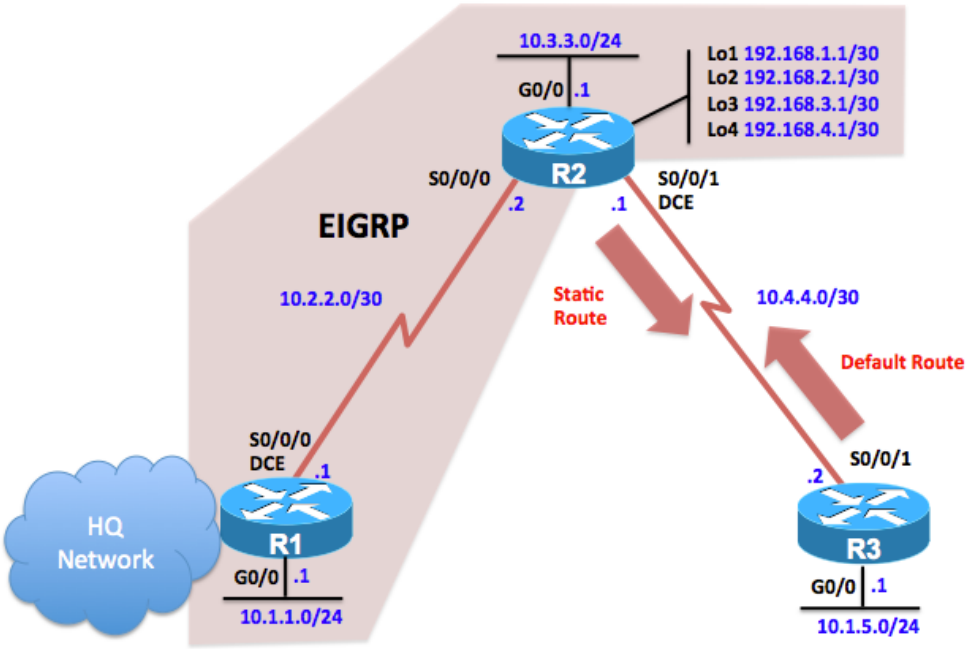
CCNPv7 ROUTE

Chapter 2 Lab 2-2, EIGRP Stub Routing

Topology



Objectives

- Configure basic EIGRP.
- Configure EIGRP stub routing options.
- Verify EIGRP stub routing options

Background

To improve network stability and reduce resource utilization on the HQ network you have decided to configure one of the branch routers, R2 as an EIGRP stub router.

Note: This lab uses Cisco 1941 routers with Cisco IOS Release 15.4 with IP Base. The switches are Cisco WS-C2960-24TT-L with Fast Ethernet interfaces, therefore the router will use routing metrics associated with a 100 Mb/s interface. 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 IOS Release 15.2 or comparable)
- 3 switches (LAN interfaces)

- Serial and Ethernet cables

Step 0: Suggested starting configurations.

a. Apply the following configuration to each router along with the appropriate **hostname**. The **exec-timeout 0 0** command should only be used in a lab environment.

```
Router(config)# no ip domain-lookup
Router(config)# line con 0
Router(config-line)# logging synchronous
Router(config-line)# exec-timeout 0 0
```

Step 1: Configure the addressing and serial links.

a. Using the addressing scheme in the diagram, configure the interfaces on each router.

```
R1(config)# interface gigabitethernet 0/0
R1(config-if)# ip address 10.1.1.1 255.255.255.0
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)# interface serial 0/0/0
R1(config-if)# ip address 10.2.2.1 255.255.255.252
R1(config-if)# clock rate 64000
R1(config-if)# no shutdown
R1(config-if)# exit

R2(config)# interface serial 0/0/0
R2(config-if)# ip address 10.2.2.2 255.255.255.252
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface gigabitethernet 0/0
R2(config-if)# ip address 10.3.3.1 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface serial 0/0/1
R2(config-if)# ip address 10.4.4.1 255.255.255.252
R2(config-if)# clockrate 64000
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface Loopback1
R2(config-if)# ip address 192.168.1.1 255.255.255.252
R2(config-if)# exit
R2(config)# interface Loopback2
R2(config-if)# ip address 192.168.2.1 255.255.255.252
R2(config-if)# exit
R2(config)# interface Loopback3
R2(config-if)# ip address 192.168.3.1 255.255.255.252
R2(config-if)# exit
R2(config)# interface Loopback4
R2(config-if)# ip address 192.168.4.1 255.255.255.252
R2(config-if)# exit

R3(config)# interface serial 0/0/1
R3(config-if)# ip address 10.4.4.2 255.255.255.252
R3(config-if)# no shutdown
R3(config-if)# exit
R3(config)# interface gigabitethernet 0/0
R3(config-if)# ip address 10.1.5.1 255.255.255.0
R3(config-if)# no shutdown
```

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

b. Verify connectivity by pinging across each of the local networks connected to each router.

c. Issue the **show ip interface brief** command on each router. This command displays a brief listing of the interfaces, their status, and their IP addresses. Router R2 is shown as an example.

```
R2# show ip interface brief
Interface                  IP-Address      OK? Method Status
Protocol
Embedded-Service-Engine0/0 unassigned      YES unset  administratively down down
GigabitEthernet0/0         10.3.3.1        YES manual up                    up
Serial0/0/0                10.2.2.2        YES manual up                    up
Serial0/0/1                10.4.4.1        YES manual up                    up
R2#
```

Step 2: Configure EIGRP.

a. Enable EIGRP AS 100 for all interfaces on R1 and R2. For your reference, these are the commands which can be used:

```
R1(config)# router eigrp 100
R1(config-router)# network 10.0.0.0

R2(config)# router eigrp 100
R2(config-router)# network 10.0.0.0
R2(config-router)# network 192.168.0.0 0.0.255.255
```

b. Summarize R2's loopback interfaces in its EIGRP update to R1 using manual summarization.

```
R2(config)# interface serial 0/0/0
R2(config-if)# ip summary-address eigrp 100 192.168.0.0 255.255.248.0
```

c. Configure a static route on R2 to R3's LAN. Configure a default static route on R3 forwarding all traffic to R2.

```
R2(config)# ip route 10.1.5.0 255.255.255.0 10.4.4.2

R3(config)# ip route 0.0.0.0 0.0.0.0 10.4.4.1
```

d. Verify that R2 and R3 can ping the other's LAN intefaces.

```
R2# ping 10.1.5.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.5.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms
R2#

R3# ping 10.3.3.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.3.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms
R3#
```

e. Verify the EIGRP the neighbor relationship between R1 and R2 with the **show ip eigrp neighbors** command. Verify that R1 is receiving a summary route for R2's loopback networks. The output for R2 is as follows.

```
R2# show ip eigrp neighbors
EIGRP-IPv4 Neighbors for AS(100)
H   Address                 Interface              Hold Uptime   SRTT   RTO  Q  Seq
                                                   (sec)         (ms)       Cnt Num
0   10.2.2.1                Se0/0/0                  12 00:51:26  363  2178  0  9
R2#
```

f. Examine R1's routing table with the **show ip route eigrp** command.

```
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
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override

Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 6 subnets, 3 masks
C        10.1.1.0/24 is directly connected, GigabitEthernet0/0
L        10.1.1.1/32 is directly connected, GigabitEthernet0/0
C        10.2.2.0/30 is directly connected, Serial0/0/0
L        10.2.2.1/32 is directly connected, Serial0/0/0
D        10.3.3.0/30 [90/2172416] via 10.2.2.2, 00:52:58, Serial0/0/0
D        10.4.4.0/30 [90/2681856] via 10.2.2.2, 00:52:58, Serial0/0/0
D     192.168.0.0/21 [90/2297856] via 10.2.2.2, 00:47:02, Serial0/0/0
R1#
```

Does R1 have a route to R3's LAN? Why or why not.

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Step 3: Configure and verify EIGRP stub routing.

a. EIGRP stub routing feature enable you to limit the EIGRP Query messages scope in the network. Routers configured as stubs do not forward EIGRP learned routes to other neighbors.

Use the **eigrp stub** command to configure a router as a stub where the router directs all IP traffic to a distribution router.

The **eigrp stub** command can be modified with several options, and these options can be used in any combination except for the **receive-only** keyword. The **receive-only** keyword will restrict the router from sharing any of its routes with any other router in that EIGRP autonomous system, and the **receive-only** keyword will not permit any other option to be specified because it prevents any type of route from being sent. The four other optional keywords (**connected**, **static**, **summary**, and **redistributed**) can be used in any combination but cannot be used with the **receive-only** keyword.

If any of these five keywords is used with the **eigrp stub** command, only the route types specified by the particular keyword(s) will be sent. Route types specified by the remaining keywords will not be sent.

The **connected** keyword permits the EIGRP stub routing feature to send connected routes. If the connected routes are not covered by a network statement, it may be necessary to redistribute connected routes with the redistribute connected command under the EIGRP process. *This option is enabled by default*.

The **static** keyword permits the EIGRP stub routing feature to send static routes. Without the configuration of this option, EIGRP will not send any static routes, including internal static routes that normally would be automatically redistributed. It will still be necessary to redistribute static routes with the redistribute static command.

The **summary** keyword permits the EIGRP stub routing feature to send summary routes. Summary routes can be created manually with the summary address command or automatically at a major network border router with the auto-summary command enabled. *This option is enabled by default*.

The **redistributed** keyword permits the EIGRP stub routing feature to send other routing protocols and autonomous systems. Without the configuration of this option, EIGRP will not advertise redistributed routes.

Note: There is one more keyword the **leak-map** option. The **leak-map** keyword permits the EIGRP stub routing feature to reference a leak map that identifies routes that are allowed to be advertised on an EIGRP stub router that would normally have been suppressed.

Configure R2 as a stub router using the default **eigrp stub** command.

```
R2(config)# router eigrp 100
R2(config-router)# eigrp stub ?
  connected      Do advertise connected routes
  leak-map       Allow dynamic prefixes based on the leak-map
  receive-only   Set receive only neighbor
  redistributed  Do advertise redistributed routes
  static         Do advertise static routes
  summary        Do advertise summary routes
  <cr>
 R2(config-router)# eigrp stub
*Jul 22 00:41:02.667: %DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 10.2.2.1
(Serial0/0/0) is down: peer info changed
R2(config-router)#
*Jul 22 00:41:03.899: %DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 10.2.2.1
(Serial0/0/0) is up: new adjacency
R2(config-router)
```

b. Examine the EIGRP section in R2's running-config. What EIGRP stub options are implemented by default?

```
R2# show running-config | section eigrp
 ip summary-address eigrp 100 192.168.0.0 255.255.248.0
router eigrp 100
 network 10.0.0.0
 network 192.168.0.0 0.0.255.255
 eigrp stub connected summary
R2#
```

What EIGRP stub options are implemented by default?

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c. Examine the EIGRP routes in R1's routing table.

```
R1# show ip route eigrp

      10.0.0.0/8 is variably subnetted, 6 subnets, 3 masks
D        10.3.3.0/24 [90/2172416] via 10.2.2.2, 00:10:34, Serial0/0/0
D        10.4.4.0/30 [90/2681856] via 10.2.2.2, 00:10:34, Serial0/0/0
D     192.168.0.0/21 [90/2297856] via 10.2.2.2, 00:10:34, Serial0/0/0
R1#
```

Notice that R1 shows EIGRP routes for R2's connected networks and R2's 192.16.0.0/21 summary route

d. Issue the **show ip eigrp neighbors detail** command to verify that R1 sees R2 as a stub router.

```
R1# show ip eigrp neighbors detail
EIGRP-IPv4 Neighbors for AS(100)
H   Address                 Interface              Hold Uptime   SRTT   RTO  Q  Seq
                                                   (sec)         (ms)       Cnt Num
0   10.2.2.2                Se0/0/0                  14 00:21:37   20   120  0  15
   Version 16.0/2.0, Retrans: 0, Retries: 0, Prefixes: 3
   Topology-ids from peer - 0
   Stub Peer Advertising (CONNECTED SUMMARY ) Routes
   Suppressing queries
Max Nbrs: 0, Current Nbrs: 0
R1#
```

Step 4: Configure and verify EIGRP stub routing options static, connected and summary.

a. Modify R2's stub routing to also include its static route in its EIGRP update to R1. It is necessary to also include the redistribute static command.

```
R2(config)# router eigrp 100
R2(config-router)# redistribute static
R2(config-router)# eigrp stub static
*Jul 22 01:08:39.891: %DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 10.2.2.1
(Serial0/0/0) is down: peer info changed
*Jul 22 01:08:40.919: %DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 10.2.2.1
(Serial0/0/0) is up: new adjacency
```

With each change of the EIGRP stub settings, reestablishment of the EIGRP neighbor session is required.

b. Examine R1's EIGRP routes using the **show ip route eigrp** command.

```
R1# show ip route eigrp

      10.0.0.0/8 is variably subnetted, 5 subnets, 3 masks
D EX     10.1.5.0/24 [170/2681856] via 10.2.2.2, 00:00:23, Serial0/0/0
R1#
```

Why does R1 only have R2's static route to R3's LAN? What do you need to do so R1 includes the previous EIGRP routes?

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c. R2's stub configuration can be verified using the **show ip eigrp neighbors detail** command on R1 and **show running-config | section eigrp** on R2.

```
R1# show ip eigrp neighbors detail
EIGRP-IPv4 Neighbors for AS(100)
H   Address                 Interface              Hold Uptime   SRTT   RTO  Q  Seq
```

```
                                                    (sec)          (ms)       Cnt Num
0   10.2.2.2                  Se0/0/0                 13 00:14:45   22   132  0   20
   Version 16.0/2.0, Retrans: 0, Retries: 0, Prefixes: 1
   Topology-ids from peer - 0
   Stub Peer Advertising (STATIC ) Routes
   Suppressing queries
Max Nbrs: 0, Current Nbrs: 0
R1#

R2# show running-config | section eigrp
 ip summary-address eigrp 100 192.168.0.0 255.255.248.0
router eigrp 100
 network 10.0.0.0
 network 192.168.0.0 0.0.255.255
 redistribute static
 eigrp stub static
R2#
```

d. Configure R2 EIGRP stub routing to include the connected, summary and static options.

```
R2(config)# router eigrp 100
R2(config-router)# eigrp stub connected summary static
*Jul 22 01:29:15.411: %DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 10.2.2.1
(Serial0/0/0) is down: peer info changed
*Jul 22 01:29:17.195: %DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 10.2.2.1
(Serial0/0/0) is up: new adjacency
```

e. Examine R1's routing table and notice R1 is now sending its connected, summarized and static routes to R1.

```
R1# show ip route eigrp

      10.0.0.0/8 is variably subnetted, 7 subnets, 3 masks
D EX     10.1.5.0/24 [170/2681856] via 10.2.2.2, 00:02:11, Serial0/0/0
D        10.3.3.0/24 [90/2172416] via 10.2.2.2, 00:02:11, Serial0/0/0
D        10.4.4.0/30 [90/2681856] via 10.2.2.2, 00:02:11, Serial0/0/0
D     192.168.0.0/21 [90/2297856] via 10.2.2.2, 00:02:11, Serial0/0/0
R1#
```

f. Verify R2's modified stub configuration using the **show ip eigrp neighbors detail** command on R1.

```
R1# show ip eigrp neighbor detail
EIGRP-IPv4 Neighbors for AS(100)
H   Address                 Interface              Hold Uptime   SRTT   RTO  Q  Seq
                                                   (sec)         (ms)       Cnt Num
0   10.2.2.2                  Se0/0/0                 11 00:02:37 1289  5000  0  22
   Version 16.0/2.0, Retrans: 0, Retries: 0, Prefixes: 4
   Topology-ids from peer - 0
   Stub Peer Advertising (CONNECTED STATIC SUMMARY ) Routes
   Suppressing queries
Max Nbrs: 0, Current Nbrs: 0
R1#
```

g. Examine the change to R2's running-configuration using the **show running-config | section eigrp** command.

```
R2# show running-config | section eigrp
 ip summary-address eigrp 100 192.168.0.0 255.255.248.0
router eigrp 100
 network 10.0.0.0
 network 192.168.0.0 0.0.255.255
```

```
 redistribute static
 eigrp stub connected static summary
R2#
```

h. At this point R1 and R3 should now be able to ping the other's LAN.

```
R1# ping 10.1.5.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.5.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms
R1#

R3# ping 10.1.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/55/56 ms
R3#
```

Step 5: Configure and verify EIGRP stub routing option receive-only.

a. The **receive-only** option prevents the stub router from sharing any of its routes with any other router in the EIGRP AS. This option does not permit any other option to be included. The option is not as common as the previous options. Examples of this the **receive-only** option include when the router has a single interface of if NAT/PAT is configured with host hidden behind the stub router.

```
R2(config)# router eigrp 100
R2(config-router)# eigrp stub receive-only
*Jul 22 01:51:37.995: %DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 10.2.2.1
(Serial0/0/0) is down: peer info changed
*Jul 22 01:51:41.115: %SYS-5-CONFIG_I: Configured from console by console
*Jul 22 01:51:41.843: %DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 10.2.2.1
(Serial0/0/0) is up: new adjacency
```

What EIGRP routes do you expect R1 to have in it's routing table?

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b. Issue the **show ip route eigrp** command to examine the EIGRP routes R1 is receiving from R2.

```
R1# show ip route eigrp
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override

Gateway of last resort is not set

R1#
```

Notice that R1 does not receive any EIGRP routes from R2.

c. Issue the **show ip eigrp neighbor detail** command on R1 to verify it sees R2 as a receive-only stub router .

```
R1# show ip eigrp neighbor detail
EIGRP-IPv4 Neighbors for AS(100)
H   Address                 Interface              Hold Uptime   SRTT   RTO  Q  Seq
                                                   (sec)         (ms)       Cnt Num
0   10.2.2.2                Se0/0/0                  11 00:01:58   19   114  0  24
   Version 16.0/2.0, Retrans: 0, Retries: 0
   Topology-ids from peer - 0
   Receive-Only Peer Advertising (No) Routes
   Suppressing queries
Max Nbrs: 0, Current Nbrs: 0
R1#
```