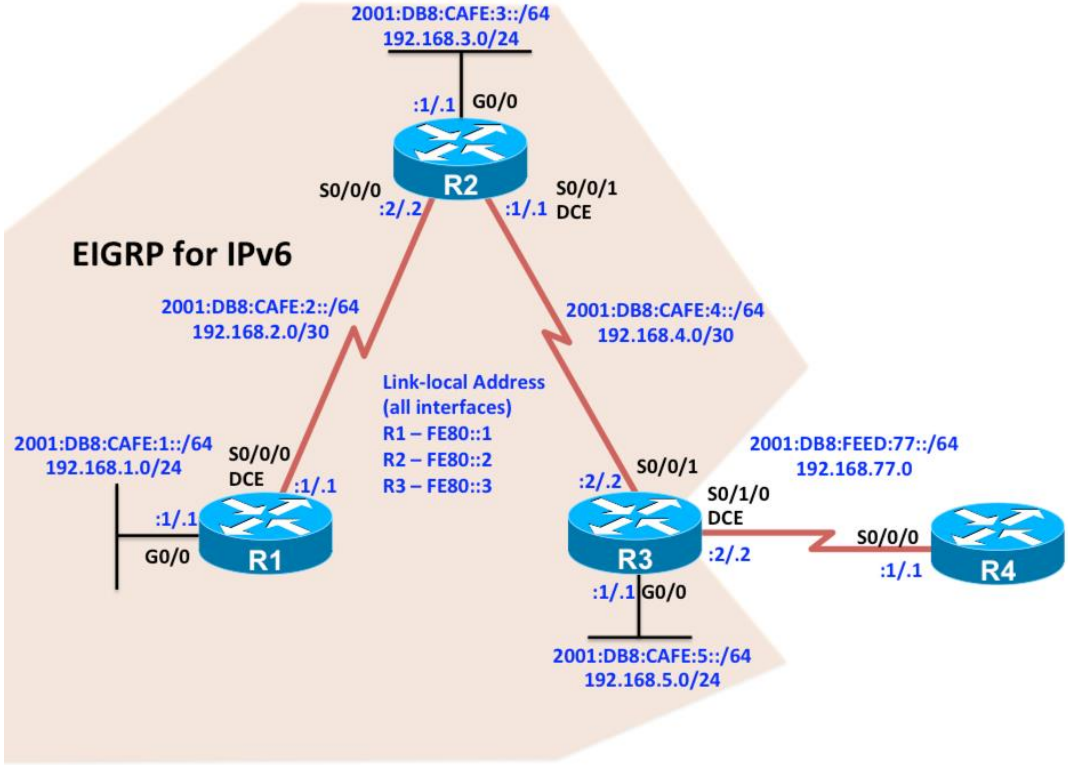
CCNPv7 ROUTE

Chapter 2 Lab 2-4, Named EIGRP Configuration

Topology



Objectives

- Configure Named EIGRP for IPv4 and IPv6.
- Verify Named EIGRP configuration.
- Configure and verify passive routes Named EIGRP configuration.
- Configure and verify default route using Named EIGRP configuration.

Background

What is known as “classic” EIGRP requires separate EIGRP configuration modes and commands for IPv4 and IPv6. Each process is configured separately, **router eigrp** *as-number* for IPv4 and **ipv6 router eigrp** *as-number* for IPv6.

Named EIGRP uses the address family (AF) feature to unify the configuration process when implementing both IPv4 and IPv6. In this lab, you will configure named EIGRP for IPv4 and IPv6.

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

- 4 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 topology, configure the IPv4 and IPv6 addresses on the interfaces of each router.

```
R1(config)# interface GigabitEthernet0/0
R1(config-if)# ip address 192.168.1.1 255.255.255.0
R1(config-if)# ipv6 address FE80::1 link-local
R1(config-if)# ipv6 address 2001:DB8:CAFE:1::1/64
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)# interface Serial0/0/0
R1(config-if)# ip address 192.168.2.1 255.255.255.252
R1(config-if)# ipv6 address FE80::1 link-local
R1(config-if)# ipv6 address 2001:DB8:CAFE:2::1/64
R1(config-if)# clock rate 64000
R1(config-if)# no shutdown

R2(config)# interface GigabitEthernet0/0
R2(config-if)# ip address 192.168.3.1 255.255.255.0
R2(config-if)# ipv6 address FE80::2 link-local
R2(config-if)# ipv6 address 2001:DB8:CAFE:3::1/64
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface Serial0/0/0
R2(config-if)# ip address 192.168.2.2 255.255.255.252
R2(config-if)# ipv6 address FE80::2 link-local
R2(config-if)# ipv6 address 2001:DB8:CAFE:2::2/64
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface Serial0/0/1
R2(config-if)# ip address 192.168.4.1 255.255.255.252
R2(config-if)# ipv6 address FE80::2 link-local
R2(config-if)# ipv6 address 2001:DB8:CAFE:4::1/64
R2(config-if)# clock rate 64000
R2(config-if)# no shutdown

R3(config)# interface GigabitEthernet0/0
R3(config-if)# ip address 192.168.5.1 255.255.255.0
R3(config-if)# ipv6 address FE80::3 link-local
R3(config-if)# ipv6 address 2001:DB8:CAFE:5::1/64
R3(config-if)# no shutdown
R3(config-if)# exit
```

```
R3(config)# interface Serial0/0/1
R3(config-if)# ip address 192.168.4.2 255.255.255.252
R3(config-if)# ipv6 address FE80::3 link-local
R3(config-if)# ipv6 address 2001:DB8:CAFE:4::2/64
R3(config-if)# no shutdown
R3(config-if)# exit
R3(config)# interface Serial0/1/0
R3(config-if)# ip address 192.168.77.2 255.255.255.0
R3(config-if)# ipv6 address FE80::3 link-local
R3(config-if)# ipv6 address 2001:DB8:FEED:77::2/64
R3(config-if)# clock rate 64000
R3(config-if)# no shutdown
R3(config-if)#

R4(config)# interface Serial0/0/0
R4(config-if)# ip address 192.168.77.1 255.255.255.0
R4(config-if)# ipv6 address FE80::4 link-local
R4(config-if)# ipv6 address 2001:DB8:FEED:77::1/64
R4(config-if)# no shutdown
R4(config-if)# exit
R4(config)# ipv6 route 2001:DB8:CAFE::/48 2001:DB8:FEED:77::2
R4(config)# ip route 0.0.0.0 0.0.0.0 192.168.77.2
R4(config)#
```

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

c. Issue the **show ip interface brief** and **show ipv6 interface brief** commands on each router. This command displays a brief listing of the interfaces, their status, and their IP addresses. Router R1 is shown as an example.

```
R1# show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Embedded-Service-Engine0/0 unassigned      YES unset  administratively down down
GigabitEthernet0/0         192.168.1.1     YES manual up                    up
GigabitEthernet0/1         unassigned      YES unset  administratively down down
Serial0/0/0                192.168.2.1     YES manual up                    up
Serial0/0/1                unassigned      YES unset  administratively down down
R1# show ipv6 interface brief
Em0/0                  [administratively down/down]
    unassigned
GigabitEthernet0/0     [up/up]
    FE80::1
    2001:DB8:CAFE:1::1
GigabitEthernet0/1     [administratively down/down]
    unassigned
Serial0/0/0            [up/up]
    FE80::1
    2001:DB8:CAFE:2::1
Serial0/0/1            [administratively down/down]
    unassigned
R1#
```

Step 2: Configure Named EIGRP for IPv4 on R1.

a. Named EIGRP is organized in an hierarchical manner. Configuration for each routing protocol, EIGRP for IPv4 and EIGRP for IPv6 is done within its own address family. To configure named EIGRP configuration use the **router eigrp** *virtual-instance-name* command in global configuration mode. The virtual-instance-names do not have to match between neighbors.

Note: IPv6 unicast routing must be enabled prior to configuring the IPv6 address family.

```
R1(config)# ipv6 unicast-routing
R1(config)# router eigrp DUAL-STACK
R1(config-router)#
```

b. EIGRP doesn't start until at least one address family has been defined (IPv4 or IPv6). The address family command starts the EIGRP protocol (IPv4 or IPv6) for the defined autonomous system.

To configure the IPv4 address family and autonomous system you use the **address-family ipv4 unicast autonomous-system** command. This command puts you into the address family configuration mode. Issue the **address-family ?** command see the two address families available. After configuring the IPv4 address family for EIGRP use the **?** to see what commands available in address family configuration mode such as the **af-interface**, **eigrp**, and **network** commands.

```
R1(config-router)# address-family ?
  ipv4  Address family IPv4
  ipv6  Address family IPv6

R1(config-router)# address-family ipv4 unicast autonomous-system 4
R1(config-router-af)# ?
Address Family configuration commands:
  af-interface          Enter Address Family interface configuration
  default               Set a command to its defaults
  eigrp                 EIGRP Address Family specific commands
  exit-address-family   Exit Address Family configuration mode
  help                  Description of the interactive help system
  maximum-prefix        Maximum number of prefixes acceptable in aggregate
  metric                Modify metrics and parameters for address advertisement
  neighbor              Specify an IPv4 neighbor router
  network               Enable routing on an IP network
  no                    Negate a command or set its defaults
  shutdown              Shutdown address family
  timers                Adjust peering based timers
  topology              Topology configuration mode

R1(config-router-af)#
```

c. In address family configuration mode you can enable EIGRP for specific interfaces and define other general parameters such as the router ID and stub routing. Issue the **eigrp ?** to see the available options configured using the **eigrp** command. Use the **eigrp router-id** command to configure the EIGRP router ID for the IPv4 address family.

```
R1(config-router-af)# eigrp ?
  default-route-tag      Default Route Tag for the Internal Routes
  log-neighbor-changes   Enable/Disable EIGRP neighbor logging
  log-neighbor-warnings  Enable/Disable EIGRP neighbor warnings
  router-id              router id for this EIGRP process
  stub                   Set address-family in stubbed mode

R1(config-router-af)# eigrp router-id 1.1.1.1
R1(config-router-af)#
```

d. While still in the address family configuration mode for IPv4, use the **network** command to enable EIGRP on the interfaces. These are the same **network** commands used in "classic" EIGRP for IPv4.

```
R1(config-router-af)# network 192.168.1.0
R1(config-router-af)# network 192.168.2.0 0.0.0.3
R1(config-router-af)#
```

e. Exit the IPv4 address family configuration mode using the **exit-address-family** command or the shorter **exit** command. Notice that you are still in named EIGRP configuration mode.

```
R1(config-router-af)# exit-address-family
R1(config-router)#
```

Step 3: Configure Named EIGRP for IPv6 on R1.

a. Configure the IPv6 address family using the autonomous system (process ID) of 6. Use the **?** the view the command options available under each mode and for some of the commands. There is no requirement for the AS numbers to match between the IPv4 and IPv6 address families, but they must match their neighbors' AS. In this example, routers R2 and R3 must use AS 4 for the IPv4 address family and AS 6 for the IPv6 address family.

```
R1(config-router)# address-family ipv6 unicast autonomous-system 6
R1(config-router-af)#
```

b. Use the **eigrp router-id** command to configure the EIGRP router ID for the IPv4 address family. The IPv6 router ID does not have to match the a router ID configured for IPv4.

```
R1(config-router-af)# eigrp router-id 1.1.1.1
R1(config-router-af)#
```

c. By default, all IPv6 interfaces are automatically enabled for EIGRP for IPv6. This will be explored further in the next step.

In this scenario, is the **eigrp router-id** command required to configure a router ID for the IPv4 AF? Is it required for the IPv6 AF? What would happen if the router ID was not configured using the **eigrp router-id** command?

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Step 4: Configure Named EIGRP on R2 and R3.

a. Configure named EIGRP on R2 for the IPv4 address family. The IPv6 unicast routing is enabled in preparation for configuring the IPv6 address family.

```
R2(config)# ipv6 unicast-routing
R2(config)# router eigrp DUAL-STACK
R2(config-router)# address-family ipv4 unicast autonomous-system 4
R2(config-router-af)# eigrp router-id 2.2.2.2
R2(config-router-af)# network 192.168.2.0 0.0.0.3
*Jul 25 20:11:37.643: %DUAL-5-NBRCHANGE: EIGRP-IPv4 4: Neighbor 192.168.2.1
(Serial0/0/0) is up: new adjacency
R2(config-router-af)# network 192.168.3.0
R2(config-router-af)# network 192.168.4.0 0.0.0.3
R2(config-router-af)# exit-address-family
```

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

Notice that the adjacency between R1 and R2 is established after enabling EIGRP for IPv4 on the serial 0/0/0 interface.

b. Configure the IPv6 address family for EIGRP on R2.

```
R2(config-router)# address-family ipv6 unicast autonomous-system 6
*Jul 25 20:19:05.435: %DUAL-5-NBRCHANGE: EIGRP-IPv6 6: Neighbor FE80::1
(Serial0/0/0) is up: new adjacency
R2(config-router-af)# eigrp router-id 2.2.2.2
R2(config-router-af)#
```

Notice that the IPv6 adjacency with R1 comes up immediately after configuring the IPv6 AF. This is because by default, all IPv6 interfaces are enabled automatically.

c. On R3, configure named EIGRP on R3 for both the IPv4 and IPv6 address families. After the appropriate commands are configured the IPv4 and IPv6 EIGRP adjacencies are established between R2 and R3. The serial link between R3 and R4 is also automatically enabled in EIGRP for IPv6. This link is not suppose to be included and will be disabled in EIGRP for IPv6 later in step 6.

```
R3(config)# ipv6 unicast-routing
R3(config)# router eigrp DUAL-STACK
R3(config-router)# address-family ipv4 unicast autonomous-system 4
R3(config-router-af)# eigrp router-id 3.3.3.3
R3(config-router-af)# network 192.168.4.0 0.0.0.3
*Jun 26 13:11:41.343: %DUAL-5-NBRCHANGE: EIGRP-IPv4 4: Neighbor 192.168.4.1
(Serial0/0/1) is up: new adjacency
R3(config-router-af)# network 192.168.5.0
R3(config-router-af)# exit-address-family
R3(config-router)# address-family ipv6 unicast autonomous-system 6
*Jun 26 13:12:22.819: %DUAL-5-NBRCHANGE: EIGRP-IPv6 6: Neighbor FE80::2
(Serial0/0/1) is up: new adjacency
R3(config-router-af)# eigrp router-id 3.3.3.3
R3(config-router-af)#
```

Step 5: Configure passive interfaces for named EIGRP.

a. Within each IPv4 and IPv6 AF is the address family interface configuration mode. This mode is used to configure EIGRP specific parameters on an interface, such as the hello timer and summarization. From address family configuration mode, use the **af-interface** *interface-type interface-number* command to enter address family interface configuration mode. The following output shows the sequence of commands starting from global configuration mode.

```
R1(config)# router eigrp DUAL-STACK
R1(config-router)# address-family ipv4 unicast autonomous-system 4
R1(config-router-af)# af-interface gigabitethernet 0/0
R1(config-router-af-interface)#
```

b. Issue the **?** to see the commands available in address family interface configuration mode. Notice various commands to configure interface specific parameters such as the hello interval, hold timer, passive interfaces, and summarization.

```
R1(config-router-af-interface)# ?
Address Family Interfaces configuration commands:
```

```
  add-paths           Advertise add paths
  authentication      authentication subcommands
  bandwidth-percent   Set percentage of bandwidth percentage limit
  bfd                 Enable Bidirectional Forwarding Detection
  dampening-change    Percent interface metric must change to cause update
  dampening-interval  Time in seconds to check interface metrics
  default             Set a command to its defaults
  exit-af-interface   Exit from Address Family Interface configuration mode
  hello-interval      Configures hello interval
  hold-time           Configures hold time
  next-hop-self       Configures EIGRP next-hop-self
  no                  Negate a command or set its defaults
  passive-interface   Suppress address updates on an interface
  shutdown            Disable Address-Family on interface
  split-horizon       Perform split horizon
  summary-address     Perform address summarization

R1(config-router-af-interface)#
```

The interface configuration mode commands are similar for both the IPv4 and IPv6 address families. Commands issued are specific for an interface within the address family, IPv4 or IPv6.

c. Using the **passive-interface** command, configure G0/0 interface as passive for both the IPv4 and IPv6 EIGRP address families.

```
R1(config-router-af-interface)# passive-interface
R1(config-router-af-interface)# exit-af-interface
R1(config-router-af)# exit-address-family
R1(config-router)# address-family ipv6 unicast autonomous-system 6
R1(config-router-af)# af-interface gigabitethernet 0/0
R1(config-router-af-interface)# passive-interface
R1(config-router-af-interface)# exit-af-interface
R1(config-router-af)# exit-address-family
R1(config-router)#
```

d. Configure R2's G0/0 interface as passive for both the IPv4 and IPv6 address families.

```
R2(config)# router eigrp DUAL-STACK
R2(config-router)# address-family ipv4 unicast autonomous-system 4
R2(config-router-af)# af-interface gigabitethernet 0/0
R2(config-router-af-interface)# passive-interface
R2(config-router-af-interface)# exit-af-interface
R2(config-router-af)# exit-address-family
R2(config-router)# address-family ipv6 unicast autonomous-system 6
R2(config-router-af)# af-interface gigabitethernet 0/0
R2(config-router-af-interface)# passive-interface
R2(config-router-af-interface)# exit
R2(config-router-af)# exit
R2(config-router)#
```

e. Configure R3's G0/0 interface as passive for both the IPv4 and IPv6 address families.

```
R3(config)# router eigrp DUAL-STACK
R3(config-router)# address-family ipv4 unicast autonomous-system 4
R3(config-router-af)# af-interface gigabitethernet 0/0
R3(config-router-af-interface)# passive-interface
R3(config-router-af-interface)# exit-af-interface
R3(config-router-af)# exit-address-family
R3(config-router)# address-family ipv6 unicast autonomous-system 6
R3(config-router-af)# af-interface gigabitethernet 0/0
R3(config-router-af-interface)# passive-interface
R3(config-router-af-interface)# exit
R3(config-router-af)# exit
R3(config-router)#
```

Notice the **exit** command was used as the shorter method for the **exit-af-interface** and **exit-address-family** commands.

Step 6: Disable named EIGRP on a specific IPv6 interface.

a. By default, all IPv6 interfaces are enabled for EIGRP for IPv6. This happens when enabling the IPv6 address family with the **address-family ipv6 unicast autonomous-system** command. Issue the **show ipv6 protocols** command on R3 to verify that all three of its IPv6 interfaces are enabled for EIGRP for IPv6. Notice that the Serial 0/1/0 interface is also included.

```
R3# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 6"
EIGRP-IPv6 VR(DUAL-STACK) Address-Family Protocol for AS(6)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0 K6=0
  Metric rib-scale 128
  Metric version 64bit
  NSF-aware route hold timer is 240
  Router-ID: 3.3.3.3
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1
    Total Prefix Count: 6
    Total Redist Count: 0

  Interfaces:
    Serial0/0/1
    Serial0/1/0
    GigabitEthernet0/0 (passive)
```

```
  Redistribution:
    None
R3#
```

b. As shown in the topology, R3's S0/1/0 interface does not need to be included in the EIGRP updates. A default route will be configured later in this lab for reachability beyond the EIGRP routing domain. When we configured the IPv4 AF we excluded the **network** command for this interface. However, the same interface is automatically included when configuring the IPv6 AF. The **shutdown** address family interface command is used to disable EIGRP on a specific interface. This does not disable the physical interface, but only removes it from participating in EIGRP.

```
R3(config)# router eigrp DUAL-STACK
R3(config-router)# address-family ipv6 unicast autonomous-system 6
R3(config-router-af)# af-interface serial 0/1/0
R3(config-router-af-interface)# shutdown
R3(config-router-af-interface)# end
R3#
```

How can you verify that the IPv6 interface is still active, in the "up and up" state?

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c. Using the **show ipv6 protocols** command, verify that R3 is no longer including S0/1/0 in EIGRP for IPv6.

```
R3# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 6"
EIGRP-IPv6 VR(DUAL-STACK) Address-Family Protocol for AS(6)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0 K6=0
  Metric rib-scale 128
  Metric version 64bit
  NSF-aware route hold timer is 240
  Router-ID: 3.3.3.3
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1
    Total Prefix Count: 5
    Total Redist Count: 0

  Interfaces:
    Serial0/0/1
    GigabitEthernet0/0 (passive)
  Redistribution:
    None
```

```
R3#
```

Does the **shutdown** command used on S0/1/0 within the IPv6 AF also have the same affect for that interface within the IPv4 AF?

_____

Step 7: Configure and distribute a default static route in named EIGRP.

a. On R3 configure IPv4 and IPv6 default static routes using an R4 as the next-hop router.

Note: With the use of CEF (Cisco Express Forwarding) it is recommended practice that a next-hop IP address is used instead of an exit-interface. There is a bug in IOS 15.4 that prevents an IPv6 static route with only a next-hop address from being redistributed. A fully specified static route with both an exit-interface and a next-hop address is used in the example.

```
R3(config)# ip route 0.0.0.0 0.0.0.0 192.168.77.1
R3(config)# ipv6 route ::/0 serial0/1/0 2001:db8:feed:77::1
R3(config)#
```

a. Redistribution of static routes in named EIGRP is done in topology configuration mode. Topology configuration mode is a subset of an address family. By default, EIGRP has a base topology for each address family. Additional topologies can be configured for Multitopology Routing (MTR) which is used to enable an EIGRP process for a specified topology. MTR is beyond the scope of CCNP.

For each address family, issue the **topology base** command to enter the base EIGRP topology. In topology configuration mode use the **redistribute static** command to redistribute the default static route into EIGRP.

```
R3(config)# router eigrp DUAL-STACK
R3(config-router)# address-family ipv4 unicast autonomous-system 4
R3(config-router-af)# topology base
R3(config-router-af-topology)# ?
Address Family Topology configuration commands:
  auto-summary         Enable automatic network number summarization
  default              Set a command to its defaults
  default-information  Control distribution of default information
  default-metric       Set metric of redistributed routes
  distance             Define an administrative distance
  distribute-list      Filter entries in eigrp updates
  eigrp                EIGRP specific commands
  exit-af-topology     Exit from Address Family Topology configuration mode
  maximum-paths        Forward packets over multiple paths
  metric               Modify metrics and parameters for advertisement
  no                   Negate a command or set its defaults
  offset-list          Add or subtract offset from EIGRP metrics
  redistribute         Redistribute IPv4 routes from another routing protocol
  snmp                 Modify snmp parameters
  summary-metric       Specify summary to apply metric/filtering
  timers               Adjust topology specific timers
  traffic-share        How to compute traffic share over alternate paths
  variance             Control load balancing variance
```

```
R3(config-router-af-topology)# redistribute static
R3(config-router-af-topology)# exit-af-topology
R3(config-router-af)# exit-address-family
R3(config-router)# address-family ipv6 unicast autonomous-system 6
R3(config-router-af)# topology base
R3(config-router-af-topology)# redistribute static
R3(config-router-af-topology)# exit-af-topology
R3(config-router-af)# exit-address-family
R3(config-router)#
```

b. Issue the **show ip protocols** and **show ipv6 protocols** commands to verify that EIGRP is redistributing the static route.

```
R3# show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "application"
  Sending updates every 0 seconds
  Invalid after 0 seconds, hold down 0, flushed after 0
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Maximum path: 32
  Routing for Networks:
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: (default is 4)

Routing Protocol is "eigrp 4"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks not flagged in outgoing updates
  Default networks not accepted from incoming updates
  Redistributing: static
  EIGRP-IPv4 VR(DUAL-STACK) Address-Family Protocol for AS(4)
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0 K6=0
    Metric rib-scale 128
    Metric version 64bit
    NSF-aware route hold timer is 240
    Router-ID: 3.3.3.3
    Topology : 0 (base)
      Active Timer: 3 min
      Distance: internal 90 external 170
      Maximum path: 4
      Maximum hopcount 100
      Maximum metric variance 1
      Total Prefix Count: 5
      Total Redist Count: 1
```

```
  Automatic Summarization: disabled
  Maximum path: 4
  Routing for Networks:
    192.168.4.0/30
    192.168.5.0
  Passive Interface(s):
    GigabitEthernet0/0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.4.1           90      02:07:02
  Distance: internal 90 external 170

R3# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 6"
EIGRP-IPv6 VR(DUAL-STACK) Address-Family Protocol for AS(6)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0 K6=0
  Metric rib-scale 128
  Metric version 64bit
  NSF-aware route hold timer is 240
  Router-ID: 3.3.3.3
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1
    Total Prefix Count: 6
    Total Redist Count: 1

  Interfaces:
    Serial0/0/1
    GigabitEthernet0/0 (passive)
  Redistribution:
    Redistributing protocol static
IPv6 Routing Protocol is "static"
R3#
```

Why does the **show ip protocols** command indicate that automatic summarization is disabled?

_____

_____

c. Examine the IPv4 and IPv6 routing tables on R1 to verify that it is receiving the default static route using EIGRP.

```
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 192.168.2.2 to network 0.0.0.0

D*EX  0.0.0.0/0 [170/34036062] via 192.168.2.2, 00:03:23, Serial0/0/0
      192.168.4.0/30 is subnetted, 1 subnets
D        192.168.4.0 [90/23796062] via 192.168.2.2, 01:28:22, Serial0/0/0
D     192.168.5.0/24 [90/23847262] via 192.168.2.2, 01:28:15, Serial0/0/0
R1# show ipv6 route eigrp
IPv6 Routing Table - default - 9 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external, ND - ND Default, NDp - ND Prefix, DCE - Destination
       NDr - Redirect, O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1
       OE2 - OSPF ext 2, ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       a - Application
EX   ::/0 [170/34036062]
     via FE80::2, Serial0/0/0
D   2001:DB8:CAFE:4::/64 [90/23796062]
     via FE80::2, Serial0/0/0
D   2001:DB8:CAFE:5::/64 [90/23847262]
     via FE80::2, Serial0/0/0
D   2001:DB8:CAFE:99::/64 [90/23796702]
     via FE80::2, Serial0/0/0
R1#
```

Step 8: Verify named EIGRP.

a. Although named EIGRP unifies configuration for EIGRP for IPv4 and IPv6, the neighbor tables, topology tables and EIGRP routing processes are still separate. Use the **show ip protocols** and **show ipv6 protocols** command to verify both EIGRP for IPv4 and IPv6 processes. Below is the output displayed for R2.

```
R2# show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "application"
  Sending updates every 0 seconds
  Invalid after 0 seconds, hold down 0, flushed after 0
```

```
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Maximum path: 32
  Routing for Networks:
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: (default is 4)

Routing Protocol is "eigrp 4"
  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-IPv4 VR(DUAL-STACK) Address-Family Protocol for AS(4)
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0 K6=0
    Metric rib-scale 128
    Metric version 64bit
    NSF-aware route hold timer is 240
    Router-ID: 2.2.2.2
    Topology : 0 (base)
      Active Timer: 3 min
      Distance: internal 90 external 170
      Maximum path: 4
      Maximum hopcount 100
      Maximum metric variance 1
      Total Prefix Count: 6
      Total Redist Count: 0

  Automatic Summarization: disabled
  Maximum path: 4
  Routing for Networks:
    192.168.2.0/30
    192.168.3.0
    192.168.4.0/30
  Passive Interface(s):
    GigabitEthernet0/0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.2.1           90      00:04:54
    192.168.4.2           90      00:04:54
  Distance: internal 90 external 170

R2#
R2# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
```

```
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 6"
EIGRP-IPv6 VR(DUAL-STACK) Address-Family Protocol for AS(6)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0 K6=0
  Metric rib-scale 128
  Metric version 64bit
  NSF-aware route hold timer is 240
  Router-ID: 2.2.2.2
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1
    Total Prefix Count: 6
    Total Redist Count: 0

  Interfaces:
    Serial0/0/0
    Serial0/0/1
    GigabitEthernet0/0 (passive)
  Redistribution:
    None
R2#
```

b. Issue the **show ip eigrp neighbors** and **show ipv6 eigrp neighbors** command on R1 to verify the neighbor adjacencies with R2.

```
R1# show ip eigrp neighbors
EIGRP-IPv4 VR(DUAL-STACK) Address-Family Neighbors for AS(4)
H   Address                 Interface              Hold Uptime   SRTT   RTO  Q  Seq
                                                   (sec)         (ms)       Cnt Num
0   192.168.2.2             Se0/0/0                  13 03:56:20   31   186  0  8
R1# show ipv6 eigrp neighbors
EIGRP-IPv6 VR(DUAL-STACK) Address-Family Neighbors for AS(6)
H   Address                 Interface              Hold Uptime   SRTT   RTO  Q  Seq
                                                   (sec)         (ms)       Cnt Num
0   Link-local address:     Se0/0/0                  13 00:09:14  669  4014  0  21
    FE80::2
R1#
```

c. Examine R1's EIGRP topology tables for IPv4 and IPv6 using the **show ip eigrp topology** and **show ipv6 eigrp topology** commands.

```
R1# show ip eigrp topology
EIGRP-IPv4 VR(DUAL-STACK) Topology Table for AS(4)/ID(1.1.1.1)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status
```

```
P 192.168.2.0/30, 1 successors, FD is 1735175958
        via Connected, Serial0/0/0
P 192.168.1.0/24, 1 successors, FD is 13107200
        via Connected, GigabitEthernet0/0
P 0.0.0.0/0, 1 successors, FD is 4356615958
        via 192.168.2.2 (4356615958/3045895958), Serial0/0/0
P 192.168.4.0/30, 1 successors, FD is 3045895958
        via 192.168.2.2 (3045895958/1735175958), Serial0/0/0
P 192.168.5.0/24, 1 successors, FD is 3052449558
        via 192.168.2.2 (3052449558/1741729558), Serial0/0/0

R1# show ipv6 eigrp topology
EIGRP-IPv6 VR(DUAL-STACK) Topology Table for AS(6)/ID(1.1.1.1)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 2001:DB8:CAFE:5::/64, 1 successors, FD is 3052449558
        via FE80::2 (3052449558/1741729558), Serial0/0/0
P 2001:DB8:CAFE:4::/64, 1 successors, FD is 3045895958
        via FE80::2 (3045895958/1735175958), Serial0/0/0
P 2001:DB8:CAFE:99::/64, 1 successors, FD is 3045977878
        via FE80::2 (3045977878/1735257878), Serial0/0/0
P 2001:DB8:CAFE:2::/64, 1 successors, FD is 1735175958
        via Connected, Serial0/0/0
P ::/0, 1 successors, FD is 4356615958
        via FE80::2 (4356615958/3045895958), Serial0/0/0
P 2001:DB8:CAFE:1::/64, 1 successors, FD is 13107200
        via Connected, GigabitEthernet0/0

R1#
```

d. Verify that R1 has all the IPv4 and IPv6 routes shown in the topology with the exclusion of R2's LAN by using the **show ip route eigrp** and **show ipv6 route eigrp** commands.

```
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 192.168.2.2 to network 0.0.0.0
```

```
D*EX  0.0.0.0/0 [170/34036062] via 192.168.2.2, 00:10:25, Serial0/0/0
D     192.168.3.0/24 [90/13607262] via 192.168.2.2, 00:48:46, Serial0/0/0
      192.168.4.0/30 is subnetted, 1 subnets
D        192.168.4.0 [90/23796062] via 192.168.2.2, 00:48:33, Serial0/0/0
D     192.168.5.0/24 [90/23847262] via 192.168.2.2, 00:38:12, Serial0/0/0
R1# show ipv6 route eigrp
IPv6 Routing Table - default - 9 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external, ND - ND Default, NDp - ND Prefix, DCE - Destination
       NDr - Redirect, O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1
       OE2 - OSPF ext 2, ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       a - Application
EX  ::/0 [170/34036062]
     via FE80::2, Serial0/0/0
D   2001:DB8:CAFE:3::/64 [90/13607262]
     via FE80::2, Serial0/0/0
D   2001:DB8:CAFE:4::/64 [90/23796062]
     via FE80::2, Serial0/0/0
D   2001:DB8:CAFE:5::/64 [90/23847262]
     via FE80::2, Serial0/0/0
R1#
```

e. As a final verification of end-to-end reachability, from R1 ping the IPv4 and IPv6 addresses on R5's LAN.

```
R1# ping 192.168.5.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.5.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms
R1# ping 2001:db8:cafe:5::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:CAFE:5::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/55/56 ms
R1#
```

f. Examine the named EIGRP configuration showing both the IPv4 and IPv6 address families with the **show running-config | section router eigrp** command. The output for R3 is displayed below.

```
R3# show running-config | section router eigrp
router eigrp DUAL-STACK
 !
 address-family ipv4 unicast autonomous-system 4
  !
  af-interface GigabitEthernet0/0
   passive-interface
  exit-af-interface
```

```
  !
  topology base
   redistribute static
  exit-af-topology
  network 192.168.4.0 0.0.0.3
  network 192.168.5.0
  eigrp router-id 3.3.3.3
 exit-address-family
 !
 address-family ipv6 unicast autonomous-system 6
  !
  af-interface GigabitEthernet0/0
   passive-interface
  exit-af-interface
  !
  af-interface Serial0/1/0
   shutdown
  exit-af-interface
  !
  topology base
   redistribute static
  exit-af-topology
  eigrp router-id 3.3.3.3
 exit-address-family
R3#
```