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Advanced Cisco CCNP Networking

iBGP Configuration

Lab 5

iBGP Setup Lab 1

Purpose
The purpose of this lab was to connect two networks running different interior gateway protocols using iBGP.

Background Information on Lab Concepts
iBGP stands for interior border gateway protocol, in contrast with eBGP, which stands for exterior border gateway protocol. BGP is frequently used with the internet. The internet is essentially a massive group of networks, with each of those networks broken into groups of smaller networks, called autonomous zones. Imagine the internet as a massive system of post offices, carriers (cars, airplanes, trucks, etc), and envelopes. The envelopes are the traffic on the network, which are transported by carriers. Carriers are similar to an interior gateway protocol (OSPF or EIGRP). Once a carrier transports envelopes to a post office, that post office determines where to send the envelopes. BGP is similar to a post office since it determines how to send the envelopes to other post offices. If you think of countries as their own autonomous zone, if you want to send envelopes internationally then you would use eBGP, and for sending mail domestically use iBGP. Therefore, iBGP routes are used within the same autonomous zones and eBGP routes are used between different autonomous zones. A unique feature of iBGP is that you need to "lay" an interior gateway protocol over iBGP to enable communication within an autonomous zone. It is best to use iBGP in situations where there are many routes since it doesn't require routes learned via eBGP to be redistributed. Interior gateway protocols, like OSPF, cannot handle thousands of routes, while iBGP can.

Lab Summary
After being introduced to the lab we first researched the new lab concepts. This mainly included reading documentation from Cisco on the use of iBGP and learning necessary configuration commands. After understanding the new lab concepts, we started creating a config. We began by building a IPv4 & IPv6 addressing scheme for the 7 routers and setting up the OSPF and EIGRP networks. Once both these networks worked, we created the necessary BGP instances on the border routers and created 3 autonomous zones. We then formed an iBGP link between these networks, and "laid" OSPF over it. We ensured the network functioned properly by pinging the interfaces between the OSPF and EIGRP networks through the iBGP link. We also used the *show ip route* command to ensure the routes were learned through iBGP by checking that an administrative distance of 200 was shown. After verifying these components, we determined our lab configuration functioned properly and as intended.

Lab Commands
Router> **enable**
Turns on privileged exec mode which allows changes to be made to the router.

Router# **config t**
Enters the router config file and allows you to make changes to the router configuration file.

Router# **copy run start**
Saves the running-configuration (current config on the router, includes the edits you have made during the session, clears when the router powers off) to the startup-configuration (file that router pulls running-config from on bootup, default config)

Router(config)# **ipv6 unicast-routing**
Enables ipv6 protocol on router. Without this command you cannot route ipv6 traffic through that router or configure any ipv6 related commands.

Router# show **ip route**
Displays information about the various routes that are available to the router, including the protocol by which the route was acquired (OSPF, RIP, EGRIP, static, etc.)

Router(config)# **router eigrp** [instance]

Enables EIGRP of a particular instance on the router and enters router configuration mode.
There can be multiple instances of EIGRP running on a router, however, adjacent routers will only communicate if they are using the same instance.

Router# show **ip[v6] route**
Displays information about the various routes that are available to the router, including the protocol by which the route was acquired (OSPF, RIP, EGRIP, static, etc.)

Router(config)# **interface** [***interface***] [***id***]
Enables configuration on a specific interface.

Router(config-router)# **network** [***network address***] [***wildcard mask***] **area** [***area number***]
Activates OSPFv2 for a specific subnet.
This command is typed after you enter router OSPF configuration mode. Routers in a particular area share a complete topological database and have route summaries of external areas.

Router(config)# **router bgp** [***autonomous system number***]
Activates a BGP router and enters router configuration mode
The autonomous system number (ASN) is a number that identifies a large collection of routers on the internet. Typically, there are networks run under an ASN by a technical administration. eBGP connects different autonomous systems while iBGP is run within each ASN.

Router(config-router)# **no bgp default ipv4-unicast**
This command is very important for BGPv6, as it enables advertising for IPv6 routes along with IPv4 routes. By default, only IPv4 routes are broadcasted. By default, BGP only runs the IPv4 address-family, so by enabling multiprotocol we can run other address-families such as IPv6 and VPNv4.

Router(config-router)# **address-family** [***protocol***]
Enters configuration mode for a BGP address family
As a basic premise, address families are used to separate certain protocols BGP supports. I find that address-families are more workspaces for the desired protocol. For example, one might enter the "ipv4" or "ipv6" address-families to configure IP routing. This is where redistribution, network statements or activation commands occur.

Router(config-router)# **network** [***network address***] **mask** [***subnet mask***]
Advertises a directly connected network to the BGP routing table
BGP's network statements are not to be confused with OSPF or EIGRPs; they aren't used to form adjacencies between BGP routers. A BGP network statement is typically configured alongside a neighbor statement, where one advertises the network and the other the neighbor establishment.

Router(config-router)# **neighbor** [***IP address***] **remote-as** [***neighbor's ASN***]
Used in forming BGP neighbor adjacencies
Unlike a network statement, this command takes the singular *IP* address of the neighbor's connected interface. The second argument is to specify the neighbor's ASN. For a BGP neighborship to be established, each router must have *routes to the neighbor's IP* and *the correct IP and ASN of their neighbor*. Having proper routes to each neighbor's IP is critical to forming adjacencies, but this also means these two BGP neighbors could lie anywhere. For example, routers *A* and *C* are connected via router *B*. Theoretically, you could establish a BGP neighbor relationship between routers *A* and *C* if they both have routes to each other's IPs.

Router(config-router-af)# **network** [***IPv6 network address***]

Specifies a directly connected network on the router that will be broadcasted to other BGP routers similarly to OSPF network statements. However, to form an adjacency with another BGP router, you also need a neighbor statement.

Router(config-router)# **neighbor** [***IP address***] **remote-as** [***neighbor's ASN***]
Used in forming BGP neighbor adjacencies. Unlike network statements, this command takes a host address (not a network address) of the neighbor's connected interface. The second argument is for the neighbors ASN.

Router(config-router-af)# **neighbor** [***IPv6 address***] **activate**
Enables the exchange of an address with a BGP neighbor.

Router(config-router)# **redistribute** [***routing protocol***] [***protocol instance***] ***metric*** *<value>> subnets*
Redistributes routes from specified routing protocol into the table of a local router
The command is typed in the router where you'd want the routes to redistribute. There are many different additional options when redistributing routes, but I've found the *metric* and *subnets* to be the most useful. Each routing protocol has a different *metric*, so when redistributing be sure to use the right one. *Subnets* usually always refers to redistributing classless networks.

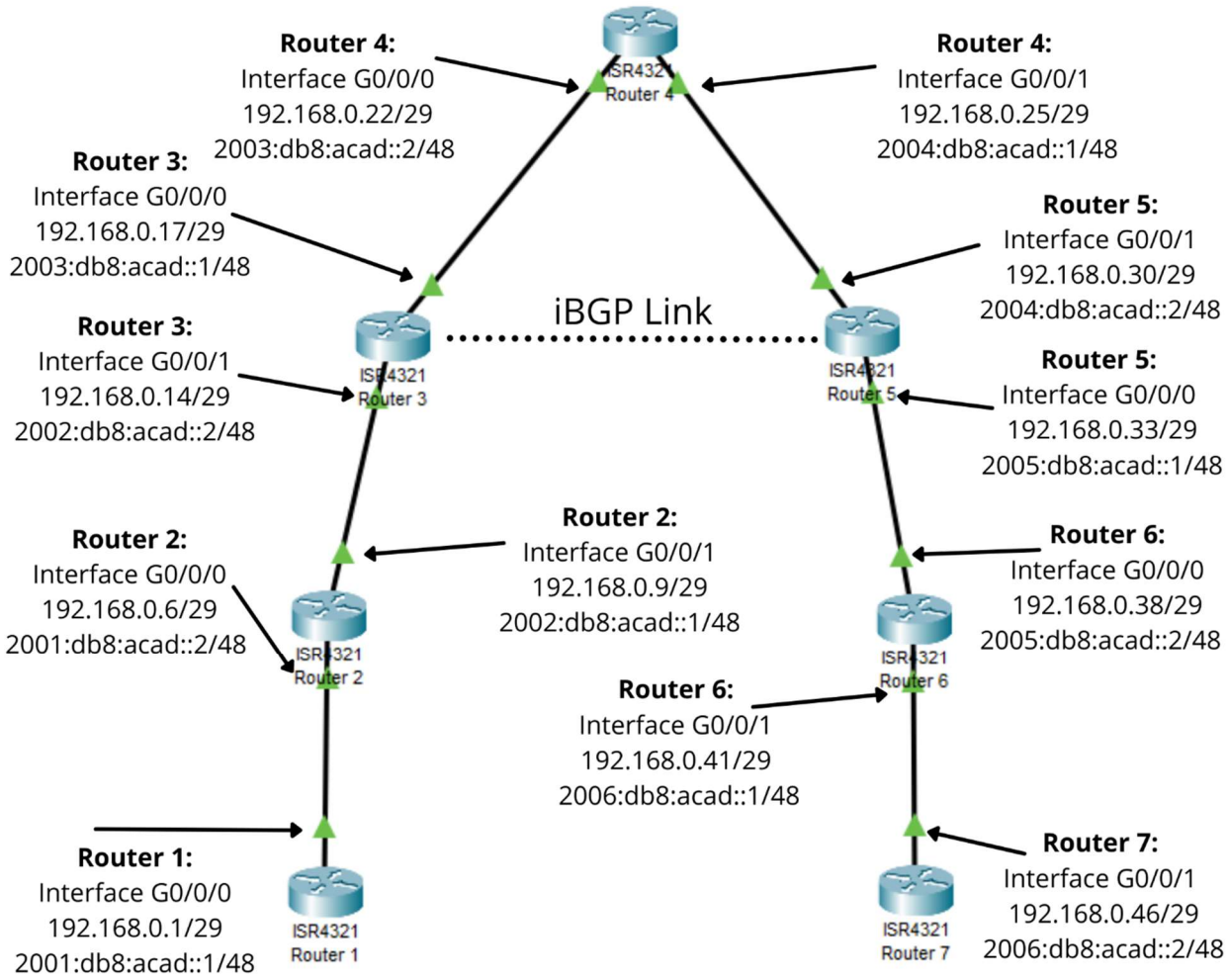
Router(config-if)# **ipv6 ospf** [***process id***] **area** [***number***]
Activates OSPFv3 under a specific interface.
This command is typed when in interface configuration mode. It is good practice for the process ID to be the same, however isn't necessary for OSPF to form adjacencies; process ID is only locally significant. Each OSPF process retains a different routing table, so depending on the configuration, process ID could determine what routes are redistributed. A router can have multiple OSPF processes but will contain a separate OSPF database per process. Routers in a particular area share a complete topological database and have route summaries of external areas.

Router(config)# **ipv6 router ospf** [***process id***]
Enables configuration for OSPFv3.
It is good practice for the process ID to be the same, however isn't necessary for OSPF to form adjacencies; process ID is only locally significant. Each OSPF process retains a different routing table, so depending on the configuration, process ID could determine what routes are redistributed. A router can have multiple OSPF processes but will contain a separate OSPF database per process.

Router(config)# **router ospf** [***process id***]
Enables the OSPF routing protocol and enters router configuration mode.
It is good practice for the process ID to be the same, however isn't necessary for OSPF to form adjacencies; process ID is only locally significant. Each OSPF process retains a different routing table, so depending on the configuration, process ID could determine what routes are redistributed. A router can have multiple OSPF processes but will contain a separate OSPF database per process.

Router(config)# **router eigrp** [***instance***]
Enables EIGRP of a particular instance on the router and enters router configuration mode.
There can be multiple instances of EIGRP running on a router, however, adjacent routers will only communicate if they are using the same instance.

Network Diagram with IP's



Configuration

Router 1:

```
R1#show run
Building configuration...
Current configuration : 3866 bytes
Last configuration change at 20:13:01
UTC Tue Jan 4 2022
version 16.9
service timestamps debug datetime
msec
service timestamps log datetime msec
platform qfp utilization monitor load
80
platform punt-keepalive disable-
kernel-core
hostname R1
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-
2189345785
enrollment selfsigned
subject-name cn=IOS-Self-Signed-
Certificate-2189345785
revocation-check none
rsakeypair TP-self-signed-2189345785
no license smart enable
diagnostic bootup level minimal
spanning-tree extend system-id
```

```
redundancy
mode none
interface GigabitEthernet0/0/0
ip address 192.168.0.1
255.255.255.248
negotiation auto
ipv6 address 2001:DB8:ACAD::1/48
ipv6 ospf 1 area 1
interface GigabitEthernet0/0/1
no ip address
shutdown
negotiation auto
interface Serial0/1/0
no ip address
shutdown
interface Serial0/1/1
no ip address
shutdown
interface GigabitEthernet0/2/0
no ip address
shutdown
negotiation auto
interface GigabitEthernet0/2/1
no ip address
shutdown
negotiation auto
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
router ospf 1
network 192.168.0.0 0.0.0.7 area 1
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface
GigabitEthernet0
ipv6 router ospf 1
router-id 1.1.1.1
control-plane
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

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, p - overrides from PfR
Gateway of last resort is not set
      192.168.0.0/24 is variably subnetted, 7 subnets, 2 masks
C        192.168.0.0/29 is directly connected, GigabitEthernet0/0/0
L        192.168.0.1/32 is directly connected, GigabitEthernet0/0/0
O        192.168.0.8/29
           [110/2] via 192.168.0.6, 00:10:14, GigabitEthernet0/0/0
O E2     192.168.0.16/29
           [110/1] via 192.168.0.6, 00:06:46, GigabitEthernet0/0/0
O E2     192.168.0.24/29
           [110/1] via 192.168.0.6, 00:05:45, GigabitEthernet0/0/0
O E2     192.168.0.32/29
           [110/1] via 192.168.0.6, 00:05:45, GigabitEthernet0/0/0
O E2     192.168.0.40/29
           [110/1] via 192.168.0.6, 00:05:45, GigabitEthernet0/0/0
```

R1#show ipv6 route

```
IPv6 Routing Table - default - 8 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
```

```
       B - BGP, R - RIP, 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
C   2001:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2001:DB8:ACAD::1/128 [0/0]
     via GigabitEthernet0/0/0, receive
OE2 2002:DB8:ACAD::/48 [110/20]
     via FE80::521C:B0FF:FE63:3830, GigabitEthernet0/0/0
OE2 2003:DB8:ACAD::/48 [110/1]
     via FE80::521C:B0FF:FE63:3830, GigabitEthernet0/0/0
OE2 2004:DB8:ACAD::/48 [110/1]
     via FE80::521C:B0FF:FE63:3830, GigabitEthernet0/0/0
OE2 2005:DB8:ACAD::/48 [110/1]
     via FE80::521C:B0FF:FE63:3830, GigabitEthernet0/0/0
OE2 2006:DB8:ACAD::/48 [110/1]
     via FE80::521C:B0FF:FE63:3830, GigabitEthernet0/0/0
L   FF00::/8 [0/0]
     via Null0, receive
```

R1#show ip ospf neighbor

```
Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.0.9       1   FULL/DR         00:00:33    192.168.0.6     GigabitEthernet
0/0/0
```

R1#show ip ospf

```
Routing Process "ospf 1" with ID 192.168.0.1
Start time: 00:17:11.354, Time elapsed: 00:12:07.047
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Supports area transit capability
Supports NSSA (compatible with RFC 3101)
Supports Database Exchange Summary List Optimization (RFC 5243)
Event-log enabled, Maximum number of events: 1000, Mode: cyclic
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 50 msecs
Minimum hold time between two consecutive SPFs 200 msecs
Maximum wait time between two consecutive SPFs 5000 msecs
Incremental-SPF disabled
Initial LSA throttle delay 50 msecs
Minimum hold time for LSA throttle 200 msecs
Maximum wait time for LSA throttle 5000 msecs
Minimum LSA arrival 100 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300
Number of external LSA 4. Checksum Sum 0x022BF7
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
```

```
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Number of areas transit capable is 0
External flood list length 0
IETF NSF helper support enabled
Cisco NSF helper support enabled
Reference bandwidth unit is 100 mbps
    Area 1
        Number of interfaces in this area is 1
        Area has no authentication
        SPF algorithm last executed 00:10:36.674 ago
        SPF algorithm executed 7 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x00C920
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R1#show ip ospf interface
GigabitEthernet0/0/0 is up, line protocol is up
  Internet Address 192.168.0.1/29, Interface ID 6, Area 1
  Attached via Network Statement
  Process ID 1, Router ID 192.168.0.1, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0           1         no          no            Base
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 192.168.0.9, Interface address 192.168.0.6
  Backup Designated router (ID) 192.168.0.1, Interface address 192.168.0.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:04
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 192.168.0.9  (Designated Router)
  Suppress hello for 0 neighbor(s)

R1#show ip ospf border-routers
            OSPF Router with ID (192.168.0.1) (Process ID 1)
                Base Topology (MTID 0)
Internal Router Routing Table
Codes: i - Intra-area route, I - Inter-area route
i 192.168.0.9 [1] via 192.168.0.6, GigabitEthernet0/0/0, ASBR, Area 1, SPF 7

R1#show ip ospf border-routers
            OSPF Router with ID (192.168.0.1) (Process ID 1)
                Base Topology (MTID 0)
Internal Router Routing Table
```

```
Codes: i - Intra-area route, I - Inter-area route
i 192.168.0.9 [1] via 192.168.0.6, GigabitEthernet0/0/0, ASBR, Area 1, SPF 7
```

```
R1#show ipv6 ospf neighbor
            OSPFv3 Router with ID (1.1.1.1) (Process ID 1)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
2.2.2.2           1   FULL/DR         00:00:36    6               GigabitEthernet
0/0/0
```

```
R1#show ipv6 ospf interface
GigabitEthernet0/0/0 is up, line protocol is up
  Link Local Address FE80::521C:B0FF:FE2C:5100, Interface ID 6
  Area 1, Process ID 1, Instance ID 0, Router ID 1.1.1.1
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 2.2.2.2, local address FE80::521C:B0FF:FE63:3830
  Backup Designated router (ID) 1.1.1.1, local address FE80::521C:B0FF:FE2C:5100
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:02
  Graceful restart helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 2.2.2.2  (Designated Router)
  Suppress hello for 0 neighbor(s)
```

```
R1#show ipv6 ospf border-routers
            OSPFv3 Router with ID (1.1.1.1) (Process ID 1)
Codes: i - Intra-area route, I - Inter-area route
i 2.2.2.2 [1] via FE80::521C:B0FF:FE63:3830, GigabitEthernet0/0/0, ASBR, Area 1,
SPF 9
```

Router 2:

```
R2#show run
Building configuration...
version 16.9
service timestamps debug datetime
msec
service timestamps log datetime msec
platform qfp utilization monitor load
80
boot-start-marker
address-family ipv4
address-family ipv6
subscriber templating
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
crypto pki trustpoint TP-self-signed-
2557841031
enrollment selfsigned
subject-name cn=IOS-Self-Signed-
Certificate-2557841031
revocation-check none
license udi pid ISR4321/K9 sn FDO21500
G1N
no license smart enable
redundancy
interface GigabitEthernet0/0/0
ip address 192.168.0.6
255.255.255.248
negotiation auto
ipv6 address 2001:DB8:ACAD::2/48
interface GigabitEthernet0/0/1
ip address 192.168.0.9
255.255.255.248
negotiation auto
interface Serial0/1/0
no ip address
```

```
interface Serial0/1/1
no ip address
interface GigabitEthernet0/2/0
no ip address
shutdown
interface GigabitEthernet0/2/1
no ip address
shutdown
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
router ospf 1
redistribute connected subnets
redistribute bgp 1 subnets
network 192.168.0.0 0.0.0.7 area 1
router bgp 1
bgp log-neighbor-changes
no bgp default ipv4-unicast
neighbor 2002:DB8:ACAD::2 remote-as 2
address-family ipv4
  network 192.168.0.0 mask
255.255.255.248
  network 192.168.0.8 mask
255.255.255.248
  redistribute connected
  redistribute ospf 1
  neighbor 192.168.0.14 activate
address-family ipv6
  redistribute connected
  redistribute ospf 1
  network 2002:DB8:ACAD::/48
  network 2003:DB8:ACAD::/48
  neighbor 2002:DB8:ACAD::2 activate
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ipv6 router ospf 1
router-id 2.2.2.2
redistribute connected
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
end
```

R2#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, p - overrides from PfR
Gateway of last resort is not set
      192.168.0.0/24 is variably subnetted, 8 subnets, 2 masks
C        192.168.0.0/29 is directly connected, GigabitEthernet0/0/0
L        192.168.0.6/32 is directly connected, GigabitEthernet0/0/0
C        192.168.0.8/29 is directly connected, GigabitEthernet0/0/1
L        192.168.0.9/32 is directly connected, GigabitEthernet0/0/1
B        192.168.0.16/29 [20/0] via 192.168.0.14, 00:09:47
B        192.168.0.24/29 [20/0] via 192.168.0.14, 00:08:46
B        192.168.0.32/29 [20/0] via 192.168.0.14, 00:08:46
B        192.168.0.40/29 [20/0] via 192.168.0.14, 00:08:46
```

R2#show ip ospf neighbor

```
Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.0.1       1   FULL/BDR        00:00:31    192.168.0.1     GigabitEthernet
0/0/0
```

R2#show ip ospf

```
Routing Process "ospf 1" with ID 192.168.0.9
```

```
Start time: 00:17:25.515, Time elapsed: 00:14:11.934
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Supports area transit capability
Supports NSSA (compatible with RFC 3101)
Supports Database Exchange Summary List Optimization (RFC 5243)
Event-log enabled, Maximum number of events: 1000, Mode: cyclic
It is an autonomous system boundary router
Redistributing External Routes from,
    connected, includes subnets in redistribution
    bgp 1, includes subnets in redistribution
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 50 msecs
Minimum hold time between two consecutive SPFs 200 msecs
Maximum wait time between two consecutive SPFs 5000 msecs
Incremental-SPF disabled
Initial LSA throttle delay 50 msecs
Minimum hold time for LSA throttle 200 msecs
Maximum wait time for LSA throttle 5000 msecs
Minimum LSA arrival 100 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300
Number of external LSA 4. Checksum Sum 0x022BF7
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Number of areas transit capable is 0
External flood list length 0
IETF NSF helper support enabled
Cisco NSF helper support enabled
Reference bandwidth unit is 100 mbps
    Area 1
        Number of interfaces in this area is 2
        Area has no authentication
        SPF algorithm last executed 00:12:46.166 ago
        SPF algorithm executed 10 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x00C920
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R2#show ip ospf interface
GigabitEthernet0/0/1 is up, line protocol is up
  Internet Address 192.168.0.9/29, Interface ID 7, Area 1
  Attached via Network Statement
  Process ID 1, Router ID 192.168.0.9, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
```

```
       0           1         no          no            Base
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.0.9, Interface address 192.168.0.9
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:08
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/2/2, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
GigabitEthernet0/0/0 is up, line protocol is up
  Internet Address 192.168.0.6/29, Interface ID 6, Area 1
  Attached via Network Statement
  Process ID 1, Router ID 192.168.0.9, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
       0           1         no          no            Base
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.0.9, Interface address 192.168.0.6
  Backup Designated router (ID) 192.168.0.1, Interface address 192.168.0.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:06
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 3, maximum is 3
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 192.168.0.1  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)

R2#show ip ospf border-routers
            OSPF Router with ID (192.168.0.9) (Process ID 1)
                Base Topology (MTID 0)
Internal Router Routing Table
Codes: i - Intra-area route, I - Inter-area route

R2#show ipv6 route
IPv6 Routing Table - default - 9 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, 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
C   2001:DB8:ACAD::/48 [0/0]
```

```
     via GigabitEthernet0/0/0, directly connected
L   2001:DB8:ACAD::2/128 [0/0]
     via GigabitEthernet0/0/0, receive
C   2002:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2002:DB8:ACAD::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
B   2003:DB8:ACAD::/48 [20/0]
     via FE80::B6A8:B9FF:FE47:9231, GigabitEthernet0/0/1
B   2004:DB8:ACAD::/48 [20/0]
     via FE80::B6A8:B9FF:FE47:9231, GigabitEthernet0/0/1
B   2005:DB8:ACAD::/48 [20/0]
     via FE80::B6A8:B9FF:FE47:9231, GigabitEthernet0/0/1
B   2006:DB8:ACAD::/48 [20/0]
     via FE80::B6A8:B9FF:FE47:9231, GigabitEthernet0/0/1
L   FF00::/8 [0/0]
     via Null0, receive
```

R2#show ipv6 ospf neighbor

```
            OSPFv3 Router with ID (2.2.2.2) (Process ID 1)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
1.1.1.1           1   FULL/BDR        00:00:33    6               GigabitEthernet
0/0/0
```

R2#show ipv6 ospf interface

```
GigabitEthernet0/0/0 is up, line protocol is up
  Link Local Address FE80::521C:B0FF:FE63:3830, Interface ID 6
  Area 1, Process ID 1, Instance ID 0, Router ID 2.2.2.2
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 2.2.2.2, local address FE80::521C:B0FF:FE63:3830
  Backup Designated router (ID) 1.1.1.1, local address FE80::521C:B0FF:FE2C:5100
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:08
  Graceful restart helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 4, maximum is 4
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 1.1.1.1  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
```

R2#show ipv6 ospf border-routers

```
            OSPFv3 Router with ID (2.2.2.2) (Process ID 1)
Codes: i - Intra-area route, I - Inter-area route
```

R2#show ip bgp

```
BGP table version is 9, local router ID is 192.168.0.9
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
              t secondary path, L long-lived-stale,
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
RPKI validation codes: V valid, I invalid, N Not found
     Network          Next Hop            Metric LocPrf Weight Path
*>   192.168.0.0/29   0.0.0.0                  0         32768 i
*    192.168.0.8/29   192.168.0.14             0             0 2 i
*>                    0.0.0.0                  0         32768 i
*>   192.168.0.16/29  192.168.0.14             0             0 2 i
*>   192.168.0.24/29  192.168.0.14                           0 2 i
*>   192.168.0.32/29  192.168.0.14                           0 2 i
*>   192.168.0.40/29  192.168.0.14                           0 2 3 i
```

R2#show bgp ipv6

```
% Command accepted but obsolete, unreleased or unsupported; see documentation.
BGP table version is 16, local router ID is 192.168.0.9
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
              t secondary path, L long-lived-stale,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
     Network          Next Hop            Metric LocPrf Weight Path
*>   2001:DB8:ACAD::/48
                      ::                       0         32768 ?
*    2002:DB8:ACAD::/48
                      2002:DB8:ACAD::2
                                               0             0 2 i
*>                    ::                       0         32768 i
*>   2003:DB8:ACAD::/48
                      2002:DB8:ACAD::2
                                               0             0 2 i
*>   2004:DB8:ACAD::/48
                      2002:DB8:ACAD::2
                                                             0 2 i
*>   2005:DB8:ACAD::/48
     Network          Next Hop            Metric LocPrf Weight Path
                      2002:DB8:ACAD::2
                                                             0 2 i
*>   2006:DB8:ACAD::/48
                      2002:DB8:ACAD::2
                                                             0 2 3 ?
% NOTE: This command is deprecated. Please use 'show bgp ipv6 unicast'
```

R2#show bgp ipv6 unicast neighbors

```
BGP neighbor is 2002:DB8:ACAD::2,  remote AS 2, external link
  BGP version 4, remote router ID 2.2.2.2
  BGP state = Established, up for 00:14:41
  Last read 00:00:21, last write 00:00:15, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
```

```
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                3          9
    Keepalives:            17         14
    Route Refresh:          0          0
    Total:                 21         24
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds
For address family: IPv6 Unicast
  Session: 2002:DB8:ACAD::2
  BGP table version 16, neighbor version 16/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                               Sent       Rcvd
  Prefix activity:             ----       ----
    Prefixes Current:             2          5 (Consumes 760 bytes)
    Prefixes Total:               2          9
    Implicit Withdraw:            0          2
    Explicit Withdraw:            0          2
    Used as bestpath:           n/a          4
    Used as multipath:          n/a          0
    Used as secondary:          n/a          0
                                 Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Bestpath from this peer:              6        n/a
    Total:                                6          0
  Number of NLRIs in the update sent: max 1, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                     Sent       Rcvd
        Refresh activity:            ----       ----
          Refresh Start-of-RIB        0          0
          Refresh End-of-RIB          0          0
  Address tracking is enabled, the RIB does have a route to 2002:DB8:ACAD::2
  Route to peer address reachability Up: 2; Down: 1
    Last notification 00:14:45
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-
connected-check)
```

```
  Interface associated: GigabitEthernet0/0/1 (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1
Local host: 2002:DB8:ACAD::1, Local port: 32136
Foreign host: 2002:DB8:ACAD::2, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x1E2CED):
Timer          Starts    Wakeups            Next
Retrans            19          0             0x0
TimeWait            0          0             0x0
AckHold            20         18             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          162        161        0x1E303C
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 2825829528  snduna: 2825830118  sndnxt: 2825830118
irs: 3102005095  rcvnxt: 3102006071
sndwnd:  15795  scale:      0  maxrcvwnd:  16384
rcvwnd:  15409  scale:      0  delrcvwnd:    975
SRTT: 921 ms, RTTO: 1531 ms, RTV: 610 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 881150 ms, Sent idletime: 15790 ms, Receive idletime: 15588 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
Rcvd: 39 (out of order: 0), with data: 20, total data bytes: 975
Sent: 40 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 40, total data bytes: 2197
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F11EA0A7D88  FREE
```

R2#show ip bgp neighbors

```
BGP neighbor is 192.168.0.14,  remote AS 2, external link
  BGP version 4, remote router ID 2.2.2.2
  BGP state = Established, up for 00:15:07
  Last read 00:00:37, last write 00:00:36, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
```

```
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                2          9
    Keepalives:            17         14
    Route Refresh:          0          0
    Total:                 20         24
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.14
  BGP table version 9, neighbor version 9/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                               Sent       Rcvd
  Prefix activity:             ----       ----
    Prefixes Current:             2          5 (Consumes 680 bytes)
    Prefixes Total:               2          9
    Implicit Withdraw:            0          3
    Explicit Withdraw:            0          1
    Used as bestpath:           n/a          4
    Used as multipath:          n/a          0
    Used as secondary:          n/a          0
                                 Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Bestpath from this peer:              5        n/a
    Total:                                5          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                     Sent       Rcvd
        Refresh activity:            ----       ----
          Refresh Start-of-RIB        0          0
          Refresh End-of-RIB          0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.14
  Route to peer address reachability Up: 2; Down: 1
    Last notification 00:15:08
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-
connected-check)
```

```
  Interface associated: GigabitEthernet0/0/1 (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1
Local host: 192.168.0.9, Local port: 179
Foreign host: 192.168.0.14, Foreign port: 65225
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x1E840F):
Timer          Starts    Wakeups            Next
Retrans            19          0             0x0
TimeWait            0          0             0x0
AckHold            21         20             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 3028463078  snduna: 3028463542  sndnxt: 3028463542
irs: 2604439856  rcvnxt: 2604440606
sndwnd:  15921  scale:      0  maxrcvwnd:  16384
rcvwnd:  15635  scale:      0  delrcvwnd:    749
SRTT: 921 ms, RTTO: 1531 ms, RTV: 610 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 907106 ms, Sent idletime: 36048 ms, Receive idletime: 35846 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 41 (out of order: 0), with data: 21, total data bytes: 749
Sent: 41 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 19, total data bytes: 463
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F11EA0A7CB8  FREE
```

R2#show ip bgp summary

```
BGP router identifier 192.168.0.9, local AS number 1
BGP table version is 9, main routing table version 9
6 network entries using 1488 bytes of memory
7 path entries using 952 bytes of memory
4/4 BGP path/bestpath attribute entries using 1120 bytes of memory
2 BGP AS-PATH entries using 64 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 3624 total bytes of memory
BGP activity 15/3 prefixes, 19/5 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
```

```
192.168.0.14    4            2      24      20        9    0    0
00:15:20        5
```

```
R2#show bgp ipv6 unicast summary
BGP router identifier 192.168.0.9, local AS number 1
BGP table version is 16, main routing table version 16
6 network entries using 1632 bytes of memory
7 path entries using 1064 bytes of memory
5/5 BGP path/bestpath attribute entries using 1400 bytes of memory
2 BGP AS-PATH entries using 64 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 4160 total bytes of memory
BGP activity 15/3 prefixes, 19/5 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
2002:DB8:ACAD::2
                4            2      25      22       16    0    0
00:15:24        5
```

Router 3:

```
R3#show run
Building configuration...
Current configuration : 2383 bytes
Last configuration change at 20:11:14
UTC Tue Jan 4 2022
version 15.5
service timestamps debug datetime
msec
service timestamps log datetime msec
no platform punt-keepalive disable-
kernel-core
hostname R3
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
ipv6 unicast-routing
subscriber templating
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO21441
WDF
spanning-tree extend system-id
redundancy
mode none
vlan internal allocation policy
ascending
interface GigabitEthernet0/0/0
 ip address 192.168.0.17
 255.255.255.248
 negotiation auto
 ipv6 address 2003:DB8:ACAD::1/48
interface GigabitEthernet0/0/1
 ip address 192.168.0.14
 255.255.255.248
 negotiation auto
 ipv6 address 2002:DB8:ACAD::2/48
 ipv6 ospf 6 area 6
interface Serial0/1/0
 no ip address
 shutdown
interface Serial0/1/1
 no ip address
 shutdown
interface GigabitEthernet0
 vrf forwarding Mgmt-intf
 no ip address
 shutdown
 negotiation auto
interface Vlan1
 no ip address
 shutdown
router ospf 6
 network 192.168.0.16 0.0.0.7 area 6
router bgp 2
 bgp router-id 2.2.2.2
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 2002:DB8:ACAD::1 remote-as 1
 neighbor 2003:DB8:ACAD::2 remote-as 2
```

```
neighbor 2004:DB8:ACAD::2 remote-as 2
neighbor 192.168.0.9 remote-as 1
neighbor 192.168.0.22 remote-as 2
neighbor 192.168.0.30 remote-as 2
address-family ipv4
  network 192.168.0.8 mask
255.255.255.248
  network 192.168.0.16 mask
255.255.255.248
  redistribute connected
  neighbor 192.168.0.9 activate
  neighbor 192.168.0.22 activate
  neighbor 192.168.0.30 activate
  neighbor 192.168.0.30 next-hop-self
exit-address-family
address-family ipv6
  redistribute connected
  network 2002:DB8:ACAD::/48
  network 2003:DB8:ACAD::/48
  neighbor 2002:DB8:ACAD::1 activate
  neighbor 2003:DB8:ACAD::2 activate
  neighbor 2004:DB8:ACAD::2 activate
  neighbor 2004:DB8:ACAD::2 next-hop-
self
exit-address-family
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface
GigabitEthernet0
ipv6 router ospf 6
router-id 3.3.3.3
control-plane
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

R3#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, p - overrides from PfR
Gateway of last resort is not set
      192.168.0.0/24 is variably subnetted, 8 subnets, 2 masks
B        192.168.0.0/29 [20/0] via 192.168.0.9, 00:16:07
C        192.168.0.8/29 is directly connected, GigabitEthernet0/0/1
L        192.168.0.14/32 is directly connected, GigabitEthernet0/0/1
C        192.168.0.16/29 is directly connected, GigabitEthernet0/0/0
L        192.168.0.17/32 is directly connected, GigabitEthernet0/0/0
O        192.168.0.24/29
           [110/2] via 192.168.0.22, 00:12:30, GigabitEthernet0/0/0
B        192.168.0.32/29 [200/0] via 192.168.0.30, 00:12:25
B        192.168.0.40/29 [200/0] via 192.168.0.30, 00:12:25
```

R3#show ipv6 route

```
IPv6 Routing Table - default - 9 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, 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
B   2001:DB8:ACAD::/48 [20/0]
     via FE80::521C:B0FF:FE63:3831, GigabitEthernet0/0/1
C   2002:DB8:ACAD::/48 [0/0]
```

```
     via GigabitEthernet0/0/1, directly connected
L   2002:DB8:ACAD::2/128 [0/0]
     via GigabitEthernet0/0/1, receive
C   2003:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2003:DB8:ACAD::1/128 [0/0]
     via GigabitEthernet0/0/0, receive
B   2004:DB8:ACAD::/48 [200/0]
     via 2003:DB8:ACAD::2
B   2005:DB8:ACAD::/48 [200/0]
     via 2004:DB8:ACAD::2
B   2006:DB8:ACAD::/48 [200/0]
     via 2004:DB8:ACAD::2
L   FF00::/8 [0/0]
     via Null0, receive
```

R3#show ip bgp

```
BGP table version is 14, local router ID is 2.2.2.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
     Network          Next Hop            Metric LocPrf Weight Path
*>  192.168.0.0/29   192.168.0.9              0             0 1 i
*   192.168.0.8/29   192.168.0.9              0             0 1 i
*>                   0.0.0.0                  0         32768 i
* i 192.168.0.16/29  192.168.0.22             0    100      0 i
*>                   0.0.0.0                  0         32768 i
r i 192.168.0.24/29  192.168.0.30             0    100      0 i
r>i                  192.168.0.22             0    100      0 i
*>i 192.168.0.32/29  192.168.0.30             0    100      0 i
*>i 192.168.0.40/29  192.168.0.30             0    100      0 3 i
```

R3#show bgp ipv6

```
BGP table version is 18, local router ID is 2.2.2.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
     Network          Next Hop            Metric LocPrf Weight Path
*>  2001:DB8:ACAD::/48
                      2002:DB8:ACAD::1
                                             0             0 1 ?
*   2002:DB8:ACAD::/48
                      2002:DB8:ACAD::1
                                             0             0 1 i
*>                  ::                       0         32768 i
* i 2003:DB8:ACAD::/48
                      2003:DB8:ACAD::2
                                             0    100      0 i
*>                  ::                       0         32768 i
* i 2004:DB8:ACAD::/48
```

```
                      2004:DB8:ACAD::2
                                                0    100      0 i
*>i                  2003:DB8:ACAD::2
     Network          Next Hop            Metric LocPrf Weight Path
                                                0    100      0 i
*>i 2005:DB8:ACAD::/48
                      2004:DB8:ACAD::2
                                                0    100      0 i
*>i 2006:DB8:ACAD::/48
                      2004:DB8:ACAD::2
                                                0    100      0 3 ?

R3#show bgp ipv6 unicast neighbors
BGP neighbor is 2002:DB8:ACAD::1,  remote AS 1, external link
  BGP version 4, remote router ID 192.168.0.9
  BGP state = Established, up for 00:17:50
  Last read 00:00:47, last write 00:00:39, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                9          3
    Keepalives:            17         20
    Route Refresh:          0          0
    Total:                 27         24
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds
For address family: IPv6 Unicast
  Session: 2002:DB8:ACAD::1
  BGP table version 18, neighbor version 18/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               5          2 (Consumes 288 bytes)
    Prefixes Total:                 9          2
    Implicit Withdraw:              2          0
    Explicit Withdraw:              2          0
    Used as bestpath:             n/a          1
```

```
    Used as multipath:            n/a          0
                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Bestpath from this peer:              3        n/a
    Total:                                3          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
          Refresh Start-of-RIB         0          0
          Refresh End-of-RIB           0          0
  Address tracking is enabled, the RIB does have a route to 2002:DB8:ACAD::1
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-
connected-check)
  Interface associated: GigabitEthernet0/0/1 (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1
Local host: 2002:DB8:ACAD::2, Local port: 179
Foreign host: 2002:DB8:ACAD::1, Foreign port: 32136
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x218D7A):
Timer          Starts    Wakeups            Next
Retrans            23          0             0x0
TimeWait            0          0             0x0
AckHold            21         19             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 3102005095  snduna: 3102006128  sndnxt: 3102006128
irs: 2825829528  rcvnxt: 2825830175
sndwnd:  15352  scale:      0  maxrcvwnd:  16384
rcvwnd:  15738  scale:      0  delrcvwnd:    646
SRTT: 954 ms, RTTO: 1319 ms, RTV: 365 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1070201 ms, Sent idletime: 39542 ms, Receive idletime: 39341 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
```

```
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
Rcvd: 46 (out of order: 0), with data: 22, total data bytes: 646
Sent: 45 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 45, total data bytes: 2840
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F623BD93B48  FREE
BGP neighbor is 2003:DB8:ACAD::2,  remote AS 2, internal link
  BGP version 4, remote router ID 192.168.0.25
  BGP state = Established, up for 00:13:52
  Last read 00:00:13, last write 00:00:42, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                6          3
    Keepalives:            16         17
    Route Refresh:          0          0
    Total:                 23         21
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv6 Unicast
  Session: 2003:DB8:ACAD::2
  BGP table version 18, neighbor version 18/0
  Output queue size : 0
  Index 2, Advertise bit 1
  2 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               3          2 (Consumes 288 bytes)
    Prefixes Total:                 7          4
    Implicit Withdraw:              4          2
    Explicit Withdraw:              0          0
    Used as bestpath:             n/a          1
    Used as multipath:            n/a          0
                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Bestpath from this peer:              1        n/a
    Bestpath from iBGP peer:              2        n/a
```

```
    Total:                                3          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
          Refresh Start-of-RIB         0          0
          Refresh End-of-RIB           0          0
  Address tracking is enabled, the RIB does have a route to 2003:DB8:ACAD::2
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 2003:DB8:ACAD::1, Local port: 179
Foreign host: 2003:DB8:ACAD::2, Foreign port: 40073
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x218D7A):
Timer          Starts    Wakeups            Next
Retrans            19          0             0x0
TimeWait            0          0             0x0
AckHold            19         15             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss:  989259787  snduna:  989260579  sndnxt:  989260579
irs: 3334975156  rcvnxt: 3334975730
sndwnd:  15593  scale:      0  maxrcvwnd:  16384
rcvwnd:  15811  scale:      0  delrcvwnd:    573
SRTT: 921 ms, RTTO: 1531 ms, RTV: 610 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 832831 ms, Sent idletime: 13369 ms, Receive idletime: 13569 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
Rcvd: 40 (out of order: 0), with data: 20, total data bytes: 573
Sent: 38 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 38, total data bytes: 2319
Packets received in fast path: 0, fast processed: 0, slow path: 0
```

```
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F623BD93A88  FREE
BGP neighbor is 2004:DB8:ACAD::2,  remote AS 2, internal link
  BGP version 4, remote router ID 192.168.0.33
  BGP state = Established, up for 00:13:47
  Last read 00:00:08, last write 00:00:10, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                5         10
    Keepalives:            17         17
    Route Refresh:          0          0
    Total:                 23         28
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv6 Unicast
  Session: 2004:DB8:ACAD::2
  BGP table version 18, neighbor version 18/0
  Output queue size : 0
  Index 3, Advertise bit 2
  3 update-group member
  NEXT_HOP is always this router for eBGP paths
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               3          3 (Consumes 432 bytes)
    Prefixes Total:                 6         12
    Implicit Withdraw:              3          9
    Explicit Withdraw:              0          0
    Used as bestpath:             n/a          2
    Used as multipath:            n/a          0
                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Bestpath from this peer:              2        n/a
    Bestpath from iBGP peer:              1        n/a
    Total:                                3          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
```

```
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                     Sent       Rcvd
        Refresh activity:            ----       ----
          Refresh Start-of-RIB        0          0
          Refresh End-of-RIB          0          0
  Address tracking is enabled, the RIB does have a route to 2004:DB8:ACAD::2
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address NOT in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 2003:DB8:ACAD::1, Local port: 17485
Foreign host: 2004:DB8:ACAD::2, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x21D00A):
Timer          Starts    Wakeups            Next
Retrans            23          3             0x0
TimeWait            0          0             0x0
AckHold            19         16             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          146        145        0x21D3DD
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss:  772238481  snduna:  772239217  sndnxt:  772239217
irs:  457202928  rcvnxt:  457204026
sndwnd:  15649  scale:      0  maxrcvwnd:  16384
rcvwnd:  15287  scale:      0  delrcvwnd:   1097
SRTT: 921 ms, RTTO: 1531 ms, RTV: 610 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 845300 ms, Sent idletime: 26511 ms, Receive idletime: 26711 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
Rcvd: 40 (out of order: 2), with data: 20, total data bytes: 1097
Sent: 42 (retransmit: 3, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 42, total data bytes: 2423
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F623BD93788  FREE

R3#show ip bgp neighbors
BGP neighbor is 192.168.0.9,  remote AS 1, external link
```

```
  BGP version 4, remote router ID 192.168.0.9
  BGP state = Established, up for 00:18:54
  Last read 00:00:43, last write 00:00:31, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                9          2
    Keepalives:            18         21
    Route Refresh:          0          0
    Total:                 28         24
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.9
  BGP table version 14, neighbor version 14/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                Sent       Rcvd
  Prefix activity:              ----       ----
    Prefixes Current:              5          2 (Consumes 240 bytes)
    Prefixes Total:                9          2
    Implicit Withdraw:             3          0
    Explicit Withdraw:             1          0
    Used as bestpath:            n/a          1
    Used as multipath:           n/a          0
                                  Outbound    Inbound
  Local Policy Denied Prefixes:   --------    -------
    Bestpath from this peer:              1        n/a
    Total:                                1          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                     Sent       Rcvd
```

```
        Refresh activity:              ----       ----
          Refresh Start-of-RIB          0          0
          Refresh End-of-RIB            0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.9
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-
connected-check)
  Interface associated: GigabitEthernet0/0/1 (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1
Local host: 192.168.0.14, Local port: 65225
Foreign host: 192.168.0.9, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x228F38):
Timer          Starts    Wakeups            Next
Retrans            26          0             0x0
TimeWait            0          0             0x0
AckHold            23         21             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          388        387        0x229192
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 2604439856  snduna: 2604440682  sndnxt: 2604440682
irs: 3028463078  rcvnxt: 3028463618
sndwnd:  15559  scale:      0  maxrcvwnd:  16384
rcvwnd:  15845  scale:      0  delrcvwnd:    539
SRTT: 969 ms, RTTO: 1216 ms, RTV: 247 ms, KRTT: 0 ms
minRTT: 2 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1141023 ms, Sent idletime: 38095 ms, Receive idletime: 37895 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 49 (out of order: 0), with data: 23, total data bytes: 539
Sent: 49 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 25, total data bytes: 825
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F623BD939C8  FREE
BGP neighbor is 192.168.0.22,  remote AS 2, internal link
  BGP version 4, remote router ID 192.168.0.25
  BGP state = Established, up for 00:15:03
  Last read 00:00:33, last write 00:00:57, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
```

```
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                3          2
    Keepalives:            18         18
    Route Refresh:          0          0
    Total:                 22         21
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.22
  BGP table version 14, neighbor version 14/0
  Output queue size : 0
  Index 2, Advertise bit 1
  2 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               3          2 (Consumes 240 bytes)
    Prefixes Total:                 3          2
    Implicit Withdraw:              0          0
    Explicit Withdraw:              0          0
    Used as bestpath:             n/a          1
    Used as multipath:            n/a          0
                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Bestpath from this peer:              2        n/a
    Bestpath from iBGP peer:              4        n/a
    Total:                                6          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
          Refresh Start-of-RIB         0          0
          Refresh End-of-RIB           0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.22
```

```
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 192.168.0.17, Local port: 179
Foreign host: 192.168.0.22, Foreign port: 61037
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x22AEC8):
Timer          Starts    Wakeups            Next
Retrans            20          0             0x0
TimeWait            0          0             0x0
AckHold            19         16             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 1926124139  snduna: 1926124704  sndnxt: 1926124704
irs: 1394658195  rcvnxt: 1394658679
sndwnd:  15820  scale:      0  maxrcvwnd:  16384
rcvwnd:  15901  scale:      0  delrcvwnd:    483
SRTT: 931 ms, RTTO: 1468 ms, RTV: 537 ms, KRTT: 0 ms
minRTT: 0 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 911016 ms, Sent idletime: 5069 ms, Receive idletime: 4868 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 41 (out of order: 0), with data: 20, total data bytes: 483
Sent: 40 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 21, total data bytes: 564
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F623BD93908  FREE
BGP neighbor is 192.168.0.30,  remote AS 2, internal link
  BGP version 4, remote router ID 192.168.0.33
  BGP state = Established, up for 00:15:05
  Last read 00:00:04, last write 00:00:33, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
```

```
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                3          6
    Keepalives:            18         18
    Route Refresh:          0          0
    Total:                 22         25
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.30
  BGP table version 14, neighbor version 14/0
  Output queue size : 0
  Index 3, Advertise bit 2
  3 update-group member
  NEXT_HOP is always this router for eBGP paths
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               3          3 (Consumes 360 bytes)
    Prefixes Total:                 3          6
    Implicit Withdraw:              0          3
    Explicit Withdraw:              0          0
    Used as bestpath:             n/a          2
    Used as multipath:            n/a          0
                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Bestpath from this peer:              4        n/a
    Bestpath from iBGP peer:              2        n/a
    Total:                                6          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
          Refresh Start-of-RIB         0          0
          Refresh End-of-RIB           0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.30
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address NOT in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
```

```
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 192.168.0.17, Local port: 179
Foreign host: 192.168.0.30, Foreign port: 27325
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x22C3DC):
Timer          Starts    Wakeups            Next
Retrans            19          0             0x0
TimeWait            0          0             0x0
AckHold            20         17             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss:  649033987  snduna:  649034533  sndnxt:  649034533
irs: 1458500096  rcvnxt: 1458500793
sndwnd:  15839  scale:      0  maxrcvwnd:  16384
rcvwnd:  15688  scale:      0  delrcvwnd:    696
SRTT: 921 ms, RTTO: 1531 ms, RTV: 610 ms, KRTT: 0 ms
minRTT: 0 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 909908 ms, Sent idletime: 8537 ms, Receive idletime: 8737 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 41 (out of order: 0), with data: 21, total data bytes: 696
Sent: 40 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 20, total data bytes: 545
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F623BD93848  FREE

R3#show ip bgp summary
BGP router identifier 2.2.2.2, local AS number 2
BGP table version is 14, main routing table version 14
6 network entries using 1488 bytes of memory
9 path entries using 1080 bytes of memory
4/4 BGP path/bestpath attribute entries using 992 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 3608 total bytes of memory
BGP activity 14/2 prefixes, 22/4 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
192.168.0.9     4            1      25      29       14    0    0
00:19:24        2
```

```
192.168.0.22    4            2      21      23       14    0    0
00:15:26        2
192.168.0.30    4            2      25      22       14    0    0
00:15:20        3
```

R3#show bgp ipv6 unicast summary

```
BGP router identifier 2.2.2.2, local AS number 2
BGP table version is 18, main routing table version 18
6 network entries using 1632 bytes of memory
9 path entries using 1296 bytes of memory
5/4 BGP path/bestpath attribute entries using 1240 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 4216 total bytes of memory
BGP activity 14/2 prefixes, 22/4 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
2002:DB8:ACAD::1
                4            1      26      29       18    0    0
00:19:39        2
2003:DB8:ACAD::2
                4            2      23      25       18    0    0
00:15:42        2
2004:DB8:ACAD::2
                4            2      30      25       18    0    0
00:15:36        3
```

R3#show ip ospf neighbor

```
Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.0.25      1   FULL/DR         00:00:39    192.168.0.22    GigabitEthernet
0/0/0
```

R3#show ip ospf

```
Routing Process "ospf 6" with ID 192.168.0.17
Start time: 00:18:35.672, Time elapsed: 00:20:16.130
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Supports area transit capability
Supports NSSA (compatible with RFC 3101)
Supports Database Exchange Summary List Optimization (RFC 5243)
Event-log enabled, Maximum number of events: 1000, Mode: cyclic
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPFs 10000 msecs
Maximum wait time between two consecutive SPFs 10000 msecs
Incremental-SPF disabled
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300
```

```
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Number of areas transit capable is 0
External flood list length 0
IETF NSF helper support enabled
Cisco NSF helper support enabled
Reference bandwidth unit is 100 mbps
    Area 6
        Number of interfaces in this area is 1
        Area has no authentication
        SPF algorithm last executed 00:15:19.787 ago
        SPF algorithm executed 7 times
        Area ranges are
        Number of LSA 5. Checksum Sum 0x025664
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R3#show ip ospf interface
GigabitEthernet0/0/0 is up, line protocol is up
  Internet Address 192.168.0.17/29, Area 6, Attached via Network Statement
  Process ID 6, Router ID 192.168.0.17, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0           1         no          no            Base
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 192.168.0.25, Interface address 192.168.0.22
  Backup Designated router (ID) 192.168.0.17, Interface address 192.168.0.17
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:07
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 192.168.0.25  (Designated Router)
  Suppress hello for 0 neighbor(s)

R3#show ip ospf border-routers
            OSPF Router with ID (192.168.0.17) (Process ID 6)
                Base Topology (MTID 0)
Internal Router Routing Table
Codes: i - Intra-area route, I - Inter-area route

R3#show ipv6 ospf interface
GigabitEthernet0/0/1 is up, line protocol is up
```

```
  Link Local Address FE80::B6A8:B9FF:FE47:9231, Interface ID 7
  Area 6, Process ID 6, Instance ID 0, Router ID 3.3.3.3
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 3.3.3.3, local address FE80::B6A8:B9FF:FE47:9231
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:05
  Graceful restart helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)

R3#show ipv6 ospf border-routers
            OSPFv3 Router with ID (3.3.3.3) (Process ID 6)
Codes: i - Intra-area route, I - Inter-area route
```

Router 4:

```
R4#show run
Building configuration...
Current configuration : 2146 bytes
Last configuration change at 20:07:48
UTC Tue Jan 4 2022
version 15.5
service timestamps debug datetime
msec
service timestamps log datetime msec
no platform punt-keepalive disable-
kernel-core
hostname R4
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
ipv6 unicast-routing
subscriber templating
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO21500
9QY
spanning-tree extend system-id
redundancy
mode none
vlan internal allocation policy
ascending
interface GigabitEthernet0/0/0
ip address 192.168.0.22
255.255.255.248
negotiation auto
ipv6 address 2003:DB8:ACAD::2/48
ipv6 ospf 6 area 6
interface GigabitEthernet0/0/1
ip address 192.168.0.25
255.255.255.248
negotiation auto
ipv6 address 2004:DB8:ACAD::1/48
ipv6 ospf 6 area 6
interface Serial0/1/0
interface Serial0/1/1
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
interface Vlan1
no ip address
shutdown
router ospf 6
network 192.168.0.16 0.0.0.7 area 6
network 192.168.0.24 0.0.0.7 area 6
router bgp 2
bgp log-neighbor-changes
no bgp default ipv4-unicast
neighbor 2003:DB8:ACAD::1 remote-as 2
neighbor 2004:DB8:ACAD::2 remote-as 2
neighbor 192.168.0.17 remote-as 2
neighbor 192.168.0.30 remote-as 2
address-family ipv4
```

```
  network 192.168.0.16 mask
255.255.255.248
  network 192.168.0.24 mask
255.255.255.248
  redistribute connected
  neighbor 192.168.0.17 activate
  neighbor 192.168.0.30 activate
exit-address-family
address-family ipv6
  redistribute connected
  network 2003:DB8:ACAD::/48
  network 2004:DB8:ACAD::/48
  neighbor 2003:DB8:ACAD::1 activate
  neighbor 2004:DB8:ACAD::2 activate
exit-address-family
ip forward-protocol nd
```

```
no ip http server
no ip http secure-server
ip tftp source-interface
GigabitEthernet0
ipv6 router ospf 6
router-id 4.4.4.4
control-plane
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

```
R4#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, p - overrides from PfR
Gateway of last resort is not set
      192.168.0.0/24 is variably subnetted, 8 subnets, 2 masks
B        192.168.0.0/29 [200/0] via 192.168.0.9, 00:18:01
B        192.168.0.8/29 [200/0] via 192.168.0.17, 00:18:06
C        192.168.0.16/29 is directly connected, GigabitEthernet0/0/0
L        192.168.0.22/32 is directly connected, GigabitEthernet0/0/0
C        192.168.0.24/29 is directly connected, GigabitEthernet0/0/1
L        192.168.0.25/32 is directly connected, GigabitEthernet0/0/1
B        192.168.0.32/29 [200/0] via 192.168.0.30, 00:18:06
B        192.168.0.40/29 [200/0] via 192.168.0.38, 00:18:01
```

```
R4#show ipv6 route
IPv6 Routing Table - default - 9 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, 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
B   2001:DB8:ACAD::/48 [200/0]
     via 2002:DB8:ACAD::1
B   2002:DB8:ACAD::/48 [200/0]
     via 2003:DB8:ACAD::1
C   2003:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2003:DB8:ACAD::2/128 [0/0]
     via GigabitEthernet0/0/0, receive
```

```
C   2004:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2004:DB8:ACAD::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
B   2005:DB8:ACAD::/48 [200/0]
     via 2004:DB8:ACAD::2
B   2006:DB8:ACAD::/48 [200/0]
     via 2005:DB8:ACAD::2
L   FF00::/8 [0/0]
     via Null0, receive
```

R4#show ip bgp

```
BGP table version is 9, local router ID is 192.168.0.25
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
     Network          Next Hop            Metric LocPrf Weight Path
*>i 192.168.0.0/29   192.168.0.9              0    100      0 1 i
*>i 192.168.0.8/29   192.168.0.17             0    100      0 i
* i 192.168.0.16/29  192.168.0.17             0    100      0 i
*>                   0.0.0.0                  0         32768 i
* i 192.168.0.24/29  192.168.0.30             0    100      0 i
*>                   0.0.0.0                  0         32768 i
*>i 192.168.0.32/29  192.168.0.30             0    100      0 i
*>i 192.168.0.40/29  192.168.0.38             0    100      0 3 i
```

R4#show bgp ipv6

```
BGP table version is 11, local router ID is 192.168.0.25
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
     Network          Next Hop            Metric LocPrf Weight Path
*>i 2001:DB8:ACAD::/48
                      2002:DB8:ACAD::1
                                           0    100      0 1 ?
*>i 2002:DB8:ACAD::/48
                      2003:DB8:ACAD::1
                                           0    100      0 i
* i 2003:DB8:ACAD::/48
                      2003:DB8:ACAD::1
                                           0    100      0 i
*>                   ::                    0         32768 i
* i 2004:DB8:ACAD::/48
                      2004:DB8:ACAD::2
                                           0    100      0 i
*>                   ::                    0         32768 i
*>i 2005:DB8:ACAD::/48
     Network          Next Hop            Metric LocPrf Weight Path
                      2004:DB8:ACAD::2
                                           0    100      0 i
```

```
*>i 2006:DB8:ACAD::/48
                      2005:DB8:ACAD::2
                                                0    100      0 3 ?
% NOTE: This command is deprecated. Please use 'show bgp ipv6 unicast'

R4#show bgp ipv6 unicast neighbors
BGP neighbor is 2003:DB8:ACAD::1,  remote AS 2, internal link
  BGP version 4, remote router ID 2.2.2.2
  BGP state = Established, up for 00:18:34
  Last read 00:00:09, last write 00:00:31, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                3          6
    Keepalives:            22         22
    Route Refresh:          0          0
    Total:                 26         29
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv6 Unicast
  Session: 2003:DB8:ACAD::1
  BGP table version 11, neighbor version 11/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                Sent       Rcvd
  Prefix activity:              ----       ----
    Prefixes Current:              2          3 (Consumes 432 bytes)
    Prefixes Total:                4          7
    Implicit Withdraw:             2          4
    Explicit Withdraw:             0          0
    Used as bestpath:            n/a          2
    Used as multipath:           n/a          0
                                  Outbound    Inbound
  Local Policy Denied Prefixes:   --------    -------
    Bestpath from this peer:              3        n/a
    Bestpath from iBGP peer:              3        n/a
    Total:                                6          0
  Number of NLRIs in the update sent: max 2, min 0
```

```
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
          Refresh Start-of-RIB         0          0
          Refresh End-of-RIB           0          0
  Address tracking is enabled, the RIB does have a route to 2003:DB8:ACAD::1
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 2003:DB8:ACAD::2, Local port: 40073
Foreign host: 2003:DB8:ACAD::1, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x133AD3):
Timer          Starts    Wakeups            Next
Retrans            25          0             0x0
TimeWait            0          0             0x0
AckHold            25         22             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          353        352        0x133BF3
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 3334975156  snduna: 3334975825  sndnxt: 3334975825
irs:  989259787  rcvnxt:  989260693
sndwnd:  15716  scale:      0  maxrcvwnd:  16384
rcvwnd:  15479  scale:      0  delrcvwnd:    905
SRTT: 964 ms, RTTO: 1245 ms, RTV: 281 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1114445 ms, Sent idletime: 9624 ms, Receive idletime: 9824 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
Rcvd: 49 (out of order: 0), with data: 26, total data bytes: 905
Sent: 51 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 51, total data bytes: 2716
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FB675946248  FREE
```

```
BGP neighbor is 2004:DB8:ACAD::2,  remote AS 2, internal link
  BGP version 4, remote router ID 192.168.0.33
  BGP state = Established, up for 00:18:33
  Last read 00:00:09, last write 00:00:43, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                3          8
    Keepalives:            22         21
    Route Refresh:          0          0
    Total:                 26         30
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv6 Unicast
  Session: 2004:DB8:ACAD::2
  BGP table version 11, neighbor version 11/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                Sent       Rcvd
  Prefix activity:              ----       ----
    Prefixes Current:              2          3 (Consumes 432 bytes)
    Prefixes Total:                4         10
    Implicit Withdraw:             2          7
    Explicit Withdraw:             0          0
    Used as bestpath:            n/a          2
    Used as multipath:           n/a          0
                                  Outbound    Inbound
  Local Policy Denied Prefixes:   --------    -------
    Bestpath from this peer:              3        n/a
    Bestpath from iBGP peer:              3        n/a
    Total:                                6          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
```

```
  Last Received Refresh End-of-rib: never
                                       Sent       Rcvd
        Refresh activity:              ----       ----
          Refresh Start-of-RIB          0          0
          Refresh End-of-RIB            0          0
  Address tracking is enabled, the RIB does have a route to 2004:DB8:ACAD::2
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 2004:DB8:ACAD::1, Local port: 56926
Foreign host: 2004:DB8:ACAD::2, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x133AD3):
Timer          Starts    Wakeups            Next
Retrans            25          0             0x0
TimeWait            0          0             0x0
AckHold            25         22             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          358        357        0x133BB9
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 2215625831  snduna: 2215626500  sndnxt: 2215626500
irs: 1796505103  rcvnxt: 1796506153
sndwnd:  15716  scale:      0  maxrcvwnd:  16384
rcvwnd:  15335  scale:      0  delrcvwnd:   1049
SRTT: 964 ms, RTTO: 1245 ms, RTV: 281 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1113422 ms, Sent idletime: 9263 ms, Receive idletime: 9463 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
Rcvd: 49 (out of order: 0), with data: 26, total data bytes: 1049
Sent: 51 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 51, total data bytes: 2716
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FB675946188  FREE

R4#show ip bgp neighbors
BGP neighbor is 192.168.0.17,  remote AS 2, internal link
  BGP version 4, remote router ID 2.2.2.2
  BGP state = Established, up for 00:18:56
```

```
  Last read 00:00:12, last write 00:00:03, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                2          3
    Keepalives:            23         23
    Route Refresh:          0          0
    Total:                 26         27
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.17
  BGP table version 9, neighbor version 9/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               2          3 (Consumes 360 bytes)
    Prefixes Total:                 2          3
    Implicit Withdraw:              0          0
    Explicit Withdraw:              0          0
    Used as bestpath:             n/a          2
    Used as multipath:            n/a          0
                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Bestpath from this peer:              3        n/a
    Bestpath from iBGP peer:              3        n/a
    Total:                                6          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
```

```
          Refresh Start-of-RIB          0          0
          Refresh End-of-RIB            0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.17
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 192.168.0.22, Local port: 61037
Foreign host: 192.168.0.17, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x138633):
Timer          Starts    Wakeups            Next
Retrans            25          0             0x0
TimeWait            0          0             0x0
AckHold            24         21             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          358        357        0x1389AC
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 1394658195  snduna: 1394658774  sndnxt: 1394658774
irs: 1926124139  rcvnxt: 1926124780
sndwnd:  15806  scale:      0  maxrcvwnd:  16384
rcvwnd:  15744  scale:      0  delrcvwnd:    640
SRTT: 964 ms, RTTO: 1245 ms, RTV: 281 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1136815 ms, Sent idletime: 3150 ms, Receive idletime: 2948 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 49 (out of order: 0), with data: 25, total data bytes: 640
Sent: 50 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 25, total data bytes: 578
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FB6759463C8  FREE
BGP neighbor is 192.168.0.30,  remote AS 2, internal link
  BGP version 4, remote router ID 192.168.0.33
  BGP state = Established, up for 00:18:53
  Last read 00:00:34, last write 00:00:33, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
```

```
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                2          3
    Keepalives:            22         22
    Route Refresh:          0          0
    Total:                 25         26
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.30
  BGP table version 9, neighbor version 9/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                Sent       Rcvd
  Prefix activity:              ----       ----
    Prefixes Current:              2          3 (Consumes 360 bytes)
    Prefixes Total:                2          3
    Implicit Withdraw:             0          0
    Explicit Withdraw:             0          0
    Used as bestpath:            n/a          2
    Used as multipath:           n/a          0
                                  Outbound    Inbound
  Local Policy Denied Prefixes:   --------    -------
    Bestpath from this peer:              3        n/a
    Bestpath from iBGP peer:              3        n/a
    Total:                                6          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                     Sent       Rcvd
        Refresh activity:            ----       ----
          Refresh Start-of-RIB        0          0
          Refresh End-of-RIB          0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.30
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address in same link)
```

```
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 192.168.0.25, Local port: 46223
Foreign host: 192.168.0.30, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x138633):
Timer          Starts    Wakeups            Next
Retrans            24          0             0x0
TimeWait            0          0             0x0
AckHold            23         18             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          353        352        0x138A31
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss:  365905743  snduna:  365906303  sndnxt:  365906303
irs: 1544090523  rcvnxt: 1544091145
sndwnd:  15825  scale:      0  maxrcvwnd:  16384
rcvwnd:  15763  scale:      0  delrcvwnd:    621
SRTT: 959 ms, RTTO: 1279 ms, RTV: 320 ms, KRTT: 0 ms
minRTT: 2 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1133741 ms, Sent idletime: 33871 ms, Receive idletime: 33670 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 47 (out of order: 0), with data: 24, total data bytes: 621
Sent: 46 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 24, total data bytes: 559
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FB675946308  FREE

R4#show ip bgp summary
BGP router identifier 192.168.0.25, local AS number 2
BGP table version is 9, main routing table version 9
6 network entries using 1488 bytes of memory
8 path entries using 960 bytes of memory
4/4 BGP path/bestpath attribute entries using 992 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 3488 total bytes of memory
BGP activity 12/0 prefixes, 16/0 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
```

```
192.168.0.17    4            2      27      26        9    0    0
00:19:13        3
192.168.0.30    4            2      27      25        9    0    0
00:19:10        3

R4#show bgp ipv6 unicast summary
BGP router identifier 192.168.0.25, local AS number 2
BGP table version is 11, main routing table version 11
6 network entries using 1632 bytes of memory
8 path entries using 1152 bytes of memory
4/4 BGP path/bestpath attribute entries using 992 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 3824 total bytes of memory
BGP activity 12/0 prefixes, 16/0 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
2003:DB8:ACAD::1
                4            2      29      27       11    0    0
00:19:16        3
2004:DB8:ACAD::2
                4            2      31      27       11    0    0
00:19:15        3

R4#show bgp ipv6 unicast summary
BGP router identifier 192.168.0.25, local AS number 2
BGP table version is 11, main routing table version 11
6 network entries using 1632 bytes of memory
8 path entries using 1152 bytes of memory
4/4 BGP path/bestpath attribute entries using 992 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 3824 total bytes of memory
BGP activity 12/0 prefixes, 16/0 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
2003:DB8:ACAD::1
                4            2      30      27       11    0    0
00:19:31        3
2004:DB8:ACAD::2
                4            2      31      27       11    0    0
00:19:30        3

R4#show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.0.33      1   FULL/DR         00:00:39    192.168.0.30    GigabitEthernet
0/0/1
192.168.0.17      1   FULL/BDR        00:00:31    192.168.0.17    GigabitEthernet
0/0/0

R4#show ip ospf
Routing Process "ospf 6" with ID 192.168.0.25
```

```
Start time: 00:02:15.360, Time elapsed: 00:19:55.938
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Supports area transit capability
Supports NSSA (compatible with RFC 3101)
Supports Database Exchange Summary List Optimization (RFC 5243)
Event-log enabled, Maximum number of events: 1000, Mode: cyclic
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPFs 10000 msecs
Maximum wait time between two consecutive SPFs 10000 msecs
Incremental-SPF disabled
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Number of areas transit capable is 0
External flood list length 0
IETF NSF helper support enabled
Cisco NSF helper support enabled
Reference bandwidth unit is 100 mbps
    Area 6
        Number of interfaces in this area is 2
        Area has no authentication
        SPF algorithm last executed 00:18:52.487 ago
        SPF algorithm executed 4 times
        Area ranges are
        Number of LSA 5. Checksum Sum 0x025664
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R4#show ip ospf interface
GigabitEthernet0/0/1 is up, line protocol is up
  Internet Address 192.168.0.25/29, Area 6, Attached via Network Statement
  Process ID 6, Router ID 192.168.0.25, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0           1         no          no            Base
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 192.168.0.33, Interface address 192.168.0.30
  Backup Designated router (ID) 192.168.0.25, Interface address 192.168.0.25
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:02
```

```
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/2/2, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 192.168.0.33  (Designated Router)
  Suppress hello for 0 neighbor(s)
GigabitEthernet0/0/0 is up, line protocol is up
  Internet Address 192.168.0.22/29, Area 6, Attached via Network Statement
  Process ID 6, Router ID 192.168.0.25, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0           1         no          no            Base
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.0.25, Interface address 192.168.0.22
  Backup Designated router (ID) 192.168.0.17, Interface address 192.168.0.17
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:04
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 192.168.0.17  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)

R4#show ip ospf border-routers
            OSPF Router with ID (192.168.0.25) (Process ID 6)
                Base Topology (MTID 0)
Internal Router Routing Table
Codes: i - Intra-area route, I - Inter-area route

R4#show ipv6 ospf neighbor
            OSPFv3 Router with ID (4.4.4.4) (Process ID 6)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
5.5.5.5           1   FULL/DR         00:00:31    7               GigabitEthernet
0/0/1

R4#show ipv6 ospf interface
GigabitEthernet0/0/1 is up, line protocol is up
  Link Local Address FE80::CE8E:71FF:FE1E:22E1, Interface ID 7
  Area 6, Process ID 6, Instance ID 0, Router ID 4.4.4.4
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 5.5.5.5, local address FE80::B6A8:B9FF:FE47:9351
  Backup Designated router (ID) 4.4.4.4, local address FE80::CE8E:71FF:FE1E:22E1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:05
```

```
  Graceful restart helper support enabled
  Index 1/2/2, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 2, maximum is 2
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 5.5.5.5  (Designated Router)
  Suppress hello for 0 neighbor(s)
GigabitEthernet0/0/0 is up, line protocol is up
  Link Local Address FE80::CE8E:71FF:FE1E:22E0, Interface ID 6
  Area 6, Process ID 6, Instance ID 0, Router ID 4.4.4.4
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 4.4.4.4, local address FE80::CE8E:71FF:FE1E:22E0
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:01
  Graceful restart helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)

R4#show ipv6 ospf border-routers
            OSPFv3 Router with ID (4.4.4.4) (Process ID 6)
Codes: i - Intra-area route, I - Inter-area route
```

Router 5:

```
R5#Show run
Building configuration...
Current configuration : 2363 bytes
Last configuration change at 20:12:20
UTC Tue Jan 4 2022
version 15.5
service timestamps debug datetime
msec
service timestamps log datetime msec
no platform punt-keepalive disable-
kernel-core
hostname R5
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
ipv6 unicast-routing
subscriber templating
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO21442
0HM
spanning-tree extend system-id
redundancy
mode none
vlan internal allocation policy
ascending
interface GigabitEthernet0/0/0
ip address 192.168.0.33
255.255.255.248
negotiation auto
ipv6 address 2005:DB8:ACAD::1/48
interface GigabitEthernet0/0/1
ip address 192.168.0.30
255.255.255.248
negotiation auto
ipv6 address 2004:DB8:ACAD::2/48
ipv6 ospf 6 area 6
interface Serial0/1/0
no ip address
shutdown
interface Serial0/1/1
no ip address
```

```
shutdown
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
interface Vlan1
no ip address
shutdown
router ospf 6
network 192.168.0.24 0.0.0.7 area 6
router bgp 2
bgp log-neighbor-changes
no bgp default ipv4-unicast
neighbor 2003:DB8:ACAD::1 remote-as 2
neighbor 2004:DB8:ACAD::1 remote-as 2
neighbor 2005:DB8:ACAD::2 remote-as 3
neighbor 192.168.0.17 remote-as 2
neighbor 192.168.0.25 remote-as 2
neighbor 192.168.0.38 remote-as 3
address-family ipv4
  network 192.168.0.24 mask
255.255.255.248
  network 192.168.0.32 mask
255.255.255.248
  redistribute connected
  neighbor 192.168.0.17 activate
  neighbor 192.168.0.17 next-hop-self
  neighbor 192.168.0.25 activate
  neighbor 192.168.0.38 activate
exit-address-family
address-family ipv6
  redistribute connected
  network 2004:DB8:ACAD::/48
  network 2005:DB8:ACAD::/48
  neighbor 2003:DB8:ACAD::1 activate
  neighbor 2003:DB8:ACAD::1 next-hop-
self
  neighbor 2004:DB8:ACAD::1 activate
  neighbor 2005:DB8:ACAD::2 activate
exit-address-family
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface
GigabitEthernet0
ipv6 router ospf 6
router-id 5.5.5.5
control-plane
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

R5#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, p - overrides from PfR
Gateway of last resort is not set
      192.168.0.0/24 is variably subnetted, 8 subnets, 2 masks
B        192.168.0.0/29 [200/0] via 192.168.0.17, 00:16:37
B        192.168.0.8/29 [200/0] via 192.168.0.17, 00:16:37
O        192.168.0.16/29
           [110/2] via 192.168.0.25, 00:16:42, GigabitEthernet0/0/1
C        192.168.0.24/29 is directly connected, GigabitEthernet0/0/1
L        192.168.0.30/32 is directly connected, GigabitEthernet0/0/1
C        192.168.0.32/29 is directly connected, GigabitEthernet0/0/0
L        192.168.0.33/32 is directly connected, GigabitEthernet0/0/0
B        192.168.0.40/29 [20/0] via 192.168.0.38, 00:18:33
```

R5#Show ipv6 route

```
IPv6 Routing Table - default - 9 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
```

```
       B - BGP, R - RIP, 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
B   2001:DB8:ACAD::/48 [200/0]
     via 2003:DB8:ACAD::1
B   2002:DB8:ACAD::/48 [200/0]
     via 2003:DB8:ACAD::1
O   2003:DB8:ACAD::/48 [110/2]
     via FE80::CE8E:71FF:FE1E:22E1, GigabitEthernet0/0/1
C   2004:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2004:DB8:ACAD::2/128 [0/0]
     via GigabitEthernet0/0/1, receive
C   2005:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2005:DB8:ACAD::1/128 [0/0]
     via GigabitEthernet0/0/0, receive
B   2006:DB8:ACAD::/48 [20/0]
     via FE80::227:90FF:FED5:F800, GigabitEthernet0/0/0
L   FF00::/8 [0/0]
     via Null0, receive
```

R5#Show ip bgp

```
BGP table version is 17, local router ID is 192.168.0.33
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
     Network          Next Hop            Metric LocPrf Weight Path
*>i 192.168.0.0/29   192.168.0.17             0    100      0 1 i
*>i 192.168.0.8/29   192.168.0.17             0    100      0 i
r i 192.168.0.16/29  192.168.0.17             0    100      0 i
r>i                  192.168.0.25             0    100      0 i
* i 192.168.0.24/29  192.168.0.25             0    100      0 i
*>                   0.0.0.0                  0         32768 i
*   192.168.0.32/29  192.168.0.38             0             0 3 i
*>                   0.0.0.0                  0         32768 i
*>  192.168.0.40/29  192.168.0.38             0             0 3 i
```

R5#Show bgp ipv6

```
BGP table version is 25, local router ID is 192.168.0.33
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
     Network          Next Hop            Metric LocPrf Weight Path
*>i 2001:DB8:ACAD::/48
                      2003:DB8:ACAD::1
                                             0    100      0 1 ?
*>i 2002:DB8:ACAD::/48
```

```
                      2003:DB8:ACAD::1
                                             0    100      0 i
r i 2003:DB8:ACAD::/48
                      2003:DB8:ACAD::1
                                             0    100      0 i
r>i                 2004:DB8:ACAD::1
                                             0    100      0 i
* i 2004:DB8:ACAD::/48
                      2004:DB8:ACAD::1
                                             0    100      0 i
*>                  ::                      0         32768 i
     Network          Next Hop            Metric LocPrf Weight Path
*   2005:DB8:ACAD::/48
                      2005:DB8:ACAD::2
                                             0             0 3 i
*>                  ::                      0         32768 i
*>  2006:DB8:ACAD::/48
                      2005:DB8:ACAD::2
                                             0             0 3 ?
% NOTE: This command is deprecated. Please use 'show bgp ipv6 unicast'

R5#Show bgp ipv6 unicast neighbors
BGP neighbor is 2003:DB8:ACAD::1,  remote AS 2, internal link
  BGP version 4, remote router ID 2.2.2.2
  BGP state = Established, up for 00:17:45
  Last read 00:00:28, last write 00:00:24, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:               10          5
    Keepalives:            21         21
    Route Refresh:          0          0
    Total:                 32         27
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv6 Unicast
  Session: 2003:DB8:ACAD::1
  BGP table version 25, neighbor version 25/0
  Output queue size : 0
  Index 4, Advertise bit 2
  4 update-group member
```

```
  NEXT_HOP is always this router for eBGP paths
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                               Sent       Rcvd
  Prefix activity:             ----       ----
    Prefixes Current:             3          3 (Consumes 432 bytes)
    Prefixes Total:               6          6
    Implicit Withdraw:            3          3
    Explicit Withdraw:            1          0
    Used as bestpath:           n/a          2
    Used as multipath:          n/a          0
                                 Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Bestpath from this peer:              3        n/a
    Bestpath from iBGP peer:              1        n/a
    Total:                                4          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                     Sent       Rcvd
        Refresh activity:            ----       ----
          Refresh Start-of-RIB        0          0
          Refresh End-of-RIB          0          0
  Address tracking is enabled, the RIB does have a route to 2003:DB8:ACAD::1
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address NOT in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 2004:DB8:ACAD::2, Local port: 179
Foreign host: 2003:DB8:ACAD::1, Foreign port: 17485
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x253DCE):
Timer          Starts    Wakeups            Next
Retrans            27          4             0x0
TimeWait            0          0             0x0
AckHold            23         20             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
```

```
iss:  457202928  snduna:  457204102  sndnxt:  457204102
irs:  772238481  rcvnxt:  772239293
sndwnd:  15211  scale:      0  maxrcvwnd:  16384
rcvwnd:  15573  scale:      0  delrcvwnd:    811
SRTT: 947 ms, RTTO: 1362 ms, RTV: 415 ms, KRTT: 0 ms
minRTT: 0 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1065598 ms, Sent idletime: 24775 ms, Receive idletime: 24574 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
Rcvd: 53 (out of order: 0), with data: 24, total data bytes: 811
Sent: 52 (retransmit: 4, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 52, total data bytes: 3261
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FDCF8F82598  FREE
BGP neighbor is 2004:DB8:ACAD::1,  remote AS 2, internal link
  BGP version 4, remote router ID 192.168.0.25
  BGP state = Established, up for 00:17:50
  Last read 00:00:00, last write 00:00:19, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                8          3
    Keepalives:            20         22
    Route Refresh:          0          0
    Total:                 29         26
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv6 Unicast
  Session: 2004:DB8:ACAD::1
  BGP table version 25, neighbor version 25/0
  Output queue size : 0
  Index 2, Advertise bit 1
  2 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                               Sent       Rcvd
  Prefix activity:             ----       ----
    Prefixes Current:             3          2 (Consumes 288 bytes)
```

```
    Prefixes Total:                10          4
    Implicit Withdraw:              7          2
    Explicit Withdraw:              0          0
    Used as bestpath:             n/a          1
    Used as multipath:            n/a          0
                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Bestpath from this peer:              2        n/a
    Bestpath from iBGP peer:              6        n/a
    Total:                                8          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
          Refresh Start-of-RIB         0          0
          Refresh End-of-RIB           0          0
  Address tracking is enabled, the RIB does have a route to 2004:DB8:ACAD::1
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 2004:DB8:ACAD::2, Local port: 179
Foreign host: 2004:DB8:ACAD::1, Foreign port: 56926
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x253DCE):
Timer          Starts    Wakeups            Next
Retrans            24          0             0x0
TimeWait            0          0             0x0
AckHold            24         19        0x253DDD
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 1796505103  snduna: 1796506134  sndnxt: 1796506134
irs: 2215625831  rcvnxt: 2215626500
sndwnd:  15354  scale:      0  maxrcvwnd:  16384
rcvwnd:  15716  scale:      0  delrcvwnd:    668
SRTT: 959 ms, RTTO: 1279 ms, RTV: 320 ms, KRTT: 0 ms
minRTT: 0 ms, maxRTT: 1000 ms, ACK hold: 200 ms
```

```
uptime: 1070363 ms, Sent idletime: 19654 ms, Receive idletime: 185 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
Rcvd: 50 (out of order: 0), with data: 25, total data bytes: 668
Sent: 47 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 47, total data bytes: 2918
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FDCF8F82718  FREE
BGP neighbor is 2005:DB8:ACAD::2,  remote AS 3, external link
  BGP version 4, remote router ID 192.168.0.41
  BGP state = Established, up for 00:20:01
  Last read 00:00:42, last write 00:00:17, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:               10          5
    Keepalives:            20         23
    Route Refresh:          0          0
    Total:                 31         29
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds
For address family: IPv6 Unicast
  Session: 2005:DB8:ACAD::2
  BGP table version 25, neighbor version 25/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                Sent       Rcvd
  Prefix activity:              ----       ----
    Prefixes Current:              5          2 (Consumes 288 bytes)
    Prefixes Total:               12          4
    Implicit Withdraw:             7          2
    Explicit Withdraw:             0          0
    Used as bestpath:            n/a          1
    Used as multipath:           n/a          0
                                  Outbound    Inbound
```

```
  Local Policy Denied Prefixes:    --------    -------
    Bestpath from this peer:              4        n/a
    Total:                                4          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                     Sent       Rcvd
        Refresh activity:            ----       ----
          Refresh Start-of-RIB        0          0
          Refresh End-of-RIB          0          0
  Address tracking is enabled, the RIB does have a route to 2005:DB8:ACAD::2
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-
connected-check)
  Interface associated: GigabitEthernet0/0/0 (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1
Local host: 2005:DB8:ACAD::1, Local port: 42628
Foreign host: 2005:DB8:ACAD::2, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x259F7D):
Timer          Starts    Wakeups            Next
Retrans            27          0             0x0
TimeWait            0          0             0x0
AckHold            26         24             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          451        450        0x25A304
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 2534194875  snduna: 2534196149  sndnxt: 2534196149
irs: 1660568002  rcvnxt: 1660568886
sndwnd:  15111  scale:      0  maxrcvwnd:  16384
rcvwnd:  15501  scale:      0  delrcvwnd:    883
SRTT: 973 ms, RTTO: 1190 ms, RTV: 217 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1228186 ms, Sent idletime: 9697 ms, Receive idletime: 9898 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
```

```
Rcvd: 53 (out of order: 0), with data: 26, total data bytes: 883
Sent: 53 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 53, total data bytes: 3401
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FDCF8F82898  FREE
```

R5#show ip bgp neighbors

```
BGP neighbor is 192.168.0.17,  remote AS 2, internal link
  BGP version 4, remote router ID 2.2.2.2
  BGP state = Established, up for 00:18:23
  Last read 00:00:11, last write 00:00:36, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                6          3
    Keepalives:            21         22
    Route Refresh:          0          0
    Total:                 28         26
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.17
  BGP table version 17, neighbor version 17/0
  Output queue size : 0
  Index 4, Advertise bit 2
  4 update-group member
  NEXT_HOP is always this router for eBGP paths
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               3          3 (Consumes 360 bytes)
    Prefixes Total:                 3          3
    Implicit Withdraw:              0          0
    Explicit Withdraw:              1          0
    Used as bestpath:             n/a          2
    Used as multipath:            n/a          0
                                  Outbound    Inbound
  Local Policy Denied Prefixes:   --------    -------
    Bestpath from this peer:              3        n/a
```

```
    Bestpath from iBGP peer:                1        n/a
    Total:                                  4          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
          Refresh Start-of-RIB         0          0
          Refresh End-of-RIB           0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.17
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address NOT in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 192.168.0.30, Local port: 27325
Foreign host: 192.168.0.17, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x25DE7D):
Timer          Starts    Wakeups            Next
Retrans            24          0             0x0
TimeWait            0          0             0x0
AckHold            23         20             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          342        341        0x25E32E
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 1458500096  snduna: 1458500850  sndnxt: 1458500850
irs:  649033987  rcvnxt:  649034609
sndwnd:  15631  scale:      0  maxrcvwnd:  16384
rcvwnd:  15763  scale:      0  delrcvwnd:    621
SRTT: 959 ms, RTTO: 1279 ms, RTV: 320 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1111163 ms, Sent idletime: 18641 ms, Receive idletime: 18841 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 47 (out of order: 0), with data: 24, total data bytes: 621
Sent: 48 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 24, total data bytes: 753
```

```
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FDCF8F82658  FREE
BGP neighbor is 192.168.0.25,  remote AS 2, internal link
  BGP version 4, remote router ID 192.168.0.25
  BGP state = Established, up for 00:18:35
  Last read 00:00:15, last write 00:00:16, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                3          2
    Keepalives:            22         22
    Route Refresh:          0          0
    Total:                 26         25
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.25
  BGP table version 17, neighbor version 17/0
  Output queue size : 0
  Index 2, Advertise bit 1
  2 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               3          2 (Consumes 240 bytes)
    Prefixes Total:                 3          2
    Implicit Withdraw:              0          0
    Explicit Withdraw:              0          0
    Used as bestpath:             n/a          1
    Used as multipath:            n/a          0
                                  Outbound    Inbound
  Local Policy Denied Prefixes:   --------    -------
    Bestpath from this peer:              2        n/a
    Bestpath from iBGP peer:              7        n/a
    Total:                                9          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
```

```
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
          Refresh Start-of-RIB         0          0
          Refresh End-of-RIB           0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.25
  Connections established 1; dropped 0
  Last reset never
  Interface associated: (none) (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 192.168.0.30, Local port: 179
Foreign host: 192.168.0.25, Foreign port: 46223
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x26007E):
Timer          Starts    Wakeups            Next
Retrans            23          0             0x0
TimeWait            0          0             0x0
AckHold            23         20             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 1544090523  snduna: 1544091145  sndnxt: 1544091145
irs:  365905743  rcvnxt:  365906303
sndwnd:  15763  scale:      0  maxrcvwnd:  16384
rcvwnd:  15825  scale:      0  delrcvwnd:    559
SRTT: 954 ms, RTTO: 1319 ms, RTV: 365 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1122977 ms, Sent idletime: 22894 ms, Receive idletime: 23094 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 46 (out of order: 0), with data: 24, total data bytes: 559
Sent: 47 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 24, total data bytes: 621
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FDCF8F82A18  FREE
BGP neighbor is 192.168.0.38,  remote AS 3, external link
  BGP version 4, remote router ID 192.168.0.41
  BGP state = Established, up for 00:21:02
```

```
  Last read 00:00:01, last write 00:00:47, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                8          2
    Keepalives:            21         24
    Route Refresh:          0          0
    Total:                 30         27
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.38
  BGP table version 17, neighbor version 17/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               5          2 (Consumes 240 bytes)
    Prefixes Total:                 7          2
    Implicit Withdraw:              1          0
    Explicit Withdraw:              1          0
    Used as bestpath:             n/a          1
    Used as multipath:            n/a          0
                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Bestpath from this peer:              1        n/a
    Total:                                1          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                      Sent       Rcvd
        Refresh activity:             ----       ----
          Refresh Start-of-RIB         0          0
```

```
         Refresh End-of-RIB            0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.38
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-
connected-check)
  Interface associated: GigabitEthernet0/0/0 (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1
Local host: 192.168.0.33, Local port: 179
Foreign host: 192.168.0.38, Foreign port: 62288
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x26220E):
Timer          Starts    Wakeups            Next
Retrans            27          0             0x0
TimeWait            0          0             0x0
AckHold            26         25             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 1976851740  snduna: 1976852566  sndnxt: 1976852566
irs: 4055196160  rcvnxt: 4055196757
sndwnd:  15540  scale:      0  maxrcvwnd:  16384
rcvwnd:  15788  scale:      0  delrcvwnd:    596
SRTT: 976 ms, RTTO: 1166 ms, RTV: 190 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1268703 ms, Sent idletime: 461 ms, Receive idletime: 260 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 55 (out of order: 0), with data: 26, total data bytes: 596
Sent: 55 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 28, total data bytes: 844
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FDCF8F827D8  FREE

R5#show ip bgp summary
BGP router identifier 192.168.0.33, local AS number 2
BGP table version is 17, main routing table version 17
6 network entries using 1488 bytes of memory
9 path entries using 1080 bytes of memory
4/4 BGP path/bestpath attribute entries using 992 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
```

```
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 3608 total bytes of memory
BGP activity 13/1 prefixes, 24/6 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
192.168.0.17    4            2      26      29       17    0    0
00:18:55        3
192.168.0.25    4            2      25      26       17    0    0
00:18:58        2
192.168.0.38    4            3      27      31       17    0    0
00:21:16        2
```

R5#show bgp ipv6 unicast summary

```
BGP router identifier 192.168.0.33, local AS number 2
BGP table version is 25, main routing table version 25
6 network entries using 1632 bytes of memory
9 path entries using 1296 bytes of memory
5/4 BGP path/bestpath attribute entries using 1240 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 4216 total bytes of memory
BGP activity 13/1 prefixes, 24/6 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
2003:DB8:ACAD::1
                4            2      28      33       25    0    0
00:18:59        3
2004:DB8:ACAD::1
                4            2      27      30       25    0    0
00:19:04        2
2005:DB8:ACAD::2
                4            3      30      32       25    0    0
00:21:15        2
```

R5#show ip ospf neighbor

```
Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.0.25      1   FULL/BDR        00:00:36    192.168.0.25    GigabitEthernet
0/0/1
```

R5#show ip ospf

```
Routing Process "ospf 6" with ID 192.168.0.33
Start time: 00:19:44.429, Time elapsed: 00:22:20.754
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Supports area transit capability
Supports NSSA (compatible with RFC 3101)
Supports Database Exchange Summary List Optimization (RFC 5243)
Event-log enabled, Maximum number of events: 1000, Mode: cyclic
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPFs 10000 msecs
```

```
Maximum wait time between two consecutive SPFs 10000 msecs
Incremental-SPF disabled
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Number of areas transit capable is 0
External flood list length 0
IETF NSF helper support enabled
Cisco NSF helper support enabled
Reference bandwidth unit is 100 mbps
    Area 6
        Number of interfaces in this area is 1
        Area has no authentication
        SPF algorithm last executed 00:18:22.908 ago
        SPF algorithm executed 8 times
        Area ranges are
        Number of LSA 5. Checksum Sum 0x025664
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R5#show ip ospf
Routing Process "ospf 6" with ID 192.168.0.33
Start time: 00:19:44.429, Time elapsed: 00:22:41.266
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Supports area transit capability
Supports NSSA (compatible with RFC 3101)
Supports Database Exchange Summary List Optimization (RFC 5243)
Event-log enabled, Maximum number of events: 1000, Mode: cyclic
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPFs 10000 msecs
Maximum wait time between two consecutive SPFs 10000 msecs
Incremental-SPF disabled
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
```

```
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Number of areas transit capable is 0
External flood list length 0
IETF NSF helper support enabled
Cisco NSF helper support enabled
Reference bandwidth unit is 100 mbps
    Area 6
        Number of interfaces in this area is 1
        Area has no authentication
        SPF algorithm last executed 00:18:43.420 ago
        SPF algorithm executed 8 times
        Area ranges are
        Number of LSA 5. Checksum Sum 0x025664
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R5#show ip ospf interface
GigabitEthernet0/0/1 is up, line protocol is up
  Internet Address 192.168.0.30/29, Area 6, Attached via Network Statement
  Process ID 6, Router ID 192.168.0.33, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0           1         no          no            Base
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.0.33, Interface address 192.168.0.30
  Backup Designated router (ID) 192.168.0.25, Interface address 192.168.0.25
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:03
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 2
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 192.168.0.25  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)

R5#show ip ospf border-routers
            OSPF Router with ID (192.168.0.33) (Process ID 6)
                Base Topology (MTID 0)
Internal Router Routing Table
Codes: i - Intra-area route, I - Inter-area route

R5#show ipv6 ospf neighbor
            OSPFv3 Router with ID (5.5.5.5) (Process ID 6)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
```

```
4.4.4.4           1   FULL/BDR        00:00:38    7               GigabitEthernet
0/0/1

R5#show ipv6 ospf interface
GigabitEthernet0/0/1 is up, line protocol is up
  Link Local Address FE80::B6A8:B9FF:FE47:9351, Interface ID 7
  Area 6, Process ID 6, Instance ID 0, Router ID 5.5.5.5
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 5.5.5.5, local address FE80::B6A8:B9FF:FE47:9351
  Backup Designated router (ID) 4.4.4.4, local address FE80::CE8E:71FF:FE1E:22E1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:01
  Graceful restart helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 2, maximum is 4
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 4.4.4.4  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)

R5#show ipv6 ospf border-routers
            OSPFv3 Router with ID (5.5.5.5) (Process ID 6)
Codes: i - Intra-area route, I - Inter-area route
```

Router 6:

```
R6#show run
Current configuration : 2103 bytes
Last configuration change at 20:08:44
UTC Tue Jan 4 2022
version 15.5
service timestamps debug datetime
msec
service timestamps log datetime msec
no platform punt-keepalive disable-
kernel-core
hostname R6
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
ipv6 unicast-routing
subscriber templating
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO21441
4DZ
spanning-tree extend system-id
redundancy
mode none
vlan internal allocation policy
ascending
interface GigabitEthernet0/0/0
ip address 192.168.0.38
255.255.255.248
negotiation auto
ipv6 address 2005:DB8:ACAD::2/48
interface GigabitEthernet0/0/1
ip address 192.168.0.41
255.255.255.248
negotiation auto
ipv6 address 2006:DB8:ACAD::1/48
ipv6 eigrp 3
interface Serial0/1/0
no ip address
shutdown
interface Serial0/1/1
no ip address
shutdown
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
interface Vlan1
```

```
no ip address
shutdown
router eigrp 3
network 192.168.0.40 0.0.0.7
redistribute bgp 3 metric 1000000 1 1
255 100
router bgp 3
bgp log-neighbor-changes
no bgp default ipv4-unicast
neighbor 2005:DB8:ACAD::1 remote-as 2
neighbor 192.168.0.33 remote-as 2
address-family ipv4
  network 192.168.0.32 mask
255.255.255.248
  network 192.168.0.40 mask
255.255.255.248
  redistribute connected
  redistribute eigrp 3
  neighbor 192.168.0.33 activate
exit-address-family
address-family ipv6
  redistribute connected
  redistribute eigrp 3
  network 2005:DB8:ACAD::/48
  neighbor 2005:DB8:ACAD::1 activate
exit-address-family
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface
GigabitEthernet0
ipv6 router eigrp 3
eigrp router-id 6.6.6.6
redistribute bgp 3 metric 1000000 1 1
255 100
control-plane
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

R6#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, p - overrides from PfR
Gateway of last resort is not set
      192.168.0.0/24 is variably subnetted, 8 subnets, 2 masks
B        192.168.0.0/29 [20/0] via 192.168.0.33, 00:11:42
B        192.168.0.8/29 [20/0] via 192.168.0.33, 00:11:42
B        192.168.0.16/29 [20/0] via 192.168.0.33, 00:12:12
B        192.168.0.24/29 [20/0] via 192.168.0.33, 00:12:12
C        192.168.0.32/29 is directly connected, GigabitEthernet0/0/0
L        192.168.0.38/32 is directly connected, GigabitEthernet0/0/0
C        192.168.0.40/29 is directly connected, GigabitEthernet0/0/1
L        192.168.0.41/32 is directly connected, GigabitEthernet0/0/1
```

R6#show ipv6 route

```
IPv6 Routing Table - default - 9 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, 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
B   2001:DB8:ACAD::/48 [20/0]
     via FE80::B6A8:B9FF:FE47:9350, GigabitEthernet0/0/0
```

```
B   2002:DB8:ACAD::/48 [20/0]
     via FE80::B6A8:B9FF:FE47:9350, GigabitEthernet0/0/0
B   2003:DB8:ACAD::/48 [20/0]
     via FE80::B6A8:B9FF:FE47:9350, GigabitEthernet0/0/0
B   2004:DB8:ACAD::/48 [20/0]
     via FE80::B6A8:B9FF:FE47:9350, GigabitEthernet0/0/0
C   2005:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2005:DB8:ACAD::2/128 [0/0]
     via GigabitEthernet0/0/0, receive
C   2006:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2006:DB8:ACAD::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
L   FF00::/8 [0/0]
     via Null0, receive

R6#show eigrp protocols
EIGRP-IPv4 Protocol for AS(3)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  Soft SIA disabled
  NSF-aware route hold timer is 240
  EIGRP NSF disabled
     NSF signal timer is 20s
     NSF converge timer is 120s
  Router-ID: 192.168.0.41
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 4
    Maximum hopcount 100
    Maximum metric variance 1
EIGRP-IPv6 Protocol for AS(3)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  Soft SIA disabled
  NSF-aware route hold timer is 240
  EIGRP NSF disabled
     NSF signal timer is 20s
     NSF converge timer is 120s
  Router-ID: 6.6.6.6
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1

R6#show ip eigrp interfaces
EIGRP-IPv4 Interfaces for AS(3)
                              Xmit Queue   PeerQ        Mean   Pacing
Time   Multicast    Pending
Interface              Peers  Un/Reliable  Un/Reliable  SRTT   Un/Reliable   Flow
Timer   Routes
```

```
Gi0/0/1                   1        0/0       0/0           1       0/0           5
0           0

R6#show ip eigrp neighbors
EIGRP-IPv4 Neighbors for AS(3)
H   Address                 Interface              Hold
Uptime   SRTT   RTO  Q  Seq
                                                   (sec)          (ms)       Cnt N
um
0   192.168.0.46            Gi0/0/1                  14
00:15:09    1   100  0  7

R6#show ipv6 eigrp interfaces
EIGRP-IPv6 Interfaces for AS(3)
                              Xmit Queue   PeerQ        Mean   Pacing
Time   Multicast    Pending
Interface              Peers  Un/Reliable  Un/Reliable  SRTT   Un/Reliable   Flow
Timer   Routes
Gi0/0/1                   1        0/0       0/0           1       0/0           5
0           0

R6#show ipv6 eigrp neighbors
EIGRP-IPv6 Neighbors for AS(3)
H   Address                 Interface              Hold
Uptime   SRTT   RTO  Q  Seq
                                                   (sec)          (ms)       Cnt N
um
0   Link-local address:     Gi0/0/1                  13
00:15:21    1   100  0  5
    FE80::B6A8:B9FF:FE01:BC61

R6#Show ip bgp
BGP table version is 9, local router ID is 192.168.0.41
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
     Network          Next Hop            Metric LocPrf Weight Path
*>  192.168.0.0/29   192.168.0.33                           0 2 1 i
*>  192.168.0.8/29   192.168.0.33                           0 2 i
*>  192.168.0.16/29  192.168.0.33                           0 2 i
*>  192.168.0.24/29  192.168.0.33             0             0 2 i
*   192.168.0.32/29  192.168.0.33             0             0 2 i
*>                   0.0.0.0                  0         32768 i
*>  192.168.0.40/29  0.0.0.0                  0         32768 i

R6#Show bgp ipv6
BGP table version is 10, local router ID is 192.168.0.41
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
```

```
     Network          Next Hop            Metric LocPrf Weight Path
*>  2001:DB8:ACAD::/48
                      2005:DB8:ACAD::1
                                                             0 2 1 ?
*>  2002:DB8:ACAD::/48
                      2005:DB8:ACAD::1
                                                             0 2 i
*>  2003:DB8:ACAD::/48
                      2005:DB8:ACAD::1
                                                             0 2 i
*>  2004:DB8:ACAD::/48
                      2005:DB8:ACAD::1
                                           0                 0 2 i
*   2005:DB8:ACAD::/48
                      2005:DB8:ACAD::1
                                           0                 0 2 i
     Network          Next Hop            Metric LocPrf Weight Path
*>                    ::                      0         32768 i
*>  2006:DB8:ACAD::/48
                      ::                      0         32768 ?
% NOTE: This command is deprecated. Please use 'show bgp ipv6 unicast'

R6#Show bgp ipv6 unicast neighbors
BGP neighbor is 2005:DB8:ACAD::1,  remote AS 2, external link
  BGP version 4, remote router ID 192.168.0.33
  BGP state = Established, up for 00:16:03
  Last read 00:00:03, last write 00:00:22, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv6 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                5         10
    Keepalives:            18         16
    Route Refresh:          0          0
    Total:                 24         27
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds
For address family: IPv6 Unicast
  Session: 2005:DB8:ACAD::1
  BGP table version 10, neighbor version 10/0
  Output queue size : 0
  Index 1, Advertise bit 0
```

```
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                               Sent       Rcvd
  Prefix activity:             ----       ----
    Prefixes Current:             2          5 (Consumes 720 bytes)
    Prefixes Total:               4         12
    Implicit Withdraw:            2          7
    Explicit Withdraw:            0          0
    Used as bestpath:           n/a          4
    Used as multipath:          n/a          0
                                 Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Bestpath from this peer:              4        n/a
    Total:                                4          0
  Number of NLRIs in the update sent: max 1, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                     Sent       Rcvd
        Refresh activity:            ----       ----
          Refresh Start-of-RIB        0          0
          Refresh End-of-RIB          0          0
  Address tracking is enabled, the RIB does have a route to 2005:DB8:ACAD::1
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-
connected-check)
  Interface associated: GigabitEthernet0/0/0 (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1
Local host: 2005:DB8:ACAD::2, Local port: 179
Foreign host: 2005:DB8:ACAD::1, Foreign port: 42628
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x219D0F):
Timer          Starts    Wakeups            Next
Retrans            21          0             0x0
TimeWait            0          0             0x0
AckHold            22         21             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0
```

```
ProcessQ            0          0             0x0
iss: 1660568002  snduna: 1660568791  sndnxt: 1660568791
irs: 2534194875  rcvnxt: 2534196073
sndwnd:  15596  scale:      0  maxrcvwnd:  16384
rcvwnd:  15187  scale:      0  delrcvwnd:   1197
SRTT: 939 ms, RTTO: 1411 ms, RTV: 472 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 963463 ms, Sent idletime: 3722 ms, Receive idletime: 3922 ms
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1440 bytes):
Rcvd: 44 (out of order: 0), with data: 22, total data bytes: 1197
Sent: 44 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 44, total data bytes: 2556
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F8D84135568  FREE

R6#show ip bgp neighbors
BGP neighbor is 192.168.0.33,  remote AS 2, external link
  BGP version 4, remote router ID 192.168.0.33
  BGP state = Established, up for 00:16:31
  Last read 00:00:44, last write 00:00:08, hold time is 180, keepalive interval
is 60 seconds
  Neighbor sessions:
    1 active, is not multisession capable (disabled)
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Four-octets ASN Capability: advertised and received
    Address family IPv4 Unicast: advertised and received
    Enhanced Refresh Capability: advertised and received
    Multisession Capability:
    Stateful switchover support enabled: NO for session 1
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                2          8
    Keepalives:            19         16
    Route Refresh:          0          0
    Total:                 22         25
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds
For address family: IPv4 Unicast
  Session: 192.168.0.33
  BGP table version 9, neighbor version 9/0
  Output queue size : 0
  Index 1, Advertise bit 0
  1 update-group member
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
```

```
                                Sent       Rcvd
  Prefix activity:              ----       ----
    Prefixes Current:              2          5 (Consumes 600 bytes)
    Prefixes Total:                2          7
    Implicit Withdraw:             0          1
    Explicit Withdraw:             0          1
    Used as bestpath:            n/a          4
    Used as multipath:           n/a          0
                                  Outbound    Inbound
  Local Policy Denied Prefixes:   --------    -------
    Bestpath from this peer:             5        n/a
    Total:                               5          0
  Number of NLRIs in the update sent: max 2, min 0
  Last detected as dynamic slow peer: never
  Dynamic slow peer recovered: never
  Refresh Epoch: 1
  Last Sent Refresh Start-of-rib: never
  Last Sent Refresh End-of-rib: never
  Last Received Refresh Start-of-rib: never
  Last Received Refresh End-of-rib: never
                                     Sent       Rcvd
        Refresh activity:            ----       ----
          Refresh Start-of-RIB        0          0
          Refresh End-of-RIB          0          0
  Address tracking is enabled, the RIB does have a route to 192.168.0.33
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-
connected-check)
  Interface associated: GigabitEthernet0/0/0 (peering address in same link)
  Transport(tcp) path-mtu-discovery is enabled
  Graceful-Restart is disabled
  SSO is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1
Local host: 192.168.0.38, Local port: 62288
Foreign host: 192.168.0.33, Foreign port: 179
Connection tableid (VRF): 0
Maximum output segment queue size: 50
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x21EE3F):
Timer          Starts    Wakeups            Next
Retrans            23          1             0x0
TimeWait            0          0             0x0
AckHold            22         20             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger          236        235         0x21F20D
DeadWait            0          0             0x0
Linger              0          0             0x0
ProcessQ            0          0             0x0
iss: 4055196160  snduna: 4055196662  sndnxt: 4055196662
irs: 1976851740  rcvnxt: 1976852471
```

```
sndwnd:  15883  scale:      0  maxrcvwnd:  16384
rcvwnd:  15654  scale:      0  delrcvwnd:    730
SRTT: 939 ms, RTTO: 1411 ms, RTV: 472 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 993857 ms, Sent idletime: 8683 ms, Receive idletime: 8481 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 44 (out of order: 0), with data: 22, total data bytes: 730
Sent: 44 (retransmit: 1, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 21, total data bytes: 501
Packets received in fast path: 0, fast processed: 0, slow path: 0
fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F8D84135628  FREE

R6#show ip bgp summary
BGP router identifier 192.168.0.41, local AS number 3
BGP table version is 9, main routing table version 9
6 network entries using 1488 bytes of memory
7 path entries using 840 bytes of memory
4/4 BGP path/bestpath attribute entries using 992 bytes of memory
2 BGP AS-PATH entries using 64 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 3384 total bytes of memory
BGP activity 12/0 prefixes, 17/3 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
192.168.0.33    4            2      26      22        9    0    0
00:16:49        5

R6#show bgp ipv6 unicast summary
BGP router identifier 192.168.0.41, local AS number 3
BGP table version is 10, main routing table version 10
6 network entries using 1632 bytes of memory
7 path entries using 1008 bytes of memory
5/5 BGP path/bestpath attribute entries using 1240 bytes of memory
2 BGP AS-PATH entries using 64 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 3944 total bytes of memory
BGP activity 12/0 prefixes, 17/3 paths, scan interval 60 secs
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/
PfxRcd
2005:DB8:ACAD::1
                4            2      27      25       10    0    0
00:16:48        5
```

Router 7:

```
R7#show run                                 Last configuration change at 20:13:37
Building configuration...                   UTC Tue Jan 4 2022
Current configuration : 1442 bytes          version 15.5
```

```
service timestamps debug datetime
msec
service timestamps log datetime msec
no platform punt-keepalive disable-
kernel-core
hostname R7
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
ipv6 unicast-routing
subscriber templating
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO21441
7Q4
spanning-tree extend system-id
redundancy
mode none
vlan internal allocation policy
ascending
interface GigabitEthernet0/0/0
no ip address
shutdown
negotiation auto
interface GigabitEthernet0/0/1
ip address 192.168.0.46
255.255.255.248
negotiation auto
ipv6 address 2006:DB8:ACAD::2/48
ipv6 eigrp 3
interface Serial0/1/0
no ip address
shutdown
interface Serial0/1/1
no ip address
shutdown
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
interface Vlan1
no ip address
shutdown
router eigrp 3
network 192.168.0.40 0.0.0.7
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface
GigabitEthernet0
ipv6 router eigrp 3
eigrp router-id 7.7.7.7
control-plane
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

R7#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, p - overrides from PfR
Gateway of last resort is not set
      192.168.0.0/24 is variably subnetted, 7 subnets, 2 masks
D EX     192.168.0.0/29
           [170/3072] via 192.168.0.41, 00:07:37, GigabitEthernet0/0/1
D EX     192.168.0.8/29
           [170/3072] via 192.168.0.41, 00:07:37, GigabitEthernet0/0/1
D EX     192.168.0.16/29
           [170/3072] via 192.168.0.41, 00:08:08, GigabitEthernet0/0/1
D EX     192.168.0.24/29
           [170/3072] via 192.168.0.41, 00:08:08, GigabitEthernet0/0/1
```

```
D EX     192.168.0.32/29
           [170/3072] via 192.168.0.41, 00:10:25, GigabitEthernet0/0/1
C        192.168.0.40/29 is directly connected, GigabitEthernet0/0/1
L        192.168.0.46/32 is directly connected, GigabitEthernet0/0/1

R7#show ipv6 route
IPv6 Routing Table - default - 7 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, 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  2001:DB8:ACAD::/48 [170/3072]
     via FE80::227:90FF:FED5:F801, GigabitEthernet0/0/1
EX  2002:DB8:ACAD::/48 [170/3072]
     via FE80::227:90FF:FED5:F801, GigabitEthernet0/0/1
EX  2003:DB8:ACAD::/48 [170/3072]
     via FE80::227:90FF:FED5:F801, GigabitEthernet0/0/1
EX  2004:DB8:ACAD::/48 [170/3072]
     via FE80::227:90FF:FED5:F801, GigabitEthernet0/0/1
C   2006:DB8:ACAD::/48 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2006:DB8:ACAD::2/128 [0/0]
     via GigabitEthernet0/0/1, receive
L   FF00::/8 [0/0]
     via Null0, receive

R7#show eigrp protocols
EIGRP-IPv4 Protocol for AS(3)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  Soft SIA disabled
  NSF-aware route hold timer is 240
  EIGRP NSF disabled
     NSF signal timer is 20s
     NSF converge timer is 120s
  Router-ID: 192.168.0.46
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 4
    Maximum hopcount 100
    Maximum metric variance 1
EIGRP-IPv6 Protocol for AS(3)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  Soft SIA disabled
  NSF-aware route hold timer is 240
  EIGRP NSF disabled
     NSF signal timer is 20s
     NSF converge timer is 120s
  Router-ID: 7.7.7.7
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
```

```
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1

R7#show ip eigrp interfaces
EIGRP-IPv4 Interfaces for AS(3)
                              Xmit Queue   PeerQ        Mean   Pacing
Time   Multicast    Pending
Interface              Peers  Un/Reliable  Un/Reliable  SRTT   Un/Reliable   Flow
Timer   Routes
Gi0/0/1                  1        0/0       0/0           1       0/0           5
0           0

R7#show ip eigrp neighbors
EIGRP-IPv4 Neighbors for AS(3)
H   Address                 Interface              Hold
Uptime   SRTT   RTO  Q  Seq
                                                   (sec)          (ms)       Cnt N
um
0   192.168.0.41            Gi0/0/1                  10
00:11:00    1   100  0  6

R7#show ipv6 eigrp interfaces
EIGRP-IPv6 Interfaces for AS(3)
                              Xmit Queue   PeerQ        Mean   Pacing
Time   Multicast    Pending
Interface              Peers  Un/Reliable  Un/Reliable  SRTT   Un/Reliable   Flow
Timer   Routes
Gi0/0/1                  1        0/0       0/0           1       0/0           5
0           0

R7#show ipv6 eigrp neighbors
EIGRP-IPv6 Neighbors for AS(3)
H   Address                 Interface              Hold
Uptime   SRTT   RTO  Q  Seq
                                                   (sec)          (ms)       Cnt N
um
0   Link-local address:     Gi0/0/1                  13
00:11:12    1   100  0  6
    FE80::227:90FF:FED5:F801
```

Pings:

Router 1 to Router 7:

```
R1#ping 192.168.0.46
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.46, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R1#ping 2006:db8:acad::2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2006:DB8:ACAD::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Router 7 to Router 1:

```
R7#ping 192.168.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
R7#ping 2001:db8:acad::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Problems

Two problems we encountered this lab were not being able to identify a command that we were missing and initially having an incorrect addressing scheme.

When we setup our config initially, we accidently miscalculated one address, which in turn snowballed into our entire addressing scheme being incorrect. We were able to remedy this problem by thoroughly reviewing our config before applying it to the routers in the lab. We would have also tested our config in packet tracer, but since it cannot properly handle BGP, we analyzed our config file instead.

Our next issue was improper setup of the iBGP. Through debugging, we found that all interfaces on the networks functioned as intended, except the OSPF network and EIGRP networks were not connected. Autonomous zone 1 and 3 were not connected. By researching online and asking other students in the lab room, we found that the command *neighbor [IP address] next-hop-self* was necessary and missing from our config. This command is necessary since it allows the BGP routes to be advertised.

Conclusions

We began our lab by thoroughly review the necessary lab concepts which allowed us to efficiently setup iBGP. Since we could not use packet tracer to test our config, we thoroughly reviewed it before applying it to the routers. We were able to find errors and remedy them. After we applied our configuration to the routers, we tested to see if our network functioned correctly. Since it did not, we debugged the network and found commands that were missing. We included these commands in our configuration, and the network functioned properly. We tested our network by pinging interfaces. We ensured traffic was going through the iBGP kink by assessing the administrative distance through which the routes were learned.

Instructor Signoff