protocol.

EIGRP router keeps a local copy of its neighbor's routing tables. If it can't find a route to a destination in one of these tables, it queries its neighbors for a route and they in turn query their neighbors until a route is found. When a routing table entry changes in one of the routers, it notifies its neighbors of the change only. In addition to the routing tables maintained on the router EIGRP keeps a Topology Table. The topology table stores routes that it has learned from neighbor routing tables. Unlike a routing table, the topology table does not store all routes, but only routes that have been determined by EIGRP. The topology table also records the metrics for each of the listed EIGRP routes, the feasible successor and the successors. Routes in the topology table are marked as "passive" or "active".

* Passive indicates that EIGRP has determined the path for the specific route and has finished processing.
* Active indicates that EIGRP is still trying to calculate the best path for the specific route.

Routes in the topology table are not usable by the router until they are inserted into the routing table. The topology table is never used by the router to forward traffic. Routes in the topology table will not be inserted into the routing table if they are active, are a feasible successor, or have a higher administrative distance than an equivalent path.

To keep all routers aware of the state of neighbors, each router sends out a periodic "hello" packet. A router from which no "hello" packet has been received in a certain period of time is assumed to be inoperative.

EIGRP uses the Diffusing-Update Algorithm (DUAL) to determine the most efficient (least cost) route to a destination. A DUAL finite state machine contains decision information used by the algorithm to determine the least-cost route (which considers distance and whether a destination path is loop-free).

# Learning Objectives:

* Review basic router and switch configuration.
* Enable EIGRP on a router.
* Advertise networks using EIGRP.
* Disable EIGRP automatically summarizes
* Configure Passive Interfaces.
* Summarizing Routes with EIGRP.
* Verify EIGRP configuration.
* Use debug to verify EIGRP updates

# Tasks:

### Basic Configuration:

1. Configure the hostnames on all routers as illustrated in the topology.
2. Configure the hostnames on all switches as illustrated in the topology.
3. Configure no domain-lookup on all routers and switches.

### LAN Configuration:

1. Assign IP address and subnet to GigabitEthernet interfaces of R1 and R3 as illustrated in the topology.
2. Insure GigabitEthernet interfaces are not administratively down.

### WAN Configuration:

1. Assign IP address and subnet to serial interfaces of R1, R2 and R3 as illustrated in the topology.
2. Configure R2 interface Serial0/0/0 and Serial0/0/1 as DCE to provide clocking to R1 and R3 at a clock speed of 2Mbps.
3. Insure Serial interfaces are not administratively down.
4. Use ping On R2 insure connectivity to routers R1 and R3.

**R2#ping 10.0.0.1**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 5/6/8 ms

**R3#ping 10.0.0.5**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.5, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 2/6/8 ms

## EIGRP Configuration:

1. Enable EIGRP 10 on all routers.
2. Advertise subnet on all routers

## Verification:

Now that we have a simple EIGRP topology configures let’s use some of the Cisco show commands to verify our configuration as well as gain a better understanding of their output.

1. Enter the show ip protocols command on all routers.

**R1#show ip protocols**

Routing Protocol is "eigrp 10 "

 Outgoing update filter list for all interfaces is not set

 Incoming update filter list for all interfaces is not set

 Default networks flagged in outgoing updates

 Default networks accepted from incoming updates

 EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0

 EIGRP maximum hopcount 100

 EIGRP maximum metric variance 1

Redistributing: eigrp 10

 Automatic network summarization is in effect

 Automatic address summarization:

 Maximum path: 4

 Routing for Networks:

 10.0.0.0

 Routing Information Sources:

 Gateway Distance Last Update

 10.0.0.2 90 5410

 10.0.0.6 90 6194

 Distance: internal 90 external 170

**R2#show ip protocols**

Routing Protocol is "eigrp 10 "

 Outgoing update filter list for all interfaces is not set

 Incoming update filter list for all interfaces is not set

 Default networks flagged in outgoing updates

 Default networks accepted from incoming updates

 EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0

 EIGRP maximum hopcount 100

 EIGRP maximum metric variance 1

Redistributing: eigrp 10

 Automatic network summarization is in effect

 Automatic address summarization:

 10.0.0.0/8 for GigabitEthernet0/0

 Summarizing with metric 2169856

 172.16.0.0/16 for Serial0/0/0

 Summarizing with metric 2816

 Maximum path: 4

 Routing for Networks:

 172.16.1.0/24

 10.0.0.0

 Routing Information Sources:

 Gateway Distance Last Update

 10.0.0.1 90 5410

 Distance: internal 90 external 170

**R3#show ip protocols**

Routing Protocol is "eigrp 10 "

 Outgoing update filter list for all interfaces is not set

 Incoming update filter list for all interfaces is not set

 Default networks flagged in outgoing updates

 Default networks accepted from incoming updates

 EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0

 EIGRP maximum hopcount 100

 EIGRP maximum metric variance 1

Redistributing: eigrp 10

 Automatic network summarization is in effect

 Automatic address summarization:

 10.0.0.0/8 for GigabitEthernet0/0

 Summarizing with metric 2169856

 Maximum path: 4

 Routing for Networks:

 10.0.0.0

 192.168.3.0

 Routing Information Sources:

 Gateway Distance Last Update

 10.0.0.5 90 6194

 Distance: internal 90 external 170

**Note:** from the above outputs we can determine a number of things.

* What routing protocol is being used and in what AS.
* That automatic network summarization is enabled.
* What network are being summarized and with what metric.
* What subnets are part of the routing process.
* What the next hop is
* What the administrative distance is.
1. Enter the show ip route eigrp on R2.

**R2#show ip route eigrp**

 10.0.0.0/8 is variably subnetted, 4 subnets, 3 masks

D 10.0.0.0/8 is a summary, 01:21:29, Null0

D 10.0.0.4/30 [90/2681856] via 10.0.0.1, 01:21:29, Serial0/0/0

 172.16.0.0/16 is variably subnetted, 3 subnets, 3 masks

D 172.16.0.0/16 is a summary, 01:21:29, Null0

D 192.168.3.0/24 [90/2682112] via 10.0.0.1, 01:18:28, Serial0/0/0

Note: the above output shows EIGRP path information, administrative distance and metric.

1. Enter the show ip eigrp neighbors command on R1.

 **R1#show ip eigrp neighbors**

IP-EIGRP neighbors for process 10

H Address Interface Hold Uptime SRTT RTO Q Seq

 (sec) (ms) Cnt Num

0 10.0.0.2 Se0/0/0 14 01:17:24 40 1000 0 8

1 10.0.0.6 Se0/0/1 13 01:17:23 40 1000 0 8

**Note:** the above output displays the following useful information.

* What eigrp AS process is being used.
* The IP addresses of the connected routers.
* What interface is being used.
* What the hold time is. You will find this useful in future labs when we adjust the EIGRP hold timer.
1. Enter the show ip eigrp interface command on R2.

**R2#show ip eigrp interfaces**

IP-EIGRP interfaces for process 10

 Xmit Queue Mean Pacing Time Multicast Pending

Interface Peers Un/Reliable SRTT Un/Reliable Flow Timer Routes

Gig0/0 0 0/0 1236 0/10 0 0

Se0/0/0 1 0/0 1236 0/10 0 0

**Note:** the main use of this output is to determine which interfaces are part of which EIGRP AS.

1. Enter the show ip eigrp topology on R2:

**R2#show ip eigrp topology**

IP-EIGRP Topology Table for AS 10

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

 r - Reply status

P 172.16.1.0/24, 1 successors, FD is 2816

 via Connected, GigabitEthernet0/0

P 10.0.0.0/30, 1 successors, FD is 2169856

 via Connected, Serial0/0/0

P 10.0.0.0/8, 1 successors, FD is 2169856

 via Summary (2169856/0), Null0

P 172.16.0.0/16, 1 successors, FD is 2816

 via Summary (2816/0), Null0

P 10.0.0.4/30, 1 successors, FD is 2681856

 via 10.0.0.1 (2681856/2169856), Serial0/0/0

P 192.168.3.0/24, 1 successors, FD is 2682112

 via 10.0.0.1 (2682112/2170112), Serial0/0/0

**Note:** this output displays the stored routes that it has learned from neighbor routing tables. Unlike a routing table, the topology table does not store all routes, but only routes that have been determined by EIGRP. The topology table also records the metrics for each of the listed EIGRP routes, the feasible successor and the successors. This also displays whether the routs are passive or active.

## Automatic Summarization:

Because of the VLSM employed in modern networks, automatic summarization is a default feature that should not be used.

1. Configure the loopback interfaces on R2 as shown in the network diagram.
2. Display the routing table on R1.

**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, 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

 10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks

C 10.0.0.0/30 is directly connected, Serial0/0/0

L 10.0.0.1/32 is directly connected, Serial0/0/0

C 10.0.0.4/30 is directly connected, Serial0/0/1

L 10.0.0.5/32 is directly connected, Serial0/0/1

D 172.16.0.0/16 [90/2170112] via 10.0.0.2, 00:01:54, Serial0/0/0

D 192.168.3.0/24 [90/2170112] via 10.0.0.6, 02:23:16, Serial0/0/1

**Note:** that the 172.16.1.1, 172.16.10.1, 172.16.20.1 and 172.16.20.1 subnets are summarized into 172.16.0.0 network. By default, similar to RIP, EIGRP will perform automatic summarization at Classful boundaries. It is considered good practice to disable this default feature.

**Real World Tip**: When you disable automatic summarization, the EIGRP adjacencies are reset, so be careful when performing this, especially in a production network environment.

1. Disable the auto summarization on R3.
2. Display the routing tables on R1.

**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, 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

 10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks

C 10.0.0.0/30 is directly connected, Serial0/0/0

L 10.0.0.1/32 is directly connected, Serial0/0/0

C 10.0.0.4/30 is directly connected, Serial0/0/1

L 10.0.0.5/32 is directly connected, Serial0/0/1

 172.16.0.0/24 is subnetted, 4 subnets

D 172.16.1.0/24 [90/2170112] via 10.0.0.2, 00:00:50, Serial0/0/0

D 172.16.10.0/24 [90/2297856] via 10.0.0.2, 00:00:50, Serial0/0/0

D 172.16.20.0/24 [90/2297856] via 10.0.0.2, 00:00:50, Serial0/0/0

D 172.16.30.0/24 [90/2297856] via 10.0.0.2, 00:00:50, Serial0/0/0

D 192.168.3.0/24 [90/2170112] via 10.0.0.6, 02:33:42, Serial0/0/1

**Note:** the 172.16.0.0 network has been subnetted into 4 subnets.

1. From R3 ping the loopback ip addresses of R1.

**R3#ping 172.16.10.1**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.10.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/9/11 ms

**R3#ping 172.16.20.1**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.20.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/10/14 ms

**R3#ping 172.16.30.1**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.30.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 2/7/15 ms

## Passive Interface:

By default, EIGRP sends updates via Multicast on all interfaces for which EIGRP is enabled. This means that EIGRP adjacencies will form on all interfaces for which EIGRP has been enabled. In some cases, this may not be desirable and should be prevented. For example, it is not possible to ever have another device connected to a Loopback interface, so it is a waste of router processing power to have EIGRP continuously send updates to a Loopback interface. To resolve this you can use the passive interface command.

1. Using the show ip eigrp interface command to verify which interfaces EIGRP is sending updates on.

**R2#show ip eigrp interfaces**

IP-EIGRP interfaces for process 10

 Xmit Queue Mean Pacing Time Multicast Pending

Interface Peers Un/Reliable SRTT Un/Reliable Flow Timer Routes

Se0/0/0 1 0/0 1236 0/10 0 0

Gig0/0 0 0/0 1236 0/10 0 0

Lo10 0 0/0 1236 0/10 0 0

Lo20 0 0/0 1236 0/10 0 0

Lo30 0 0/0 1236 0/10 0 0

1. Make all loopback interfaces passive.
2. Using the show ip eigrp interface command to verify which interfaces EIGRP is sending updates on now.

**R2#show ip eigrp interfaces**

IP-EIGRP interfaces for process 10

 Xmit Queue Mean Pacing Time Multicast Pending

Interface Peers Un/Reliable SRTT Un/Reliable Flow Timer Routes

Se0/0/0 1 0/0 1236 0/10 0 0

Gig0/0 0 0/0 1236 0/10 0 0

**Note:** the loopback interfaces are no longer in the table.

Enter the show ip protocols command on R2.

**R2#show ip protocols**

Routing Protocol is "eigrp 10 "

 Outgoing update filter list for all interfaces is not set

 Incoming update filter list for all interfaces is not set

 Default networks flagged in outgoing updates

 Default networks accepted from incoming updates

 EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0

 EIGRP maximum hopcount 100

 EIGRP maximum metric variance 1

Redistributing: eigrp 10

 Automatic network summarization is not in effect

 Maximum path: 4

 Routing for Networks:

 10.0.0.0

 172.16.0.0

 Passive Interface(s):

 Loopback10

 Loopback20

 Loopback30

 Routing Information Sources:

 Gateway Distance Last Update

 10.0.0.1 90 9358080

 Distance: internal 90 external 170

**Note:** The loopback interfaces are listed as passive.

## Summarizing Routes with EIGRP

With the subnetted networks of today, routing tables can become extremely large due to the sheer number of network entries causing excessive process and memory utilization. In order to reduce the burden of extremely large routing tables on routers, route summarization can be used.

1. Display the routing tables on R1.

**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, 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

 10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks

C 10.0.0.0/30 is directly connected, Serial0/0/0

L 10.0.0.1/32 is directly connected, Serial0/0/0

C 10.0.0.4/30 is directly connected, Serial0/0/1

L 10.0.0.5/32 is directly connected, Serial0/0/1

 172.16.0.0/24 is subnetted, 4 subnets

D 172.16.1.0/24 [90/2170112] via 10.0.0.2, 00:55:31, Serial0/0/0

D 172.16.10.0/24 [90/2297856] via 10.0.0.2, 00:55:31, Serial0/0/0

D 172.16.20.0/24 [90/2297856] via 10.0.0.2, 00:55:31, Serial0/0/0

D 172.16.30.0/24 [90/2297856] via 10.0.0.2, 00:55:31, Serial0/0/0

D 192.168.3.0/24 [90/2170112] via 10.0.0.6, 03:28:23, Serial0/0/1

Before we continue you need to calculate a summary address for the 172.16.0.0/24 subnets. If you have not already learned this or you need to refresh your knowledge you can refer this article How to [Do Summary Routes Quickly](https://learningnetwork.cisco.com/thread/23983). Once you have calculated the summary route we can continue.

1. Configure the summary route on the serial interface S0/0/0 of R2.

R2(config-if)#ip summary-address eigrp 10 172.16.0.0 255.255.224.0

1. Display the routing table on R1.

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, 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

 10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks

C 10.0.0.0/30 is directly connected, Serial0/0/0

L 10.0.0.1/32 is directly connected, Serial0/0/0

C 10.0.0.4/30 is directly connected, Serial0/0/1

L 10.0.0.5/32 is directly connected, Serial0/0/1

 172.16.0.0/19 is subnetted, 1 subnets

D 172.16.0.0/19 [90/2170112] via 10.0.0.2, 00:01:18, Serial0/0/0

D 192.168.3.0/24 [90/2170112] via 10.0.0.6, 03:57:18, Serial0/0/1

Note: the 172.16.1.0, 172.16.10.0, 172.116.20.0 and 172.16.30 subnet have been summarized into 172.16.0.0/19.

1. Save the configuration on all routers.

This concludes this CCNA Packet tracer lab I hope you found it helpful.