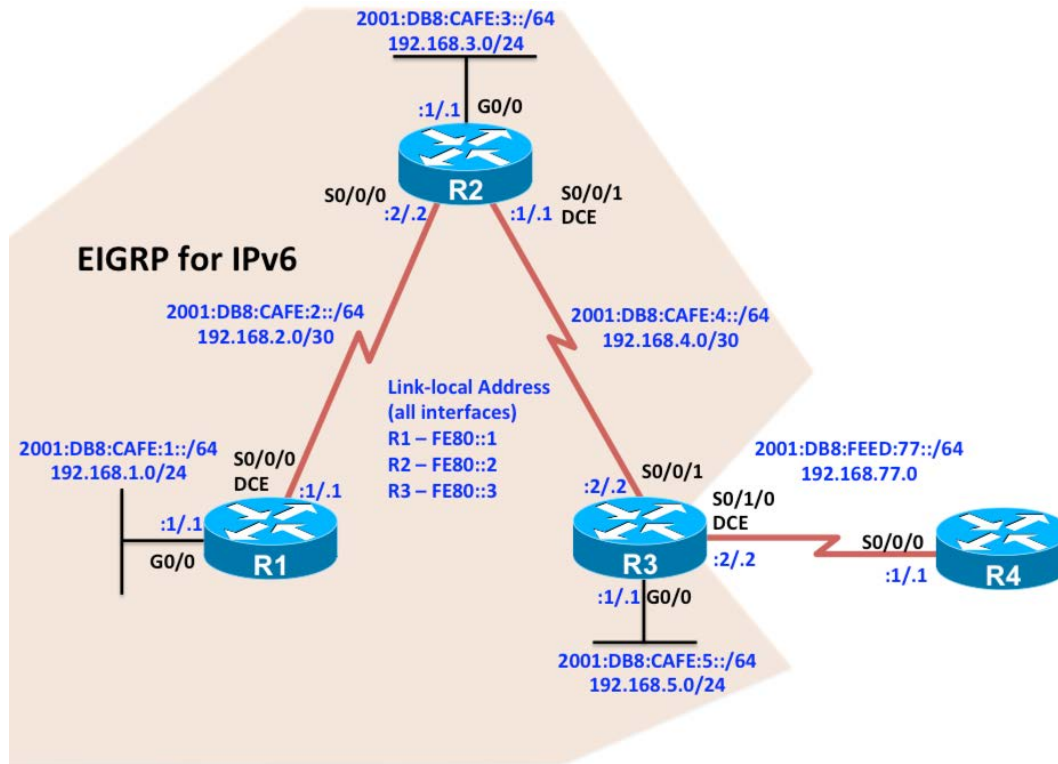


CCNPv7 ROUTE

Chapter 2 Lab 2-4, Named EIGRP Configuration **Instructor Version**

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 ? to 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?

In this scenarios, the **eigrp router-id** command is not required because the routers have at least one active IPv4 address. If the **eigrp router-id** command is not used, the router will use the highest IPv4 loopback address. If there are no IPv4 loopback addresses, the router will use the highest IPv4 address on an active physical interface. The router ID is a 32-bit value for both EIGRP for IPv4 and IPv6.

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?

There are several ways including using the **show ipv6 interface brief** command on R3.

- 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?

No, the **shutdown** command on S0/1/0 was configured within the IPv6 AF and has no affect on 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 serial10/1/0 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?

In IOS 15, automatic summarization in EIGRP for IPv4 is disabled by default. It can be enabled using the **auto-summary** command in topology configuration mode.

- 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#
```

Device Configurations (Instructor version)**Initial Configurations****Router R1**

```
hostname R1
!
interface GigabitEthernet0/0
 ip address 192.168.1.1 255.255.255.0
 ipv6 address FE80::1 link-local
 ipv6 address 2001:DB8:CAFE:1::1/64
 no shutdown
!
interface Serial0/0/0
 ip address 192.168.2.1 255.255.255.252
 ipv6 address FE80::1 link-local
 ipv6 address 2001:DB8:CAFE:2::1/64
 clock rate 64000
 no shutdown
!
end
```

Router R2

```
hostname R2
!
interface GigabitEthernet0/0
 ip address 192.168.3.1 255.255.255.0
 ipv6 address FE80::2 link-local
 ipv6 address 2001:DB8:CAFE:3::1/64
 no shutdown
!
interface Serial0/0/0
 ip address 192.168.2.2 255.255.255.252
 ipv6 address FE80::2 link-local
 ipv6 address 2001:DB8:CAFE:2::2/64
 no shutdown
!
interface Serial0/0/1
 ip address 192.168.4.1 255.255.255.252
 ipv6 address FE80::2 link-local
 ipv6 address 2001:DB8:CAFE:4::1/64
 clock rate 64000
 no shutdown
!
end
```

Router R3

```
hostname R3
!
interface GigabitEthernet0/0
 ip address 192.168.5.1 255.255.255.0
```

```
    ipv6 address FE80::3 link-local
    ipv6 address 2001:DB8:CAFE:5::1/64
    no shutdown
  !
interface Serial0/0/1
  ip address 192.168.4.2 255.255.255.252
  ipv6 address FE80::3 link-local
  ipv6 address 2001:DB8:CAFE:4::2/64
  no shutdown
  !
interface Serial0/1/0
  ip address 192.168.77.2 255.255.255.0
  ipv6 address FE80::3 link-local
  ipv6 address 2001:DB8:FEED:77::2/64
  clock rate 64000
  no shutdown
  !
end
```

Router R4

```
hostname R4
!
interface Serial0/0/0
  ip address 192.168.77.1 255.255.255.0
  ipv6 address FE80::4 link-local
  ipv6 address 2001:DB8:FEED:77::1/64
  no shutdown
  !
  ipv6 route 2001:DB8:ABCD::/48 2001:DB8:FEED:77::2
  ipv6 route 2001:DB8:CAFE::/48 2001:DB8:FEED:77::2
  ip route 0.0.0.0 0.0.0.0 192.168.77.2
  !
end
```

Final Configurations

Router R1

```
hostname R1
!
ipv6 unicast-routing
ip cef
ipv6 cef
!
interface GigabitEthernet0/0
  ip address 192.168.1.1 255.255.255.0
  ipv6 address FE80::1 link-local
  ipv6 address 2001:DB8:CAFE:1::1/64
  !
interface Serial0/0/0
  ip address 192.168.2.1 255.255.255.252
  ipv6 address FE80::1 link-local
  ipv6 address 2001:DB8:CAFE:2::1/64
  clock rate 64000
```

```
!  
router eigrp DUAL-STACK  
!  
address-family ipv4 unicast autonomous-system 4  
!  
af-interface GigabitEthernet0/0  
passive-interface  
exit-af-interface  
!  
topology base  
exit-af-topology  
network 192.168.1.0  
network 192.168.2.0 0.0.0.3  
eigrp router-id 1.1.1.1  
exit-address-family  
!  
address-family ipv6 unicast autonomous-system 6  
!  
af-interface GigabitEthernet0/0  
passive-interface  
exit-af-interface  
!  
topology base  
exit-af-topology  
eigrp router-id 1.1.1.1  
exit-address-family  
!  
end
```

Router R2

```
hostname R2  
!  
ipv6 unicast-routing  
ip cef  
ipv6 cef  
!  
interface GigabitEthernet0/0  
ip address 192.168.3.1 255.255.255.0  
ipv6 address FE80::2 link-local  
ipv6 address 2001:DB8:CAFE:3::1/64  
!  
interface Serial0/0/0  
ip address 192.168.2.2 255.255.255.252  
ipv6 address FE80::2 link-local  
ipv6 address 2001:DB8:CAFE:2::2/64  
!  
interface Serial0/0/1  
ip address 192.168.4.1 255.255.255.252  
ipv6 address FE80::2 link-local  
ipv6 address 2001:DB8:CAFE:4::1/64  
clock rate 64000  
!  
router eigrp DUAL-STACK  
!  
address-family ipv4 unicast autonomous-system 4
```

```
!
af-interface GigabitEthernet0/0
  passive-interface
exit-af-interface
!
topology base
exit-af-topology
network 192.168.2.0 0.0.0.3
network 192.168.3.0
network 192.168.4.0 0.0.0.3
eigrp router-id 2.2.2.2
exit-address-family
!
address-family ipv6 unicast autonomous-system 6
!
af-interface GigabitEthernet0/0
  passive-interface
exit-af-interface
!
topology base
exit-af-topology
eigrp router-id 2.2.2.2
exit-address-family
!
end
```

Router R3

```
hostname R3
!
ipv6 unicast-routing
ip cef
ipv6 cef
!
interface GigabitEthernet0/0
  ip address 192.168.5.1 255.255.255.0
  ipv6 address FE80::3 link-local
  ipv6 address 2001:DB8:CAFE:5::1/64
!
interface Serial0/0/1
  ip address 192.168.4.2 255.255.255.252
  ipv6 address FE80::3 link-local
  ipv6 address 2001:DB8:CAFE:4::2/64
!
interface Serial0/1/0
  ip address 192.168.77.2 255.255.255.0
  ipv6 address FE80::3 link-local
  ipv6 address 2001:DB8:FEED:77::2/64
  clock rate 64000
!
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
!
ip route 0.0.0.0 0.0.0.0 192.168.77.1
!
ipv6 route ::/0 Serial0/1/0 2001:DB8:FEED:77::1
!
end
```

Router R4

```
hostname R4
!
interface Serial0/0/0
  ip address 192.168.77.1 255.255.255.0
  ipv6 address FE80::4 link-local
  ipv6 address 2001:DB8:FEED:77::1/64
!
ipv6 route 2001:DB8:CAFE::/48 2001:DB8:FEED:77::2
ip route 0.0.0.0 0.0.0.0 192.168.77.2
!
end
```