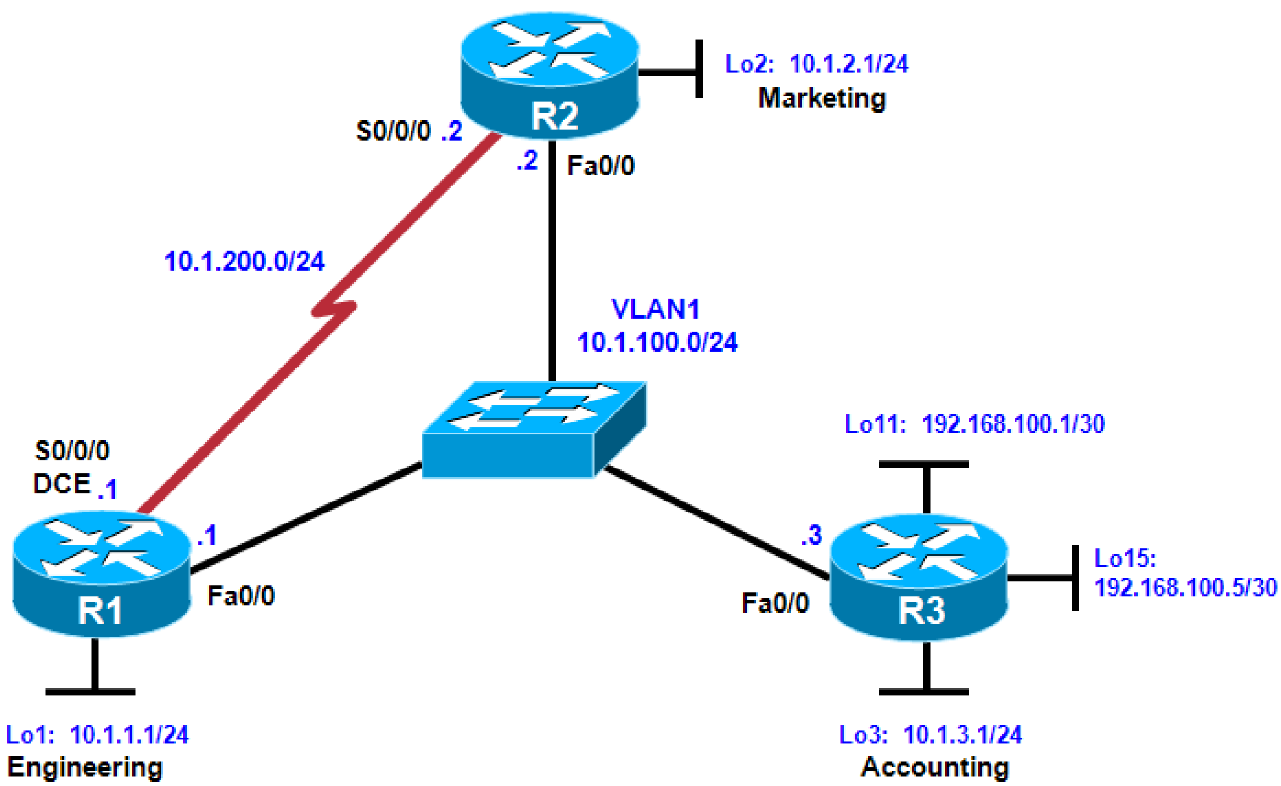
Chapter 2 Lab 2-1, EIGRP Configuration, Bandwidth, and Adjacencies

Topology



Objectives

- Configure EIGRP on multiple routers.
- Configure the **bandwidth** command to modify the EIGRP metric.
- Verify EIGRP adjacencies.
- Verify EIGRP routing information exchange.
- Use debugging commands for troubleshooting EIGRP.
- (Challenge) Test convergence for EIGRP when a topology change occurs.

Background

You are responsible for configuring a new network to connect your company's Engineering, Marketing, and Accounting departments, represented by the loopback interfaces on each of the three routers. The physical devices have just been installed and are connected by Fast Ethernet and serial interfaces. Your task is to configure EIGRP to enable full connectivity between all departments.

Note: This lab uses Cisco 1841 routers with Cisco IOS Release 12.4(24)T1 and the Advanced IP Services image c1841-advipservicesk9-mz.124-24.T1.bin. The switch is a Cisco WS-C2960-24TT-L with the Cisco IOS image c2960-lanbasek9-mz.122-46.SE.bin. You can use other routers (such as 2801 or 2811), switches (such as 2950), and Cisco IOS Software versions if they have comparable capabilities and features. Depending on the router or switch model and Cisco IOS Software version, the commands available and output produced might vary from what is shown in this lab.

Required Resources

- 3 routers (Cisco 1841 with Cisco IOS Release 12.4(24)T1 Advanced IP Services or comparable)
- 1 switch (Cisco 2960 with the Cisco IOS Release 12.2(46)SE C2960-LANBASEK9-M image or comparable)
- Serial and Ethernet cables

Step 1: Configure addressing and loopbacks.

a. Using the addressing scheme in the diagram, apply IP addresses to the Fast Ethernet interfaces on R1, R2, and R3. Then create Loopback1 on R1, Loopback2 on R2, and Loopback3 on R3 and address them according to the diagram.

```
R1# configure terminal
R1(config)# interface Loopback1
R1(config-if)# description Engineering Department
R1(config-if)# ip address 10.1.1.1 255.255.255.0
R1(config-if)# exit
R1(config)# interface FastEthernet0/0
R1(config-if)# ip address 10.1.100.1 255.255.255.0
R1(config-if)# no shutdown

R2# configure terminal
R2(config)# interface Loopback2
R2(config-if)# description Marketing Department
R2(config-if)# ip address 10.1.2.1 255.255.255.0
R2(config-if)# exit
R2(config)# interface FastEthernet0/0
R2(config-if)# ip address 10.1.100.2 255.255.255.0
R2(config-if)# no shutdown

R3# configure terminal
R3(config)# interface Loopback3
R3(config-if)# description Accounting Department
R3(config-if)# ip address 10.1.3.1 255.255.255.0
R3(config-if)# exit
R3(config)# interface FastEthernet0/0
R3(config-if)# ip address 10.1.100.3 255.255.255.0
R3(config-if)# no shutdown
```

Leave the switch in its default (blank) configuration. By default, all switch ports are in VLAN1 and are not administratively down.

Note: If the switch has been previously configured, erase the startup config, delete the vlan.dat file from flash memory, and reload the switch.

For now, also leave the serial interfaces in their default configuration. You will configure the serial link between R1 and R2 in Step 4.

b. Verify that the line protocol of each interface is up and that you can successfully ping across each link. You should see output similar to the following on each router.

```
R1# show ip interface brief
```



```
Interface              IP-Address      OK? Method Status
Protocol
FastEthernet0/0        10.1.100.1      YES manual up                    up
FastEthernet0/1        unassigned      YES unset  administratively down down
Serial0/0/0            unassigned      YES manual administratively down down
Serial0/0/1            unassigned      YES unset  administratively down down
Loopback1              10.1.1.1        YES manual up                    up
```

Step 2: Configure EIGRP on the Ethernet network.

a. After you have implemented your addressing scheme, create an EIGRP autonomous system (AS) on R1 using the following commands in global configuration mode.

```
R1(config)# router eigrp 1
R1(config-router)# network 10.0.0.0
R1(config-router)# no auto-summary
```

Using network statements with major networks causes EIGRP to begin sending EIGRP hello packets out all interfaces in that network (that is, subnets of the major network 10.0.0.0/8). In this case, EIGRP should start sending hello packets out of its FastEthernet0/0 and Loopback1 interfaces.

b. To check if this is occurring, use the **debug eigrp packets** command in privileged EXEC mode.

```
R1# debug eigrp packets
EIGRP Packets debugging is on
(UPDATE, REQUEST, QUERY, REPLY, HELLO, IPXSAP, PROBE, ACK, STUB, SIAQUERY,
SIAREPLY)
R1#
*Feb  3 16:54:43.555: EIGRP: Sending HELLO on FastEthernet0/0
*Feb  3 16:54:43.555:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Feb  3 16:54:43.995: EIGRP: Sending HELLO on Loopback1
*Feb  3 16:54:43.995:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Feb  3 16:54:43.995: EIGRP: Received HELLO on Loopback1 nbr 10.1.1.1
*Feb  3 16:54:43.995:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0
*Feb  3 16:54:43.995: EIGRP: Packet from ourselves ignored
```

The hello packets are unanswered by the other routers because EIGRP is not yet running on R2 or R3. R1 ignores the hello packets from itself on Loopback1.

c. Use the **undebug all** command to stop the debug output.

```
R1# undebug all
```

d. Use the **show ip eigrp interfaces** command to display the interfaces that are participating in EIGRP.

```
R1# show ip eigrp interfaces
IP-EIGRP interfaces for process 1

                         Xmit Queue   Mean   Pacing Time   Multicast
Pending
Interface        Peers   Un/Reliable  SRTT   Un/Reliable   Flow Timer   Routes
Fa0/0              0         0/0         0       0/1            0            0
Lo1                0         0/0         0       0/1            0            0
```

Which interfaces are involved in the EIGRP routing process on this router?

To monitor the EIGRP adjacency forming between routers R1 and R2 in real time while you configure R2, issue the **debug eigrp packets** command on both routers before configuring router R2.

e. In global configuration mode on R2, issue the same set of commands that you issued on R1 to create EIGRP AS 1 and advertise the 10.0.0.0/8 network. You should see debug output similar to the following.

```
R2# debug eigrp packets
EIGRP Packets debugging is on
    (UPDATE, REQUEST, QUERY, REPLY, HELLO, IPXSAP, PROBE, ACK, STUB,
SIAQUERY, SIAREPLY)

R2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.

R2(config)# router eigrp 1
R2(config-router)# network 10.0.0.0
R2(config-router)#
*Feb  3 17:01:03.427: EIGRP: Sending HELLO on FastEthernet0/0
*Feb  3 17:01:03.427:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Feb  3 17:01:03.431: EIGRP: Received HELLO on FastEthernet0/0 nbr 10.1.100.1
*Feb  3 17:01:03.431:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0
*Feb  3 17:01:03.431: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 1: Neighbor 10.1.100.1
(FastEthernet0/0) is up: new adjacency
*Feb  3 17:01:03.431: EIGRP: Enqueueing UPDATE on FastEthernet0/0 nbr
10.1.100.1 iidbQ un/rely 0/1 peerQ un/rely 0/0
*Feb  3 17:01:03.435: EIGRP: Received UPDATE on FastEthernet0/0 nbr
10.1.100.1
*Feb  3 17:01:03.435:   AS 1, Flags 0x1, Seq 1/0 idbQ 0/0 iidbQ un/rely 0/1
peerQ un/rely 0/0
*Feb  3 17:01:03.435: EIGRP: Requeued unicast on FastEthernet0/0
*Feb  3 17:01:03.435: EIGRP: Sending HELLO on FastEthernet0/0
*Feb  3 17:01:03.435:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Feb  3 17:01:03.439: EIGRP: Sending UPDATE on FastEthernet0/0 nbr 10.1.100.1
*Feb  3 17:01:03.439:   AS 1, Flags 0x1, Seq 1/1 idbQ 0/0 iidbQ un/rely 0/0
peerQ un/rely 0/1
*Feb  3 17:01:03.443: EIGRP: Received UPDATE on FastEthernet0/0 nbr
10.1.100.1
*Feb  3 17:01:03.443:   AS 1, Flags 0x8, Seq 2/0 idbQ 0/0 iidbQ un/rely 0/0
peerQ un/rely 0/1
*Feb  3 17:01:03.447: EIGRP: Received ACK on FastEthernet0/0 nbr 10.1.100.1
*Feb  3 17:01:03.447:   AS 1, Flags 0x0, Seq 0/1 idbQ 0/0 iidbQ un/rely 0/0
un/rely 0/1
*Feb  3 17:01:03.447: EIGRP: Enqueueing UPDATE on FastEthernet0/0 nbr
10.1.100.1 iidbQ un/rely 0/1 peerQ un/rely 0/0 serno 1-2
*Feb  3 17:01:03.451: EIGRP: Requeued unicast on FastEthernet0/0
*Feb  3 17:01:03.455: EIGRP: Sending UPDATE on FastEthernet0/0 nbr 10.1.100.1
*Feb  3 17:01:03.455:   AS 1, Flags 0x8, Seq 2/2 idbQ 0/0 iidbQ un/rely 0/0
peerQ un/rely 0/1 serno 1-2
*Feb  3 17:01:03.455: EIGRP: Enqueueing UPDATE on FastEthernet0/0 iidbQ
un/rely 0/1 serno 3-3
*Feb  3 17:01:03.455: EIGRP: Received UPDATE on FastEthernet0/0 nbr
10.1.100.1
*Feb  3 17:01:03.455:   AS 1, Flags 0x8, Seq 3/1 idbQ 0/0 iidbQ un/rely 0/1
peerQ un/rely 0/1
*Feb  3 17:01:03.455: EIGRP: Enqueueing ACK on FastEthernet0/0 nbr 10.1.100.1
*Feb  3 17:01:03.455:   Ack seq 3 iidbQ un/rely 0/1 peerQ un/rely 1/1
*Feb  3 17:01:03.459: EIGRP: Received ACK on FastEthernet0/0 nbr 10.1.100.1
*Feb  3 17:01:03.459:   AS 1, Flags 0x0, Seq 0/2 idbQ 0/0 iidbQ un/rely 0/1
peerQ un/rely 1/1
*Feb  3 17:01:03.467: EIGRP: Forcing multicast xmit on FastEthernet0/0
*Feb  3 17:01:03.467: EIGRP: Sending UPDATE on FastEthernet0/0
```



```
*Feb  3 17:01:03.467:   AS 1, Flags 0x0, Seq 3/0 idbQ 0/0 iidbQ un/rely 0/0 
serno 3-3
*Feb  3 17:01:03.471: EIGRP: Received ACK on FastEthernet0/0 nbr 10.1.100.1
*Feb  3 17:01:03.471:   AS 1, Flags 0x0, Seq 0/3 idbQ 0/0 iidbQ un/rely 0/0 
peerQ un/rely 1/1
*Feb  3 17:01:03.471: EIGRP: FastEthernet0/0 multicast flow blocking cleared
*Feb  3 17:01:03.479: EIGRP: Sending ACK on FastEthernet0/0 nbr 10.1.100.1
*Feb  3 17:01:03.479:   AS 1, Flags 0x0, Seq 0/3 idbQ 0/0 iidbQ un/rely 0/0 
peerQ un/rely 1/0
```

The debug output displays the EIGRP hello, update, and ACK packets. Because EIGRP uses Reliable Transport Protocol (RTP) for update packets, you see routers replying to update packets with the ACK packet. You can turn off debugging with the **undebug all** command.

f. Configure EIGRP on R3 using the same commands.

```
R3(config)# router eigrp 1
R3(config-router)# network 10.0.0.0

*Feb  3 17:16:05.415: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 1: Neighbor 10.1.100.2 
(FastEthernet0/1) is up: new adjacency
*Feb  3 17:16:05.419: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 1: Neighbor 10.1.100.1 
(FastEthernet0/1) is up: new adjacency
```

Step 3: Verify the EIGRP configuration.

a. When R3 is configured, issue the **show ip eigrp neighbors** command on each router. If you have configured each router successfully, each router has two adjacencies.

Note: In the output, the “H” column on the left lists the order in which a peering session was established with the specified neighbor. The order uses sequential numbering, starting with 0. The “H” stands for “handle,” which is an internal number used by the EIGRP implementation to refer to a particular neighbor.

```
R1# show ip eigrp neighbors
IP-EIGRP neighbors for process 1
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
1   10.1.100.3              Fa0/0             10 00:00:17    1   200  0  7
0   10.1.100.2              Fa0/0             11 00:02:01    5   200  0  6

R2# show ip eigrp neighbors
IP-EIGRP neighbors for process 1
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
1   10.1.100.3              Fa0/0             13 00:00:56    1   200  0  7
0   10.1.100.1              Fa0/0             12 00:02:40    1   200  0  47

R3# show ip eigrp neighbors
IP-EIGRP neighbors for process 1
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
1   10.1.100.2              Fa0/0             11 00:01:21  819  4914  0  6
0   10.1.100.1              Fa0/0             11 00:01:21    2   200  0  47
```

b. Check whether the EIGRP routes are being exchanged between the routers using the **show ip eigrp topology** command.

```
R1# show ip eigrp topology
IP-EIGRP Topology Table for AS(1)/ID(10.1.1.1)
```



```
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 10.1.3.0/24, 1 successors, FD is 156160
        via 10.1.100.3 (156160/128256), FastEthernet0/0
P 10.1.2.0/24, 1 successors, FD is 156160
        via 10.1.100.2 (156160/128256), FastEthernet0/0
P 10.1.1.0/24, 1 successors, FD is 128256
        via Connected, Loopback1
P 10.1.100.0/24, 1 successors, FD is 28160
        via Connected, FastEthernet0/0
```

You should see all the networks currently advertised by EIGRP on every router. You will explore the output of this command in the next lab. For now, verify that each loopback network exists in the EIGRP topology table.

c. Because EIGRP is the only routing protocol running and currently has routes to these networks, issuing the **show ip route eigrp** command displays the best route to the destination network.

```
R1# show ip route eigrp
     10.0.0.0/24 is subnetted, 4 subnets
D       10.1.3.0 [90/156160] via 10.1.100.3, 00:00:53, FastEthernet0/0
D       10.1.2.0 [90/156160] via 10.1.100.2, 00:00:53, FastEthernet0/0
```

d. To check whether you have full connectivity, ping the remote loopbacks from each router. If you have successfully pinged all the remote loopbacks, congratulations! You have configured EIGRP to route between these three remote networks.

Step 4: Configure EIGRP on the R1 and R2 serial interfaces.

a. Your serial interfaces are still in their default configuration. Specify the interface addresses according to the diagram, and set the clock rate to 64 kb/s for R1.

```
R1(config)# interface serial 0/0/0
R1(config-if)# ip address 10.1.200.1 255.255.255.0
R1(config-if)# clock rate 64000
R1(config-if)# no shut

R2(config)# interface serial 0/0/0
R2(config-if)# ip address 10.1.200.2 255.255.255.0
R2(config-if)# no shut
```

Notice that even though you have clocked the interface at 64 kb/s, issuing the **show interface serial 0/0/0** command reveals that the interface still shows the full T1 bandwidth of 1544 kb/s.

```
R1# show interfaces serial 0/0/0
Serial0/0/0 is up, line protocol is up
  Hardware is GT96K Serial
  Internet address is 10.1.200.1/24
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255

<output omitted>
```

The bandwidth is set primarily to provide the correct composite metric factor and a realistic and true description of the available bandwidth on an interface. It is also set to prevent EIGRP from flooding the interface. By default, EIGRP uses up to 50 percent of the bandwidth that the interface reports to the Cisco IOS software. Suppose there was a significant routing instability in some other part of the EIGRP AS. If

EIGRP were to use 50 percent of 1544 kb/s for its own routing information traffic, EIGRP traffic would fully saturate the low-bandwidth 64 kb/s serial link.

Recall that EIGRP uses a composite metric in which one of the variables is the bandwidth of the interface. For EIGRP to make an accurate computation, it needs correct information about the bandwidth of the serial link. Therefore, you must manually configure the bandwidth variable to 64 kb/s.

b. Apply the **bandwidth 64** command to the R1 and R2 serial interfaces.

```
R1(config)# interface serial 0/0/0
R1(config-if)# bandwidth 64

R2(config)# interface serial 0/0/0
R2(config-if)# bandwidth 64
```

c. Verify that your bandwidth configuration is reflected in the output of the **show interface serial 0/0/0** command.

```
R1# show interfaces serial 0/0/0
Serial0/0/0 is up, line protocol is up
  Hardware is GT96K Serial
  Internet address is 10.1.200.1/24
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
<output omitted>

R2# show interfaces serial 0/0/0
Serial0/0/0 is up, line protocol is up
  Hardware is GT96K Serial
  Internet address is 10.1.200.2/24
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
<output omitted>
```

d. Issue the **show ip eigrp neighbors** command, which displays the following neighbor relationship between R1 and R2.

```
R1# show ip eigrp neighbors
IP-EIGRP neighbors for process 1
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
2   10.1.200.2              Se0/0/0           10 00:03:03   24   200  0  53
1   10.1.100.3              Fa0/0             14 09:22:42  269  1614  0  54
0   10.1.100.2              Fa0/0             11 09:22:42  212  1272  0  59
```

Step 5: Configure network statement wildcard masks.

a. On R3, create Loopback11 with IP address 192.168.100.1/30, and Loopback15 with IP address 192.168.100.5/30.

```
R3(config)# interface Loopback11
R3(config-if)# ip address 192.168.100.1 255.255.255.252
R3(config-if)# exit
R3(config)# interface Loopback15
R3(config-if)# ip address 192.168.100.5 255.255.255.252
R3(config-if)# exit
```


How can you add the 192.168.100.0/30 network to EIGRP without involving the 192.168.100.4/30 network as well?

In Step 2, you looked at how network statements select networks for routing using major network boundaries. EIGRP also provides a way to select networks using wildcard masks. In a wildcard mask, bits that can vary are denoted by 1s in the binary bit values. If you wanted to route both Loopback11 and Loopback15 with EIGRP, you could use a wildcard mask that includes both of their network addresses, such as **network 192.168.100.0 0.0.0.7** or **network 192.168.100.0 0.0.0.255**. However, in this scenario, you want to select only the IP network for Loopback11.

b. On R3, issue the following commands:

```
R3(config)# router eigrp 1
R3(config-router)# network 192.168.100.0 0.0.0.3
```

c. Did this solution work? Check it with the **show ip eigrp interfaces** command. Notice that Loopback11 is involved in EIGRP, and Loopback15 is not.

```
R3# show ip eigrp interfaces
IP-EIGRP interfaces for process 1

                        Xmit Queue   Mean   Pacing Time   Multicast
Pending
Interface        Peers  Un/Reliable  SRTT   Un/Reliable   Flow Timer   Routes
Fa0/0              2        0/0        5        0/1          50           0
Lo3                0        0/0        0        0/1           0           0
Lo11               0        0/0        0        0/1           0           0
```

d. Which of these two IP networks can you see in the routing table on R1 after EIGRP converges with the new network? Look at the output of the **show ip route eigrp** command on R1.

```
R1# show ip route eigrp
     10.0.0.0/24 is subnetted, 5 subnets
D       10.1.3.0 [90/156160] via 10.1.100.3, 00:05:59, FastEthernet0/0
D       10.1.2.0 [90/156160] via 10.1.100.2, 00:12:16, FastEthernet0/0
D    192.168.100.0/24 [90/156160] via 10.1.100.3, 00:03:05, FastEthernet0/0
```

Notice that the subnet mask for the 192.168.100.0 network advertised by R3 is 24 bits. This will be examined more fully in the next lab. Which configuration command would allow R3 to advertise the proper subnet mask to its adjacent routers?

e. On R3, issue the **show ip protocols** command. Notice that automatic summarization is in effect. Also note the networks for which it is routing.

```
R3# show ip protocols
Routing Protocol is "eigrp 1"
  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 1
  EIGRP NSF-aware route hold timer is 240s
  Automatic network summarization is in effect
  Automatic address summarization:
    192.168.100.0/24 for Loopback11
      Summarizing with metric 128256
    10.0.0.0/8 for Loopback3, FastEthernet0/0
      Summarizing with metric 28160
  Maximum path: 4
  Routing for Networks:
    10.0.0.0
    192.168.100.0/30
  Routing Information Sources:
    Gateway         Distance      Last Update
    (this router)         90      00:22:13
    Gateway         Distance      Last Update
    10.1.100.2            90      00:22:15
    10.1.100.1            90      00:22:15
  Distance: internal 90 external 170
```

Challenge: Topology Change

You have been reading up about the advantages of different routing protocols. You noticed statements claiming that EIGRP converges faster than other routing protocols in a topology where there are multiple paths to the destination network. You are interested in testing this before you bring the network that you are designing online.

Verify the neighbor relationships and that the routing table of each router has the original loopback interfaces of the other routers, as described in the initial diagram. Make sure that you issue the **debug ip eigrp** command on all routers.

a. Issue the **show ip route** command on R2 and R3.

```
R2# show ip route eigrp
     10.0.0.0/24 is subnetted, 5 subnets
D       10.1.3.0 [90/156160] via 10.1.100.3, 00:05:22, FastEthernet0/0
D       10.1.1.0 [90/156160] via 10.1.100.1, 00:05:22, FastEthernet0/0
D    192.168.100.0/24 [90/156160] via 10.1.100.3, 00:14:30, FastEthernet0/0

R3# show ip route eigrp
     10.0.0.0/24 is subnetted, 5 subnets
D       10.1.2.0 [90/156160] via 10.1.100.2, 09:25:37, FastEthernet0/0
D       10.1.1.0 [90/156160] via 10.1.100.1, 09:25:37, FastEthernet0/0
D       10.0.0.0/8 is a summary, 09:25:37, Null0
D       10.1.200.0 [90/40514560] via 10.1.100.2, 00:03:01, FastEthernet0/0
                   [90/40514560] via 10.1.100.1, 00:03:01, FastEthernet0/0
     192.168.100.0/24 is variably subnetted, 3 subnets, 2 masks
D       192.168.100.0/24 is a summary, 00:18:15, Null0
```

b. From R3, trace the route to the Lo1 IP address on R1.

```
R3# traceroute 10.1.1.1

Type escape sequence to abort.
```



```
Tracing the route to 10.1.1.1

  1 10.1.100.1 4 msec *  0 msec
```

R3 is using R1 as the next hop to get to destination network 10.1.1.0/24 per the R3 routing table. However, R3 could potentially get to R1 through R2 via the serial link if the Fa0/0 interface on R1 was shut down.

c. From R3, issue a ping with a high repeat count to the destination address 10.1.1.1. You should see multiple exclamation points flooding the console output from R3.

```
R3# ping 10.1.1.1 repeat 10000
```

d. While the extended ping on R3 is running, shut down the Fa0/0 interface on R1. Allow the pings on R3 to complete.

```
R1(config)# interface FastEthernet0/0
R1(config-if)# shutdown


Type escape sequence to abort.
Sending 10000, 100-byte ICMP Echos to 10.1.1.1, timeout is 2 seconds:
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*Feb  4 13:35:55.311: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 1: Neighbor 10.1.100.1
(FastEthernet0/0) is down: holding time expired

<output omitted>

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Success rate is 99 percent (9992/10000), round-trip min/avg/max = 1/16/68 ms
```

From the perspective of R3, how many packets were dropped?

Which of the EIGRP timers causes this delay in the route recalculation?

e. Use the **traceroute** command to find the new route from R3 to R1.

```
R3# traceroute 10.1.1.1

Type escape sequence to abort.
Tracing the route to 10.1.1.1

  1 10.1.100.2 0 msec 0 msec 0 msec
  2 10.1.200.1 16 msec 12 msec *
```

f. Start the repeated ping again from R3, and administratively bring up the Fa0/0 interface on R1.

```
R3# ping 10.1.1.1 repeat 10000

R1(config)# interface FastEthernet0/0
R1(config-if)# no shutdown

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*Feb  4 13:35:55.147: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 1: Neighbor 10.1.100.1
(FastEthernet0/0) is up: new adjacency!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

<output omitted>

Success rate is 99 percent (9983/10000), round-trip min/avg/max = 1/2/44 ms
```

From the perspective of R3, how many packets were dropped?

Note: The loss ICMP ECHO packets results in a significant delay, as many as 30 or more seconds. Why did it take so long for R3 to reestablish ping connectivity with R3 after the R1 Fa0/0 interface was re-enabled and what changes could be made to correct the problem? The answer lies with the switch itself.

The switch that connects the three routers together is in its default configuration, running STP on each port and requiring 30 seconds to proceed through Listening and Learning states until a port transitions to the Forwarding state. The 17 lost packets are caused by the 30 seconds required by STP to transition the port to Forwarding state plus a couple of seconds for DTP to determine the port mode and perhaps ARP to resolve R3's MAC address.

This issue can be addressed by configuring the switch with the **spanning-tree portfast default** command. In addition, all ports could be defined as static access ports using the **switchport mode access** command.

If you were using RIPv2 as your routing protocol instead of EIGRP, would fewer or more packets be dropped?

Router Interface Summary Table

Router Interface Summary				
Router Model	Ethernet Interface #1	Ethernet Interface #2	Serial Interface #1	Serial Interface #2
1700	Fast Ethernet 0 (FA0)	Fast Ethernet 1 (FA1)	Serial 0 (S0)	Serial 1 (S1)
1800	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2600	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0 (S0/0)	Serial 0/1 (S0/1)
2800	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
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. Rather than list all 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 might contain one. For example, for an ISDN BRI interface, the string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.				

