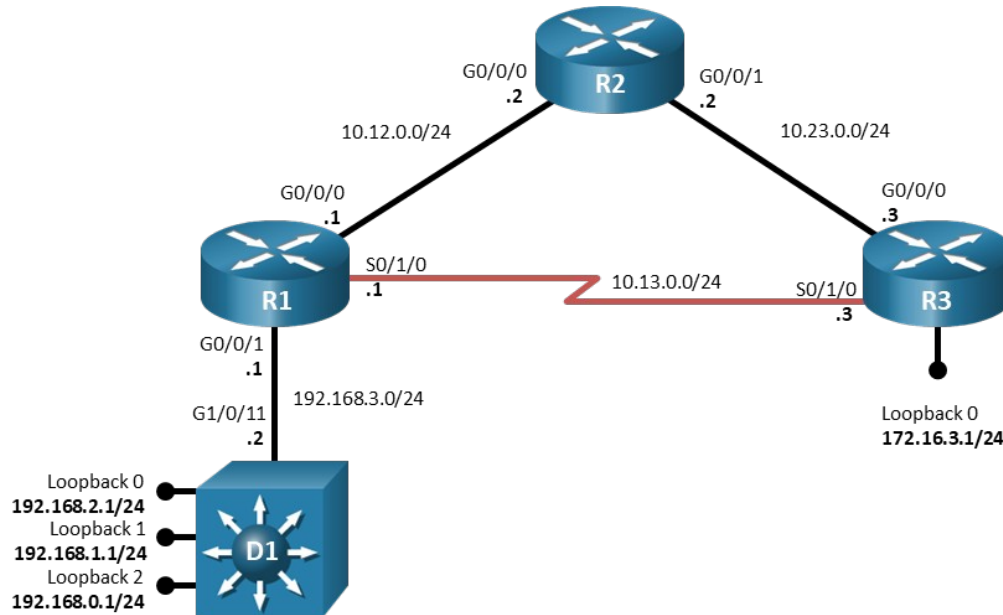


## Lab - Implement Advanced EIGRP for IPv4 Features (Instructor Version)

**Instructor Note:** Red font color or gray highlights indicate text that appears in the instructor copy only.

### Topology



### Addressing Table

Device	Interface	IP Address	Subnet Mask
R1	G0/0/0	10.12.0.1	255.255.255.0
	G0/0/1	192.168.3.1	255.255.255.0
	S0/1/0	10.13.0.1	255.255.255.0
R2	G0/0/0	10.12.0.2	255.255.255.0
	G0/0/1	10.23.0.2	255.255.255.0
R3	G0/0/0	10.23.0.3	255.255.255.0
	S0/1/0	10.13.0.3	255.255.255.0
	Loopback0	172.16.3.1	255.255.255.0
D1	G1/0/11	192.168.3.2	255.255.255.0
	Loopback0	192.168.1.1	255.255.255.0
	Loopback1	192.168.1.1	255.255.255.0
	Loopback2	192.168.0.1	255.255.255.0

### Objectives

**Part 1: Build the Network and Configure Basic Device Settings**

**Part 2: Implement EIGRP for IPv4**

**Part 3: Implement Advanced Features**

### Background / Scenario

Customizing the operation of EIGRP can yield many benefits, most notably speeding convergence and stabilizing network operations during outages. In this lab you will explore some advanced techniques that can be used to customize and improve EIGRP performance on an enterprise network.

**Note:** The routers used with CCNP hands-on labs are Cisco 4221s with Cisco IOS XE Release 16.9.4 (universalk9 image). The switches used in the labs are Cisco Catalyst 3650s with Cisco IOS XE Release 16.9.4 (universalk9 image). Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and the output produced might vary from what is shown in the labs.

**Note:** Make sure that the routers and switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

**Instructor Note:** Refer to the Instructor Lab Manual for the procedures to initialize and reload devices.

### Required Resources

- 3 Routers (Cisco 4221 with Cisco IOS XE Release 16.9.4 universal image or comparable)
- 1 Switch (Cisco 3650 with Cisco IOS XE release 16.9.4 universal image or comparable)
- 1 PC (Choice of operating system with a terminal emulation program installed)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet cables as shown in the topology

### Instructions

#### Part 1: Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic settings and interface addressing.

**a. Cable the network as shown in the topology.**

Attach the devices as shown in the topology diagram, and cable as necessary.

**b. Configure basic settings for each device.**

- a. Console into each device, enter global configuration mode, and apply the basic settings. The startup configurations for each device are provided below.

**Router R1**

```
hostname R1
no ip domain lookup
banner motd # R1, Implement Advanced EIGRP for IPv4 Features #
line con 0
  exec-timeout 0 0
  logging synchronous
```

```
exit
line vty 0 4
  privilege level 15
  exec-timeout 0 0
  password cisco123
  login
exit
!
interface g0/0/0
  ip address 10.12.0.1 255.255.255.0
  no shutdown
exit
interface s0/1/0
  ip address 10.13.0.1 255.255.255.0
  no shutdown
exit
interface g0/0/1
  ip address 192.168.3.1 255.255.255.0
  no shutdown
exit
end
```

### Router R2

```
hostname R2
no ip domain lookup
banner motd # R2, Implement Advanced EIGRP for IPv4 Features #
line con 0
  exec-timeout 0 0
  logging synchronous
exit
line vty 0 4
  privilege level 15
  exec-timeout 0 0
  password cisco123
  login
exit
!
interface g0/0/0
  ip address 10.12.0.2 255.255.255.0
  no shutdown
exit
interface g0/0/1
  ip address 10.23.0.2 255.255.255.0
  no shutdown
exit
end
```

### Router R3

```
hostname R3
no ip domain lookup
banner motd # R3, Implement Advanced EIGRP for IPv4 Features #
line con 0
  exec-timeout 0 0
  logging synchronous
  exit
line vty 0 4
  privilege level 15
  exec-timeout 0 0
  password cisco123
  login
  transport input telnet
  exit
interface g0/0/0
  ip address 10.23.0.3 255.255.255.0
  no shutdown
  exit
interface s0/1/0
  ip address 10.13.0.3 255.255.255.0
  no shutdown
  exit
interface loopback 0
  ip address 172.16.3.1 255.255.255.0
  no shutdown
  exit
end
```

### Switch D1

```
hostname D1
no ip domain lookup
ip routing
banner motd # D1, Implement Advanced EIGRP for IPv4 Features #
line con 0
  exec-timeout 0 0
  logging synchronous
  exit
line vty 0 4
  privilege level 15
  exec-timeout 0 0
  password cisco123
  login
  exit
interface range g1/0/1-24
```

```
shutdown
exit
interface g1/0/11
no switchport
ip address 192.168.3.2 255.255.255.0
no shutdown
exit
interface loopback 0
ip address 192.168.2.1 255.255.255.0
no shutdown
exit
interface loopback 1
ip address 192.168.1.1 255.255.255.0
no shutdown
exit
interface loopback 2
ip address 192.168.0.1 255.255.255.0
no shutdown
exit
end
```

- b. Set the clock on all devices to UTC time.
- c. Save the running configuration to startup-config on all devices.

## Part 2: Implement EIGRP for IPv4

In this part, you will configure classic EIGRP for IPv4 and verify that all routing tables are converged.

### a. Configure classic EIGRP for IPv4.

Configure classic EIGRP for IPv4 on all devices. Use Autonomous System number 98, and advertise only the connected interfaces on each device.

```
R1# config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)# router eigrp 98
R1(config-router)# network 10.12.0.0 0.0.0.255
R1(config-router)# network 10.13.0.0 0.0.0.255
R1(config-router)# network 192.168.3.0 0.0.0.255
R1(config-router)# exit
R1(config)# end
```

```
R2# config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)# router eigrp 98
R2(config-router)# network 10.12.0.0 0.0.0.255
R2(config-router)# network 10.23.0.0 0.0.0.255
R2(config-router)# exit
```

```
R2(config)# end
```

```
R3# config t
```

Enter configuration commands, one per line. End with CNTL/Z.

```
R3(config)# router eigrp 98
```

```
R3(config-router)# network 10.23.0.0 0.0.0.255
```

```
R3(config-router)# network 10.13.0.0 0.0.0.255
```

```
R3(config-router)# network 172.16.3.0 0.0.0.255
```

```
R3(config-router)# exit
```

```
R3(config)# end
```

```
D1# config t
```

Enter configuration commands, one per line. End with CNTL/Z.

```
D1(config)# router eigrp 98
```

```
D1(config-router)# network 192.168.3.0 0.0.0.255
```

```
D1(config-router)# network 192.168.2.0 0.0.0.255
```

```
D1(config-router)# network 192.168.1.0 0.0.0.255
```

```
D1(config-router)# network 192.168.0.0 0.0.0.255
```

```
D1(config-router)# exit
```

```
D1(config)# end
```

### b. Verify EIGRP for IPv4 routing.

Verify that each device has a complete routing table for all the networks shown in the topology and Addressing Table.

```
R1# show ip route eigrp | begin Gateway
```

Gateway of last resort is not set

```

    10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
D       10.23.0.0/24 [90/3072] via 10.12.0.2, 00:06:05, GigabitEthernet0/0/0
    172.16.0.0/24 is subnetted, 1 subnets
D       172.16.3.0 [90/131072] via 10.12.0.2, 00:06:04, GigabitEthernet0/0/0
D       192.168.0.0/24
          [90/130816] via 192.168.3.2, 00:05:37, GigabitEthernet0/0/1
D       192.168.1.0/24
          [90/130816] via 192.168.3.2, 00:05:37, GigabitEthernet0/0/1
D       192.168.2.0/24
          [90/130816] via 192.168.3.2, 00:05:37, GigabitEthernet0/0/1
```

```
R2# show ip route eigrp | begin Gateway
```

Gateway of last resort is not set

```

    10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
D       10.13.0.0/24
          [90/1782016] via 10.12.0.1, 00:06:47, GigabitEthernet0/0/0
    172.16.0.0/24 is subnetted, 1 subnets
D       172.16.3.0 [90/130816] via 10.23.0.3, 00:06:47, GigabitEthernet0/0/1
D       192.168.0.0/24 [90/131072] via 10.12.0.1, 00:06:20, GigabitEthernet0/0/0
```

```
D    192.168.1.0/24 [90/131072] via 10.12.0.1, 00:06:20, GigabitEthernet0/0/0
D    192.168.2.0/24 [90/131072] via 10.12.0.1, 00:06:20, GigabitEthernet0/0/0
D    192.168.3.0/24 [90/3072] via 10.12.0.1, 00:06:44, GigabitEthernet0/0/0
```

```
R3# show ip route eigrp | begin Gateway
```

```
Gateway of last resort is not set
```

```
    10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
D    10.12.0.0/24 [90/3072] via 10.23.0.2, 00:07:25, GigabitEthernet0/0/0
D    192.168.0.0/24 [90/131328] via 10.23.0.2, 00:07:01, GigabitEthernet0/0/0
D    192.168.1.0/24 [90/131328] via 10.23.0.2, 00:07:01, GigabitEthernet0/0/0
D    192.168.2.0/24 [90/131328] via 10.23.0.2, 00:07:01, GigabitEthernet0/0/0
D    192.168.3.0/24 [90/3328] via 10.23.0.2, 00:07:25, GigabitEthernet0/0/0
```

```
D1# show ip route eigrp | begin Gateway
```

```
Gateway of last resort is not set
```

```
    10.0.0.0/24 is subnetted, 3 subnets
D    10.12.0.0 [90/3072] via 192.168.3.1, 00:07:37, GigabitEthernet1/0/11
D    10.13.0.0
    [90/1782016] via 192.168.3.1, 00:07:37, GigabitEthernet1/0/11
D    10.23.0.0 [90/3328] via 192.168.3.1, 00:07:37, GigabitEthernet1/0/11
    172.16.0.0/24 is subnetted, 1 subnets
D    172.16.3.0
    [90/131328] via 192.168.3.1, 00:07:37, GigabitEthernet1/0/11
```

### Part 3: Implement Advanced Features

In this part of the lab you will customize several different settings within EIGRP and see the impact of those changes on the network.

#### a. Modify timers.

EIGRP uses standard **hello-interval** and **hold-time** timers based on the speed of the interface. If the interface speed is a T1 or less, hellos are sent every 60 seconds and the hold-time is set to 180 seconds. If the interface speed is greater than a T1, hellos are sent every 5 seconds and the **hold-time** is set to 15 seconds. These default times might not be appropriate for some network scenarios.

- a. To see what the timers are set to, issue the **show ip eigrp interfaces detail** command.

```
R1# show ip eigrp interfaces detail
```

```
EIGRP-IPv4 Interfaces for AS(98)
```

		Xmit Queue	PeerQ	Mean	Pacing Time	Multicast
Pending						
Interface	Peers	Un/Reliable	Un/Reliable	SRTT	Un/Reliable	Flow
Timer Routes						
Gi0/0/0	1	0/0	0/0	1	0/050	0
Hello-interval is 5, Hold-time is 15						
Split-horizon is enabled						
Next xmit serial <none>						
Packetized sent/expedited: 5/1						
Hello's sent/expedited: 29/2						

```
Un/reliable mcasts: 0/5  Un/reliable ucasts: 7/3
Mcast exceptions: 0  CR packets: 0  ACKs suppressed: 0
Retransmissions sent: 2  Out-of-sequence rcvd: 0
Topology-ids on interface - 0
Authentication mode is not set
Topologies advertised on this interface:  base
Topologies not advertised on this interface:
```

```
Se0/1/0          1          0/0          0/0          1          0/1250          0
```

```
Hello-interval is 5, Hold-time is 15
```

```
Split-horizon is enabled
Next xmit serial <none>
Packetized sent/expedited: 4/0
Hello's sent/expedited: 32/2
Un/reliable mcasts: 0/0  Un/reliable ucasts: 6/5
Mcast exceptions: 0  CR packets: 0  ACKs suppressed: 0
Retransmissions sent: 0  Out-of-sequence rcvd: 0
Topology-ids on interface - 0
Authentication mode is not set
Topologies advertised on this interface:  base
Topologies not advertised on this interface:
```

```
Gi0/0/1          1          0/0          0/0          4          0/050          0
```

```
Hello-interval is 5, Hold-time is 15
```

```
Split-horizon is enabled
Next xmit serial <none>
Packetized sent/expedited: 2/1
Hello's sent/expedited: 31/2
Un/reliable mcasts: 0/2  Un/reliable ucasts: 4/3
Mcast exceptions: 0  CR packets: 0  ACKs suppressed: 0
Retransmissions sent: 2  Out-of-sequence rcvd: 0
Topology-ids on interface - 0
Authentication mode is not set
Topologies advertised on this interface:  base
Topologies not advertised on this interface:
```

- b. For this lab, the timers on R1 interface G0/0/0 and S0/1/0 need to be adjusted to send hellos every 10 seconds and establish a hold time of 30 seconds. EIGRP is unique in that each interface can have a customized **hello-interval** and **hold-time**. The times are not needed to match between the ends of a link. Change the timers using the **ip hello-interval eigrp ASN seconds** and the **ip hold-time eigrp ASN seconds** interface configuration commands.

```
R1# config t
```

```
Enter configuration commands, one per line.  End with CNTL/Z.
```

```
R1(config)# interface g0/0/0
```

```
R1(config-if)# ip hello-interval eigrp 98 10
```

```
R1(config-if)# ip hold-time eigrp 98 30
```

```
R1(config-if)# exit
```

```
R1(config)# interface s0/1/0
```

```
R1(config-if)# ip hello-interval eigrp 98 10
```



```
R1(config-if)# ip hold-time eigrp 98 30
R1(config-if)# exit
R1(config)# end
```

- c. To verify that the changes were made, check the output of the **show ip eigrp interfaces detail** command.

```
R1# show ip eigrp interfaces detail
```

```
EIGRP-IPv4 Interfaces for AS(98)
```

Pending		Xmit Queue	PeerQ	Mean	Pacing Time	Multicast
Interface	Peers	Un/Reliable	Un/Reliable	SRTT	Un/Reliable	Flow
Timer	Routes					

Gi0/0/0	1	0/0	0/0	1	0/050	0
---------	---	-----	-----	---	-------	---

```
Hello-interval is 10, Hold-time is 30
```

```
Split-horizon is enabled
```

```
Next xmit serial <none>
```

```
Packetized sent/expedited: 5/1
```

```
Hello's sent/expedited: 84/2
```

```
Un/reliable mcasts: 0/5 Un/reliable ucasts: 7/3
```

```
Mcast exceptions: 0 CR packets: 0 ACKs suppressed: 0
```

```
Retransmissions sent: 2 Out-of-sequence rcvd: 0
```

```
Topology-ids on interface - 0
```

```
Authentication mode is not set
```

```
Topologies advertised on this interface: base
```

```
Topologies not advertised on this interface:
```

Se0/1/0	1	0/0	0/0	1	0/1250	0
---------	---	-----	-----	---	--------	---

```
Hello-interval is 10, Hold-time is 30
```

```
Split-horizon is enabled
```

```
Next xmit serial <none>
```

```
Packetized sent/expedited: 4/0
```

```
Hello's sent/expedited: 87/2
```

```
Un/reliable mcasts: 0/0 Un/reliable ucasts: 6/5
```

```
Mcast exceptions: 0 CR packets: 0 ACKs suppressed: 0
```

```
Retransmissions sent: 0 Out-of-sequence rcvd: 0
```

```
Topology-ids on interface - 0
```

```
Authentication mode is not set
```

```
Topologies advertised on this interface: base
```

```
Topologies not advertised on this interface:
```

Gi0/0/1	1	0/0	0/0	4	0/050	0
---------	---	-----	-----	---	-------	---

```
Hello-interval is 5, Hold-time is 15
```

```
Split-horizon is enabled
```

```
Next xmit serial <none>
```

```
Packetized sent/expedited: 2/1
```

```
Hello's sent/expedited: 92/2
```

```
Un/reliable mcasts: 0/2 Un/reliable ucasts: 4/3
```

```
Mcast exceptions: 0 CR packets: 0 ACKs suppressed: 0
```

```
Retransmissions sent: 2 Out-of-sequence rcvd: 0
```

```
Topology-ids on interface - 0
```

```
Authentication mode is not set
Topologies advertised on this interface:  base
Topologies not advertised on this interface:
```

### b. Create summarized routes in EIGRP.

Large routing tables take more memory and require more CPU time to process. Reducing the size of the routing table is advantageous in all network scenarios. EIGRP supports summarization of routes at any point in the network. There is no boundary router limitation like the limitations imposed in OSPF. However, in order for the summary route to be valid, EIGRP requires that some component of the summary route be in the routing table for the router doing the summarization.

- a. Issue the **show ip route eigrp | begin Gateway** command on R3 and note the group of networks from the 192.168 range of addresses. R1 is advertising this contiguous block of networks individually, instead of sending a summary.

```
R3# show ip route eigrp | begin Gateway
Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
D      10.12.0.0/24 [90/3072] via 10.23.0.2, 00:06:35, GigabitEthernet0/0/0
D      192.168.0.0/24 [90/131328] via 10.23.0.2, 00:06:08, GigabitEthernet0/0/0
D      192.168.1.0/24 [90/131328] via 10.23.0.2, 00:06:08, GigabitEthernet0/0/0
D      192.168.2.0/24 [90/131328] via 10.23.0.2, 00:06:08, GigabitEthernet0/0/0
D      192.168.3.0/24 [90/3328] via 10.23.0.2, 00:06:35, GigabitEthernet0/0/0
```

- b. On R1, configure a summary of the networks between R1 and D1, as well as the networks on D1 on the interfaces connecting to R3 and R2.

```
R1# conf t
R1(config)# interface g0/0/0
R1(config-if)# ip summary-address eigrp 98 192.168.0.0 255.255.252.0
*Mar  6 00:07:33.742: %DUAL-5-NBRCHANGE: EIGRP-IPv4 98: Neighbor 10.12.0.2
(GigabitEthernet0/0/0) is resync: summary configured
R1(config-if)# exit
R1(config)# interface s0/1/0
R1(config-if)# ip summary-address eigrp 98 192.168.0.0 255.255.252.0
*Mar  6 00:07:35.220: %DUAL-5-NBRCHANGE: EIGRP-IPv4 98: Neighbor 10.13.0.3
(Serial0/1/0) is resync: summary configured
R1(config-if)# end
```

- c. Now examine the routing table on R3 again using the **show ip route eigrp | begin Gateway** command. In the output, you now see a single route taking the place of what had been four distinct routes.

```
R3# show ip route eigrp | begin Gateway
Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
D      10.12.0.0/24 [90/3072] via 10.23.0.2, 00:07:59, GigabitEthernet0/0/0
D      192.168.0.0/22 [90/3328] via 10.23.0.2, 00:00:25, GigabitEthernet0/0/0
```

### c. Control EIGRP query propagation with EIGRP stub routers.

EIGRP uses query messages to find a path to networks in the autonomous system. The query messages always require an acknowledgement. But a router will only send a response if it has a potential route that

satisfies the query. If it does not have a route, it sends its own queries to its neighbors. This process can lead to long delays in reconvergence after an outage.

Query scoping refers to using various techniques to control how far across a network queries have to be sent. Summarization is one way of controlling query propagation. Another way to control query propagation is to use EIGRP stub routers where appropriate. When a router is single-homed to the rest of the network, and no other networks exist beyond that router, there is no real point in sending it a query looking for lost networks. The stub router declares itself as a stub to the router connected to the rest of the network, which is considered a hub router. The hub router then forwards no queries to the stub router because it knows there are no other networks, beyond those reported, existing beyond the stub router. In the topology for this lab, switch D1 is a stub router and R1 is its hub router.

- a. To verify that switch D1 is receiving EIGRP queries, issue the **shutdown** command on R2 interface G0/0/1. On switch D1, issue the **show ip eigrp events** command. This command outputs a timestamped list of actions that EIGRP is taking. In the output, you will find an entry that says switch D1 received a query trying to find the 10.23.0.0/24 network. Take note of the time stamp.

```
D1# show ip eigrp events
```

```
Event information for AS 98:
```

```
1 00:10:46.753 NDB delete: 10.23.0.0/24 1
2 00:10:46.753 RDB delete: 10.23.0.0/24 192.168.3.1
3 00:10:46.737 Metric set: 10.23.0.0/24 metric(Infinity)
4 00:10:46.737 Poison squashed: 10.23.0.0/24 lost if
5 00:10:46.737 Poison squashed: 10.23.0.0/24 rt net gone
6 00:10:46.737 Route installing: 10.23.0.0/24 192.168.3.1
7 00:10:46.737 Send reply: 10.23.0.0/24 192.168.3.1
8 00:10:46.737 Not active net/1=SH: 10.23.0.0/24 1
9 00:10:46.737 FC not sat Dmin/met: metric(Infinity) metric(1782272)
10 00:10:46.737 Find FS: 10.23.0.0/24 metric(1782272)
11 00:10:46.737 Rcv query met/succ met: metric(Infinity) metric(Infinity)
12 00:10:46.737 Rcv query dest/nh: 10.23.0.0/24 192.168.3.1
```

- b. Issue the **no shutdown** command on R2 interface G0/0/1.

- c. Configure D1 as an EIGRP stub router.

```
D1# config t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
D1(config)# router eigrp 98
```

```
D1(config-router)# eigrp stub
```

```
D1(config)# end
```

```
D1#
```

```
Mar 6 00:11:40.624: %DUAL-5-NBRCHANGE: EIGRP-IPv4 98: Neighbor 192.168.3.1
(GigabitEthernet1/0/11) is down: peer info changed
```

```
Mar 6 00:11:45.174: %DUAL-5-NBRCHANGE: EIGRP-IPv4 98: Neighbor 192.168.3.1
(GigabitEthernet1/0/11) is up: new adjacency
```

- d. Verify that R1 sees switch D1 as a stub by examining the output of the **show ip eigrp neighbor detail** command.

```
R1# show ip eigrp neighbor detail
```

```
EIGRP-IPv4 Neighbors for AS(98)
```

H	Address	Interface	Hold (sec)	Uptime	SRTT (ms)	RTO	QSeq CntNum
2	192.168.3.2	Gi0/0/1	14	00:00:39	3	100	010

```
Version 25.0/2.0, Retrans: 1, Retries: 0, Prefixes: 3
```

```
Topology-ids from peer - 0
Topologies advertised to peer: base
```

### Stub Peer Advertising (CONNECTED SUMMARY ) Routes

```
Suppressing queries
```

```
1 10.13.0.3 Se0/1/0 11 00:11:44 1 100 028
```

```
Time since Restart 00:04:06
```

```
Version 25.0/2.0, Retrans: 0, Retries: 0, Prefixes: 3
```

```
Topology-ids from peer - 0
```

```
Topologies advertised to peer: base
```

```
0 10.12.0.2 Gi0/0/0 12 00:12:24 1 100 030
```

```
Time since Restart 00:04:07
```

```
Version 25.0/2.0, Retrans: 2, Retries: 0, Prefixes: 2
```

```
Topology-ids from peer - 0
```

```
Topologies advertised to peer: base
```

```
Max Nbrs: 0, Current Nbrs: 0
```

- e. Issue the **shutdown** command on R2 interface G0/0/1. Take note of the timestamp on the syslog message reporting that the interface is down.
- f. On switch D1, issue the **show ip eigrp events** command. You will see that no query was received looking for the 10.23.0.0/24 network. The query was stopped at R1, speeding up the convergence process.

```
D1# show ip eigrp events
```

```
Event information for AS 98:
```

```
1 00:12:53.776 NDB delete: 10.23.0.0/24 1
2 00:12:53.776 Poison squashed: 10.23.0.0/24 rt net gone
3 00:12:53.776 RDB delete: 10.23.0.0/24 192.168.3.1
4 00:12:53.776 Not active net/1=SH: 10.23.0.0/24 1
5 00:12:53.776 FC not sat Dmin/met: metric(Infinity) metric(1782272)
6 00:12:53.776 Find FS: 10.23.0.0/24 metric(1782272)
7 00:12:53.776 Rcv update met/succmet: metric(Infinity) metric(Infinity)
8 00:12:53.776 Rcv update dest/nh: 10.23.0.0/24 192.168.3.1
9 00:12:53.776 Ignored route, hopcount: 10.23.0.0 255
10 00:12:50.077 Metric set: 172.16.3.0/24 metric(1910016)
11 00:12:50.077 Route installed: 172.16.3.0/24 192.168.3.1
12 00:12:50.077 Route installing: 172.16.3.0/24 192.168.3.1
13 00:12:50.077 Find FS: 172.16.3.0/24 metric(Infinity)
14 00:12:50.077 Free reply status: 172.16.3.0/24
15 00:12:50.077 Clr handle num/bits: 0 0x0
16 00:12:50.077 Clr handle dest/cnt: 172.16.3.0/24 0
17 00:12:50.077 Rcv reply met/succ met: metric(1910016) metric(1909760)
18 00:12:50.077 Rcv reply dest/nh: 172.16.3.0/24 192.168.3.1
19 00:12:50.077 Metric set: 10.23.0.0/24 metric(1782272)
20 00:12:50.076 Route installed: 10.23.0.0/24 192.168.3.1
21 00:12:50.076 Route installing: 10.23.0.0/24 192.168.3.1
22 00:12:50.076 Find FS: 10.23.0.0/24 metric(Infinity)
23 00:12:50.076 Free reply status: 10.23.0.0/24
```

- g. Issue the **no shutdown** command on R2 interface G0/0/1.

### d. Filter EIGRP routes with a distribute list.

EIGRP supports several different filtering capabilities. The simplest and most direct is to use a distribute list. A distribute list refers to an access list which can be applied to all EIGRP updates being sent by a certain router, or it can be applied to a specific interface to modify updates as they exit. For this exercise, we will filter the 10.12.0.0/24 network from updates being sent out of R2 interface G0/0/1. This will cause a change in R3's routing table.

- a. Examine the routing table on R3 by issuing the **show ip route eigrp | begin Gateway** command. In the output, you can see that R3 has calculated the path via R2 at 10.23.0.2 to be the best path to reach the 10.12.0.0/24 network.

```
R3# show ip route eigrp | begin Gateway
```

```
Gateway of last resort is not set
```

```
10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
```

```
D      10.12.0.0/24 [90/3072] via 10.23.0.2, 00:00:17, GigabitEthernet0/0/0
```

```
D      192.168.0.0/22 [90/3328] via 10.23.0.2, 00:00:53, GigabitEthernet0/0/0
```

- b. Our intent is to change the configuration at R2 so that R3 only learns about the 10.12.0.0/24 network from R1. Create an access list that denies the 10.12.0.0/24 network and permits all other networks.

```
R2# config t
```

```
R2(config)# ip access-list standard EIGRP-FILTER
```

```
R2(config-std-nacl)# deny 10.12.0.0 0.0.255.255
```

```
R2(config-std-nacl)# permit any
```

```
R2(config-std-nacl)# exit
```

- c. Enter EIGRP router configuration mode and configure the distribute list to reference the access list you just created, further specifying that the filter should be effective outbound on interface G0/0/1.

```
R2(config)# router eigrp 98
```

```
R2(config-router)# distribute-list EIGRP-FILTER out g0/0/1
```

```
R2(config-router)# end
```

```
*Mar 6 00:19:56.379: %DUAL-5-NBRCHANGE: EIGRP-IPv4 98: Neighbor 10.23.0.3  
(GigabitEthernet0/0/1) is resync: intf route configuration changed
```

- d. On R3, issue the **show ip route eigrp | begin Gateway** command. As you can see, the successor for the 10.12.0.0/24 network has changed to R1 at 10.13.0.1.

```
R3# show ip route eigrp | begin Gateway
```

```
Gateway of last resort is not set
```

```
10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
```

```
D      10.12.0.0/24 [90/1792256] via 10.13.0.1, 00:01:30, Serial0/1/0
```

```
D      192.168.0.0/22 [90/3328] via 10.23.0.2, 00:03:00, GigabitEthernet0/0/0
```

## Router Interface Summary Table

Router Model	Ethernet Interface #1	Ethernet Interface #2	Serial Interface #1	Serial Interface #2
1800	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)

Router Model	Ethernet Interface #1	Ethernet Interface #2	Serial Interface #1	Serial Interface #2
1900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2801	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
2811	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
4221	Gigabit Ethernet 0/0/0 (G0/0/0)	Gigabit Ethernet 0/0/1 (G0/0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
4300	Gigabit Ethernet 0/0/0 (G0/0/0)	Gigabit Ethernet 0/0/1 (G0/0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)

**Note:** To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.

### Device Configs – Final

#### Router R1

```
R1# show run
```

```
Building configuration...
```

```
Current configuration : 1619 bytes
```

```
!
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
!
hostname R1
!
boot-start-marker
boot-end-marker
!
no aaa new-model
!
no ip domain lookup
!
login on-success log
!
```

```
subscriber templating
!
multilink bundle-name authenticated
!
spanning-tree extend system-id
!
redundancy
mode none
!
interface GigabitEthernet0/0/0
 ip address 10.12.0.1 255.255.255.0
 ip hello-interval eigrp 98 10
 ip hold-time eigrp 98 30
 ip summary-address eigrp 98 192.168.0.0 255.255.252.0
 negotiation auto
!
interface GigabitEthernet0/0/1
 ip address 192.168.3.1 255.255.255.0
 negotiation auto
!
interface Serial0/1/0
 ip address 10.13.0.1 255.255.255.0
 ip hello-interval eigrp 98 10
 ip hold-time eigrp 98 30
 ip summary-address eigrp 98 192.168.0.0 255.255.252.0
!
interface Serial0/1/1
 no ip address
!
router eigrp 98
 network 10.12.0.0 0.0.0.255
 network 10.13.0.0 0.0.0.255
 network 192.168.3.0
!
ip forward-protocol nd
no ip http server
ip http secure-server
!
control-plane
!
banner motd ^C R1, Implement Advanced EIGRP for IPv4 Features ^C
!
line con 0
 exec-timeout 0 0
 logging synchronous
 transport input none
 stopbits 1
line aux 0
 stopbits 1
line vty 0 4
```

```
exec-timeout 0 0
privilege level 15
password cisco123
login
!
end
```

### Router R2

R2# **show run**

Building configuration..

Current configuration : 1409 bytes

```
!
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
!
hostname R2
!
boot-start-marker
boot-end-marker
!
no aaa new-model
!
no ip domain lookup
!
login on-success log
!
subscriber templating
!
!
multilink bundle-name authenticated
!
spanning-tree extend system-id
!
!
redundancy
mode none
!
interface GigabitEthernet0/0/0
ip address 10.12.0.2 255.255.255.0
negotiation auto
!
interface GigabitEthernet0/0/1
ip address 10.23.0.2 255.255.255.0
negotiation auto
!
```



## Lab - Implement Advanced EIGRP for IPv4 Features

---

```
router eigrp 98
  distribute-list EIGRP-FILTER out GigabitEthernet0/0/1
  network 10.12.0.0 0.0.0.255
  network 10.23.0.0 0.0.0.255
!
ip forward-protocol nd
no ip http server
ip http secure-server
!
ip access-list standard EIGRP-FILTER
  deny 10.12.0.0 0.0.255.255
  permit any
!
control-plane
!
banner motd ^C R2, Implement Advanced EIGRP for IPv4 Features ^C
!
line con 0
  exec-timeout 0 0
  logging synchronous
  transport input none
  stopbits 1
line aux 0
  stopbits 1
line vty 0 4
  exec-timeout 0 0
  privilege level 15
  password cisco123
  login
!
end
```

### Router R3

```
R3# show run
Building configuration...

Current configuration : 1464 bytes
!
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
!
hostname R3
!
boot-start-marker
boot-end-marker
```

## Lab - Implement Advanced EIGRP for IPv4 Features

---

```
!  
no aaa new-model  
!  
no ip domain lookup  
!  
login on-success log  
!  
subscriber templating  
!  
multilink bundle-name authenticated  
!  
spanning-tree extend system-id  
!  
redundancy  
mode non  
!  
interface Loopback0  
ip address 172.16.3.1 255.255.255.0  
!  
interface GigabitEthernet0/0/0  
ip address 10.23.0.3 255.255.255.0  
negotiation auto  
!  
interface GigabitEthernet0/0/1  
no ip address  
negotiation auto  
!  
interface Serial0/1/0  
ip address 10.13.0.3 255.255.255.0  
!  
interface Serial0/1/1  
no ip address  
!  
router eigrp 98  
network 10.13.0.0 0.0.0.255  
network 10.23.0.0 0.0.0.255  
network 172.16.3.0 0.0.0.255  
!  
ip forward-protocol nd  
no ip http server  
ip http secure-server  
!  
control-plane  
!  
banner motd ^C R3, Implement Advanced EIGRP for IPv4 Features ^C  
!  
line con 0  
exec-timeout 0 0  
logging synchronous  
transport input none
```

```
stopbits 1
line aux 0
stopbits 1
line vty 0 4
exec-timeout 0 0
privilege level 15
password cisco123
login
transport input telnet
!
end
```

### Switch D1

```
D1# show run
Building configuration...

Current configuration : 6911 bytes
!
version 16.9
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
! Call-home is enabled by Smart-Licensing.
service call-home
no platform punt-keepalive disable-kernel-core
!
hostname D1
!
vrf definition Mgmt-vrf
!
address-family ipv4
exit-address-family
!
address-family ipv6
exit-address-family
!
no aaa new-model
switch 1 provision ws-c3650-24ps
!
ip routing
!
no ip domain lookup
!
login on-success log
!
license boot level ipservicesk9
!
diagnostic bootup level minimal
!
```

## Lab - Implement Advanced EIGRP for IPv4 Features

---

```
spanning-tree mode rapid-pvst
spanning-tree extend system-id
!
redundancy
mode sso
!
transceiver type all
monitoring
!
class-map match-any system-cpp-police-topology-control
description Topology control
class-map match-any system-cpp-police-sw-forward
description Sw forwarding, L2 LVX data, LOGGING
class-map match-any system-cpp-default
description Inter FED, EWLC control, EWLC data
class-map match-any system-cpp-police-sys-data
description Learning cache ovfl, High Rate App, Exception, EGR Exception,
NFLSAMPLED DATA, RPF Failed
class-map match-any system-cpp-police-punt-webauth
description Punt Webauth
class-map match-any system-cpp-police-l2lvx-control
description L2 LVX control packets
class-map match-any system-cpp-police-forus
description Forus Address resolution and Forus traffic
class-map match-any system-cpp-police-multicast-end-station
description MCAST END STATION
class-map match-any system-cpp-police-multicast
description Transit Traffic and MCAST Data
class-map match-any system-cpp-police-l2-control
description L2 control
class-map match-any system-cpp-police-dot1x-auth
description DOT1X Auth
class-map match-any system-cpp-police-data
description ICMP redirect, ICMP_GEN and BROADCAST
class-map match-any system-cpp-police-stackwise-virt-control
description Stackwise Virtual
class-map match-any non-client-nrt-class
class-map match-any system-cpp-police-routing-control
description Routing control and Low Latency
class-map match-any system-cpp-police-protocol-snooping
description Protocol snooping
class-map match-any system-cpp-police-dhcp-snooping
description DHCP snooping
class-map match-any system-cpp-police-system-critical
description System Critical and Gold Pkt
!
policy-map system-cpp-policy
!
interface Loopback0
ip address 192.168.2.1 255.255.255.0
```

## Lab - Implement Advanced EIGRP for IPv4 Features

---

```
!  
interface Loopback1  
ip address 192.168.1.1 255.255.255.0  
!  
interface Loopback2  
ip address 192.168.0.1 255.255.255.0  
!  
interface GigabitEthernet0/0  
vrf forwarding Mgmt-vrf  
no ip address  
negotiation auto  
!  
interface GigabitEthernet1/0/1  
shutdown  
!  
interface GigabitEthernet1/0/2  
shutdown  
!  
interface GigabitEthernet1/0/3  
shutdown  
!  
interface GigabitEthernet1/0/4  
shutdown  
!  
interface GigabitEthernet1/0/5  
shutdown  
!  
interface GigabitEthernet1/0/6  
shutdown  
!  
interface GigabitEthernet1/0/7  
shutdown  
!  
interface GigabitEthernet1/0/8  
shutdown  
!  
interface GigabitEthernet1/0/9  
shutdown  
!  
interface GigabitEthernet1/0/10  
shutdown  
!  
interface GigabitEthernet1/0/11  
no switchport  
ip address 192.168.3.2 255.255.255.0  
!  
interface GigabitEthernet1/0/12  
shutdown  
!  
interface GigabitEthernet1/0/13
```

## Lab - Implement Advanced EIGRP for IPv4 Features

---

```
shutdown
!
interface GigabitEthernet1/0/14
shutdown
!
interface GigabitEthernet1/0/15
shutdown
!
interface GigabitEthernet1/0/16
shutdown
!
interface GigabitEthernet1/0/17
shutdown
!
interface GigabitEthernet1/0/18
shutdown
!
interface GigabitEthernet1/0/19
shutdown
!
interface GigabitEthernet1/0/20
shutdown
!
interface GigabitEthernet1/0/21
shutdown
!
interface GigabitEthernet1/0/22
shutdown
!
interface GigabitEthernet1/0/23
shutdown
!
interface GigabitEthernet1/0/24
shutdown
!
interface GigabitEthernet1/1/1
!
interface GigabitEthernet1/1/2
!
interface GigabitEthernet1/1/3
!
interface GigabitEthernet1/1/4
!
interface Vlan1
no ip address
!
router eigrp 98
network 192.168.0.0
network 192.168.1.0
network 192.168.2.0
```

## Lab - Implement Advanced EIGRP for IPv4 Features

---

```
network 192.168.3.0
eigrp stub connected summary
!
ip forward-protocol nd
ip http server
ip http secure-server
!
control-plane
service-policy input system-cpp-policy
!
banner motd ^C D1, Implement Advanced EIGRP for IPv4 Features ^C
!
line con 0
exec-timeout 0 0
logging synchronous
stopbits 1
line aux 0
stopbits 1
line vty 0 4
exec-timeout 0 0
privilege level 15
password cisco123
login
line vty 5 15
login
!
end
```