CCNP ROUTING AND SWITCHING

CISCO™

Configuring iBGP Routing

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Purpose:

      The purpose of this lab is to configure IBGP on an internal network for IPv4 and IPv6, allowing EBGP configurations for two border networks to be preserved through IBGP.IGBP will run overtop of EIGRP, and EBGP will be used to redistribute routes from OSPF border networks into the internal EIGRP network. Students will learn how to configure IBGP and run two routing protocols simultaneously.

Background:

      While IGBP is not as widely used as EBGP, it still serves an important purpose in many networks on the internet. IBGP is an interior routing protocol, but not in the traditional sense. Unlike OSPF or EIGRP, IBGP does not use its own routes, instead they provide a way to route EBGP route advertisements overtop of traditional IGP protocols like OSPF. IBGP neighbors or peers do not have to be directly connected, although they do have to be configured through neighbor peer relationships. The commands neighbor and neighbor activate creates this full mesh. IBGP also supports multi-hop connections so as long as there is a path to the router and they are within the same AS they can be IBGP neighbors. IBGP helps provide more information to internal routers and retains the BGP routes through IBGP instead of redistributing them through a routing protocol like EIGRP. If you don't use synchronization, route recursion is a way to share route lookups. Using the destination network can help determine where the packet gets sent instead of the AS-path.

Lab Summary:

      When configuring this IBGP lab, I set up seven 4321 Cisco Routers connected with copper crossover cables between their Gig 0/0/0 and 0/0/1 interfaces. Routers used the IPv4 network of 10.0.0.0 with a /30 subnet from 10.0.0-10.0.0.22. They also used the IPv6 network of 2001:db8:acad::/64. Loopback addresses are used in the place of LANs. Loopbacks have the IPv4 addresses in the 192.168.0.0/16 network and are subnetted into /30s. They use IPv6 addresses in the 2001:db8:acad:0::1/64 network. I also configured OSPFv2 and OSPFv3 router 1,2,6,7, EIGRP for router 3,4,5, EBGP for 2,3,5,6 and IBGP for 3,4,5. I set loopback interfaces as passive interfaces and pinged all addresses in the network to ensure routes and IBGP was working. To check that IBGP is working, consult page 25, 31, 45, and 47, the appropriate areas should be highlighted in red.

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Lab Commands:

Router(config-router)#neighbor # update-source #
Definition: This command specifies that the router should use IBGP peers as the source address.
Router#show ip bgp summary
Definition: Displays the BGP path, prefix, and attribute information for all connections to BGP Neighbors.
Router#show bgp ipv6 unicast summary
Definition:
Router#show ip bgp neighbors
Definition: This command displays information about IPv4 BGP and TCP connections to neighbors. For BGP, this
includes detailed neighbor attribute, capability, path, and prefix information. For TCP, this includes
statistics related to BGP neighbor session establishment and maintenance.
Router#show bgp ipv6 neighbors
Definition: This command displays information about IPv6 BGP and TCP connections to neighbors. For BGP, this
includes detailed neighbor attribute, capability, path, and prefix information. For TCP, this includes
statistics related to BGP neighbor session establishment and maintenance.
Router#show ip bgp
Definition: This command displays the contents of the IPv4 BGP routing table, including prefixes, entries and
other BGP entries.
Router#show bgp ipv6
Definition: This command displays the contents of the IPv6 BGP routing table, including prefixes, entries and
other BGP entries.
```
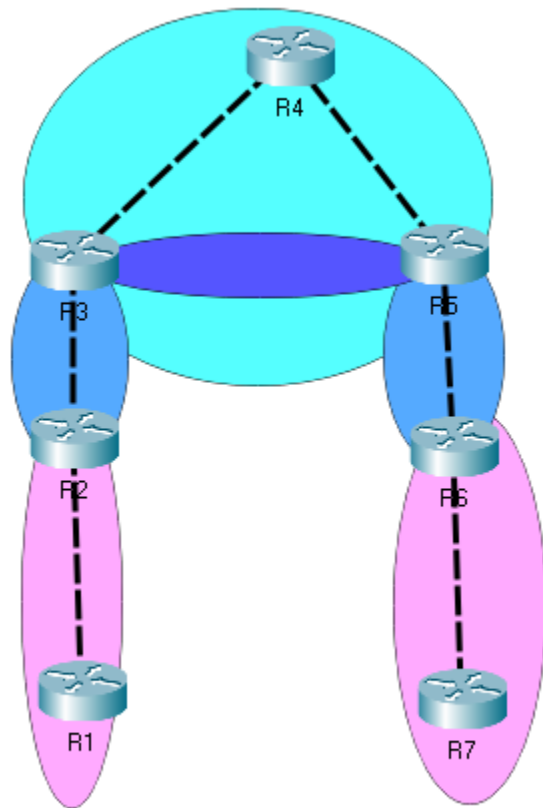
Topology Diagram:

Blue: EBGP
Pink: OSPF
Dark Blue: IBGP
Light Blue: EIGRP

Addressing Table:

Device	Interface	IP Address	IPv6 Address	Link-Local Addresses
R1	G 0/0/1	10.0.0.1/30	2001:db8:acad:1::1/64	fe80::1
	Loopback 0	192.168.0.1/24	2001:db8:acad:a::1/64	fe80::1
R2	G 0/0/0	10.0.0.2/30	2001:db8:acad:1::2/64	fe80::2
	G 0/0/1	10.0.0.5/30	2001:db8:acad:2::1/64	fe80::2
	Loopback 0	192.168.1.1/24	2001:db8:acad:b::1/64	fe80::2
R3	G 0/0/0	10.0.0.6/30	2001:db8:acad:2::2/64	fe80::3
	G 0/0/1	10.0.0.9/30	2001:db8:acad:3::1/64	fe80::3
	Loopback 0	192.168.2.1/24	2001:db8:acad:c::1/64	fe80::3
R4	G 0/0/0	10.0.0.10/30	2001:db8:acad:3::2/64	fe80::4
	G 0/0/1	10.0.0.13/30	2001:db8:acad:4::1/64	fe80::4
	Loopback 0	192.168.3.1/24	2001:db8:acad:d::1/64	fe80::4
R5	G 0/0/0	10.0.0.14/30	2001:db8:acad:4::2/64	fe80::5

	G 0/0/1	10.0.0.17/30	2001:db8:acad:5::1/64	fe80::5
	Loopback 0	192.168.4.1/32	2001:db8:acad:e::1/64	fe80::5
R6	G 0/0/0	10.0.0.18/30	2001:db8:acad:5::2/64	fe80::6
	G 0/0/1	10.0.0.21/30	2001:db8:acad:6::1/64	fe80::6
	Loopback 0	192.168.5.1/32	2001:db8:acad:f::1/64	fe80::6
R7	G 0/0/0	10.0.0.22/30	2001:db8:acad:6::2/64	fe80::7
	Loopback 0	192.168.6.1/32	2001:db8:acad:aa::1/64	fe80::7

Problems and Troubleshooting:

The OSPF and EIGRP routing was configured without any problems. The main issues I had was configuring BGP and the redistribution between BGP and the IGPs. First, iBGP routes were not being put into the routing table. Second, iBGP was not redistributing EIGRP or OSPF routes across the link. Third, iBGP was not redistributing directly connected routes of the routers running BGP. iBGP Routes not visible:
After configuring the IP addressing schemes and enabling OSPF and EIGRP instances, I configured BGP on R2, R3 and R5, R6 using the router bgp asn command and assigned a router-id. I also specified the BGP peers and their remote-as and redistributed either ospf or eigrp in the address-families depending on which router I was on. When I entered the show ip route, I did not see any BGP routes. After researching online, I realized I had to use the update the source loopback in order to start IBGP, and to get it to share BGP routes. After configuring this, I was able to see BGP routes in the autonomous system I was in and the directly connected routes of the BGP router. When I started pinging, I discovered one final issue. The Loopback interface on R3 was not reachable nor was it in the routing table. When I checked the interface, I realized that I had accidentally entered in the wrong subnet for the interface so after I changed it all routers and networks. were reachable.

Conclusion:
While not as widely used, IBGP is still a critical part of major network infrastructures, allowing for configurations in BGP to be preserved while moving over parts of the network without BGP. Routing protocols are designed to solve certain problems. The problem of managing and exchanging huge volume of routes within and between autonomous systems is solved by BGP. The use of BGP as the main routing protocol for the Internet shows its scalability, performance and reliability. iBGP and eBGP can allow for both efficient routing and redistribution of IGPs.

```
Pings:

R7#ping 10.0.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.5
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.5, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.6
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.6, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.9
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.9, timeout is 2 seconds:
!!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.10
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.13
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.13, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.14
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.14, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.17
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.17, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.18
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.18, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.21
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.21, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 10.0.0.22
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.22, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms


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 = 1/1/1 ms
R7#ping 192.168.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 192.168.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 192.168.3.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 192.168.4.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.4.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 192.168.5.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.5.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 192.168.6.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.6.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:1::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:1::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:1::2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:1::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:2::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:2::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:2::2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:2::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:3::1
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:3::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:3::2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:3::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:4::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:4::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/6 ms
R7#ping 2001:db8:acad:4::2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:4::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:5::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:5::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:5::2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:5::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:6::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:6::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:6::2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:6::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms


R7#ping 2001:db8:acad:a::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:A::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:b::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:B::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:c::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:C::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:d::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:D::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:f::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:F::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R7#ping 2001:db8:acad:e::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:E::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

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

Router 1 Config:

Show Run:

```
version 15.5
service timestamps debug datetime msec
service timestamps log datetime msec
no 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
!
ipv6 unicast-routing
!
subscriber templating
multilink bundle-name authenticated
!
license udi pid ISR4321/K9 sn FDO214811ZM
!
spanning-tree extend system-id
!
redundancy
 mode none
!
vlan internal allocation policy ascending
!
interface Loopback0
 ip address 192.168.0.1 255.255.255.0
 ipv6 address FE80::1 link-local
 ipv6 address 2001:DB8:ACAD:A::1/64
 ipv6 ospf 10 area 0
!
interface GigabitEthernet0/0/0
 no ip address
 negotiation auto
!
interface GigabitEthernet0/0/1
 ip address 10.0.0.1 255.255.255.252
 negotiation auto
 ipv6 address FE80::1 link-local
 ipv6 address 2001:DB8:ACAD:1::1/64
 ipv6 ospf 10 area 0
!
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
!
interface Vlan1
 no ip address
 shutdown
```

```
!
router ospf 1
 router-id 1.1.1.1
 passive-interface Loopback0
 network 10.0.0.0 0.0.0.3 area 0
 network 192.168.0.0 0.0.0.255 area 0
!
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface GigabitEthernet0
!
!
ipv6 router ospf 10
 router-id 1.1.1.1
 passive-interface Loopback0
!
control-plane
!
line con 0
 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

      10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks
C        10.0.0.0/30 is directly connected, GigabitEthernet0/0/1
L        10.0.0.1/32 is directly connected, GigabitEthernet0/0/1
O        10.0.0.4/30 [110/2] via 10.0.0.2, 00:19:19, GigabitEthernet0/0/1
O E2     10.0.0.8/30
            [110/10000000] via 10.0.0.2, 00:17:40, GigabitEthernet0/0/1
O E2     10.0.0.12/30
            [110/10000000] via 10.0.0.2, 00:09:04, GigabitEthernet0/0/1
O E2     10.0.0.16/30
            [110/10000000] via 10.0.0.2, 00:07:42, GigabitEthernet0/0/1
O E2     10.0.0.20/30
            [110/10000000] via 10.0.0.2, 00:05:44, GigabitEthernet0/0/1
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/24 is directly connected, Loopback0
L        192.168.0.1/32 is directly connected, Loopback0
      192.168.1.0/32 is subnetted, 1 subnets
O        192.168.1.1 [110/2] via 10.0.0.2, 00:19:29, GigabitEthernet0/0/1
      192.168.2.0/30 is subnetted, 1 subnets
O E2     192.168.2.0
            [110/10000000] via 10.0.0.2, 00:18:14, GigabitEthernet0/0/1
      192.168.3.0/30 is subnetted, 1 subnets
O E2     192.168.3.0
            [110/10000000] via 10.0.0.2, 00:17:09, GigabitEthernet0/0/1
      192.168.4.0/30 is subnetted, 1 subnets
O E2     192.168.4.0
            [110/10000000] via 10.0.0.2, 00:08:33, GigabitEthernet0/0/1
      192.168.5.0/30 is subnetted, 1 subnets
O E2     192.168.5.0
            [110/10000000] via 10.0.0.2, 00:06:30, GigabitEthernet0/0/1
      192.168.6.0/32 is subnetted, 1 subnets
O E2     192.168.6.1
            [110/10000000] via 10.0.0.2, 00:04:59, GigabitEthernet0/0/1
```

```
R1#show ipv6 route
IPv6 Routing Table - default - 16 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:1::/64 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2001:DB8:ACAD:1::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
O   2001:DB8:ACAD:2::/64 [110/2]
     via FE80::2, GigabitEthernet0/0/1
OE2 2001:DB8:ACAD:3::/64 [110/10000000]
     via FE80::2, GigabitEthernet0/0/1
OE2 2001:DB8:ACAD:4::/64 [110/10000000]
     via FE80::2, GigabitEthernet0/0/1
OE2 2001:DB8:ACAD:5::/64 [110/10000000]
     via FE80::2, GigabitEthernet0/0/1
OE2 2001:DB8:ACAD:6::/64 [110/10000000]
     via FE80::2, GigabitEthernet0/0/1
C   2001:DB8:ACAD:A::/64 [0/0]
     via Loopback0, directly connected
L   2001:DB8:ACAD:A::1/128 [0/0]
     via Loopback0, receive
O   2001:DB8:ACAD:B::1/128 [110/1]
     via FE80::2, GigabitEthernet0/0/1
OE2 2001:DB8:ACAD:C::/64 [110/10000000]
     via FE80::2, GigabitEthernet0/0/1
OE2 2001:DB8:ACAD:D::/64 [110/10000000]
     via FE80::2, GigabitEthernet0/0/1
OE2 2001:DB8:ACAD:E::/64 [110/10000000]
     via FE80::2, GigabitEthernet0/0/1
OE2 2001:DB8:ACAD:F::/64 [110/10000000]
     via FE80::2, GigabitEthernet0/0/1
OE2 2001:DB8:ACAD:AA::1/128 [110/10000000]
     via FE80::2, GigabitEthernet0/0/1
L   FF00::/8 [0/0]
     via Null0, receive

R1#                          show ip ospf neighbor

Neighbor ID     Pri   State          Dead Time   Address          Interface
2.2.2.2          1    FULL/DR        00:00:36    10.0.0.2         GigabitEthernet0/0/1
R1# show ip ospf
 Routing Process "ospf 1" with ID 1.1.1.1
 Start time: 02:44:16.715, Time elapsed: 00:21:36.848
 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 9. Checksum Sum 0x077160
 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 BACKBONE(0)
        Number of interfaces in this area is 2 (1 loopback)
        Area has no authentication
        SPF algorithm last executed 00:19:36.831 ago
        SPF algorithm executed 6 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x00DC40
        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
Loopback0 is up, line protocol is up
  Internet Address 192.168.0.1/24, Area 0, Attached via Network Statement
  Process ID 1, Router ID 1.1.1.1, Network Type LOOPBACK, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown     Topology Name
        0           1        no          no           Base
  Loopback interface is treated as a stub Host
GigabitEthernet0/0/1 is up, line protocol is up
  Internet Address 10.0.0.1/30, Area 0, Attached via Network Statement
  Process ID 1, Router ID 1.1.1.1, 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) 2.2.2.2, Interface address 10.0.0.2
  Backup Designated router (ID) 1.1.1.1, Interface address 10.0.0.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:05
  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 2.2.2.2  (Designated Router)
  Suppress hello for 0 neighbor(s)
R1# show ip ospf border-routers

           OSPF Router with ID (1.1.1.1) (Process ID 1)


            Base Topology (MTID 0)

Internal Router Routing Table
Codes: i - Intra-area route, I - Inter-area route

i 2.2.2.2 [1] via 10.0.0.2, GigabitEthernet0/0/1, ASBR, Area 0, SPF 6
R1#show ipv6 ospf neighbor

           OSPFv3 Router with ID (1.1.1.1) (Process ID 10)

Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
2.2.2.2          1    FULL/DR         00:00:35    6               GigabitEthernet0/0/1
R1#show ipv6 ospf interface
Loopback0 is up, line protocol is up
  Link Local Address FE80::1, Interface ID 14
  Area 0, Process ID 10, Instance ID 0, Router ID 1.1.1.1
  Network Type LOOPBACK, Cost: 1
  Loopback interface is treated as a stub Host
GigabitEthernet0/0/1 is up, line protocol is up
  Link Local Address FE80::1, Interface ID 7
  Area 0, Process ID 10, 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::2
```

```
  Backup Designated router (ID) 1.1.1.1, local address FE80::1
  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 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 10)

Codes: i - Intra-area route, I - Inter-area route

i 2.2.2.2 [1] via FE80::2, GigabitEthernet0/0/1, ASBR, Area 0, SPF 3
R1#show ip protocol
*** IP Routing is NSF aware ***

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

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.0.0.0 0.0.0.3 area 0
    192.168.0.0 0.0.0.255 area 0
  Passive Interface(s):
  Passive Interface(s):
    Loopback0
  Routing Information Sources:
    Gateway         Distance      Last Update
    2.2.2.2           110         00:05:58
  Distance: (default is 110)

R1#show ipv6 protocol
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "ospf 10"
  Router ID 1.1.1.1
  Number of areas: 1 normal, 0 stub, 0 nssa
  Interfaces (Area 0):
    Loopback0
    GigabitEthernet0/0/1
  Redistribution:
    None

R2 Config:


R2#show run
Building configuration...


Current configuration : 2524 bytes
!
! Last configuration change at 18:37:08 UTC Wed Jan 5 2022
!
```

```
version 15.5
service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core
!
hostname R2
!
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 FDO214414TX
!
spanning-tree extend system-id
!
!
redundancy
 mode none
!
!
vlan internal allocation policy ascending
!
interface Loopback0
 ip address 192.168.1.1 255.255.255.252
 ipv6 address FE80::2 link-local
 ipv6 address 2001:DB8:ACAD:B::1/64
 ipv6 ospf 10 area 0
!
interface GigabitEthernet0/0/0
 ip address 10.0.0.2 255.255.255.252
 negotiation auto
 ipv6 address FE80::2 link-local
 ipv6 address 2001:DB8:ACAD:1::2/64
 ipv6 ospf 10 area 0
!
interface GigabitEthernet0/0/1
 ip address 10.0.0.5 255.255.255.252
 negotiation auto
 ipv6 address FE80::2 link-local
 ipv6 address 2001:DB8:ACAD:2::1/64
 ipv6 ospf 10 area 0
!
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
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 router-id 2.2.2.2
 redistribute bgp 100 metric 10000000 subnets
 passive-interface Loopback0
 network 10.0.0.0 0.0.0.3 area 0
 network 10.0.0.4 0.0.0.3 area 0
 network 192.168.1.0 0.0.0.255 area 0
!
router bgp 100
 bgp router-id 2.2.2.2
 bgp log-neighbor-changes
 neighbor 10.0.0.6 remote-as 200
 neighbor 2001:DB8:ACAD:2::2 remote-as 200
 !
 address-family ipv4
  redistribute ospf 1
  neighbor 10.0.0.6 activate
  no neighbor 2001:DB8:ACAD:2::2 activate
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  redistribute ospf 10
  neighbor 2001:DB8:ACAD:2::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 10
 router-id 2.2.2.2
 passive-interface Loopback0
 redistribute bgp 100 metric 10000000
!
!
!
!
control-plane
!
!
line con 0
 stopbits 1
line aux 0
 stopbits 1
line vty 0 4
 login
!
!
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

      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
C        10.0.0.0/30 is directly connected, GigabitEthernet0/0/0
L        10.0.0.2/32 is directly connected, GigabitEthernet0/0/0
C        10.0.0.4/30 is directly connected, GigabitEthernet0/0/1
L        10.0.0.5/32 is directly connected, GigabitEthernet0/0/1
B        10.0.0.8/30 [20/0] via 10.0.0.6, 00:20:19
B        10.0.0.12/30 [20/3072] via 10.0.0.6, 00:11:43
B        10.0.0.16/30 [20/3328] via 10.0.0.6, 00:10:21
B        10.0.0.20/30 [20/26368] via 10.0.0.6, 00:08:23
      192.168.0.0/32 is subnetted, 1 subnets
O        192.168.0.1 [110/2] via 10.0.0.1, 00:22:07, GigabitEthernet0/0/0
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/30 is directly connected, Loopback0
L        192.168.1.1/32 is directly connected, Loopback0
      192.168.2.0/30 is subnetted, 1 subnets
B        192.168.2.0 [20/0] via 10.0.0.6, 00:20:53
      192.168.3.0/30 is subnetted, 1 subnets
B        192.168.3.0 [20/130816] via 10.0.0.6, 00:19:48
      192.168.4.0/30 is subnetted, 1 subnets
B        192.168.4.0 [20/131072] via 10.0.0.6, 00:11:12
      192.168.5.0/30 is subnetted, 1 subnets
B        192.168.5.0 [20/26368] via 10.0.0.6, 00:09:09
      192.168.6.0/32 is subnetted, 1 subnets
B        192.168.6.1 [20/26368] via 10.0.0.6, 00:07:38

R2#show ipv6 route
IPv6 Routing Table - default - 17 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:1::/64 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2001:DB8:ACAD:1::2/128 [0/0]
     via GigabitEthernet0/0/0, receive
C   2001:DB8:ACAD:2::/64 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2001:DB8:ACAD:2::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
B   2001:DB8:ACAD:3::/64 [20/0]
     via FE80::3, GigabitEthernet0/0/1
B   2001:DB8:ACAD:4::/64 [20/3072]
     via FE80::3, GigabitEthernet0/0/1
B   2001:DB8:ACAD:5::/64 [20/3328]
     via FE80::3, GigabitEthernet0/0/1
B   2001:DB8:ACAD:6::/64 [20/26368]
     via FE80::3, GigabitEthernet0/0/1
O   2001:DB8:ACAD:A::1/128 [110/1]
     via FE80::1, GigabitEthernet0/0/0
C   2001:DB8:ACAD:B::/64 [0/0]
     via Loopback0, directly connected
L   2001:DB8:ACAD:B::1/128 [0/0]
     via Loopback0, receive
B   2001:DB8:ACAD:C::/64 [20/0]
     via FE80::3, GigabitEthernet0/0/1
B   2001:DB8:ACAD:D::/64 [20/130816]
     via FE80::3, GigabitEthernet0/0/1
B   2001:DB8:ACAD:E::/64 [20/131072]
     via FE80::3, GigabitEthernet0/0/1
B   2001:DB8:ACAD:F::/64 [20/26368]
     via FE80::3, GigabitEthernet0/0/1
B   2001:DB8:ACAD:AA::1/128 [20/26368]
     via FE80::3, GigabitEthernet0/0/1
L   FF00::/8 [0/0]
```

```
       via Null0, receive

R2# show ip bgp
BGP table version is 22, 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
 *>  10.0.0.0/30      0.0.0.0                  0         32768 ?
 *   10.0.0.4/30      10.0.0.6                 0             0 200 ?
 *>                   0.0.0.0                  0         32768 ?
 *>  10.0.0.8/30      10.0.0.6                 0             0 200 ?
 *>  10.0.0.12/30     10.0.0.6              3072             0 200 ?
 *>  10.0.0.16/30     10.0.0.6              3328             0 200 ?
 *>  10.0.0.20/30     10.0.0.6             26368             0 200 ?
 *>  192.168.0.1/32   10.0.0.1                 2         32768 ?
 *>  192.168.1.0/30   0.0.0.0                  0         32768 ?
 *>  192.168.2.0/30   10.0.0.6                 0             0 200 ?
 *>  192.168.3.0/30   10.0.0.6            130816             0 200 ?
 *>  192.168.4.0/30   10.0.0.6            131072             0 200 ?
 *>  192.168.5.0/30   10.0.0.6             26368             0 200 ?
 *>  192.168.6.1/32   10.0.0.6             26368             0 200 ?
R2#show bgp ipv6
BGP table version is 26, 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:1::/64
                      ::                       0         32768 ?
 *   2001:DB8:ACAD:2::/64
                      2001:DB8:ACAD:2::2
                                               0             0 200 ?
 *>                   ::                       0         32768 ?
 *>  2001:DB8:ACAD:3::/64
                      2001:DB8:ACAD:2::2
                                               0             0 200 ?
 *>  2001:DB8:ACAD:4::/64
                      2001:DB8:ACAD:2::2
                                            3072             0 200 ?
 *>  2001:DB8:ACAD:5::/64
                      2001:DB8:ACAD:2::2
                                            3328             0 200 ?
     Network          Next Hop            Metric LocPrf Weight Path
 *>  2001:DB8:ACAD:A::1/128
                      FE80::1                  1         32768 ?
 *>  2001:DB8:ACAD:B::/64
                      ::                       0         32768 ?
 *>  2001:DB8:ACAD:C::/64
                      2001:DB8:ACAD:2::2
                                               0             0 200 ?
 *>  2001:DB8:ACAD:D::/64
                      2001:DB8:ACAD:2::2
                                          130816             0 200 ?
 *>  2001:DB8:ACAD:E::/64
                      2001:DB8:ACAD:2::2
                                          131072             0 200 ?
 *>  2001:DB8:ACAD:AA::1/128
                      2001:DB8:ACAD:2::2
                                           26368             0 200 ?
% NOTE: This command is deprecated. Please use 'show bgp ipv6 unicast'
R2#show bgp ipv6 unicast neighbors
BGP neighbor is 2001:DB8:ACAD:2::2,  remote AS 200, external link
  BGP version 4, remote router ID 3.3.3.3
  BGP state = Established, up for 00:22:20
  Last read 00:00:42, 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:               5         16
    Keepalives:           25         19
    Route Refresh:         0          0
    Total:                31         36
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds

 For address family: IPv6 Unicast
  Session: 2001:DB8:ACAD:2::2
  BGP table version 26, neighbor version 26/0
  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:             4          8 (Consumes 1152 bytes)
    Prefixes Total:               8         14
    Implicit Withdraw:            4          2
    Explicit Withdraw:            0          4
    Used as bestpath:           n/a          7
    Used as multipath:          n/a          0

                                Outbound   Inbound
  Local Policy Denied Prefixes:  --------   -------
    Bestpath from this peer:         11        n/a
    Total:                           11          0
  Number of NLRIs in the update sent: max 3, 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 2001:DB8:ACAD:2::2
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-connected-check)
  Interface associated: GigabitEthernet0/0/1 (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: 2001:DB8:ACAD:2::1, Local port: 34359
Foreign host: 2001:DB8:ACAD:2::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 0xACBC40):
Timer            Starts    Wakeups           Next
Retrans             28          0            0x0
TimeWait             0          0            0x0
AckHold             35         30            0x0
SendWnd              0          0            0x0
KeepAlive            0          0            0x0
GiveUp               0          0            0x0
PmtuAger           525        524       0xACBD48
DeadWait             0          0            0x0
Linger               0          0            0x0
ProcessQ             0          0            0x0

iss:  399757082  snduna:  399758064  sndnxt:  399758064
irs: 1014810708  rcvnxt: 1014812409


sndwnd:  15403  scale:      0  maxrcvwnd:  16384
rcvwnd:  16132  scale:      0  delrcvwnd:    252


SRTT: 976 ms, RTTO: 1166 ms, RTV: 190 ms, KRTT: 0 ms
minRTT: 2 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1340998 ms, Sent idletime: 31207 ms, Receive idletime: 31006 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6

Datagrams (max data segment is 1440 bytes):
Rcvd: 63 (out of order: 0), with data: 35, total data bytes: 1700
Sent: 62 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 62, total data
bytes: 3469

 Packets received in fast path: 0, fast processed: 0, slow path: 0
 fast lock acquisition failures: 0, slow path: 0
TCP Semaphore       0x7F32C5A81BA8  FREE


R2# show ip bgp summary
BGP router identifier 2.2.2.2, local AS number 100
BGP table version is 22, main routing table version 22
13 network entries using 3224 bytes of memory
14 path entries using 1680 bytes of memory
8/8 BGP path/bestpath attribute entries using 1984 bytes of memory
1 BGP AS-PATH entries using 24 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 6912 total bytes of memory
BGP activity 30/6 prefixes, 36/10 paths, scan interval 60 secs


Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.6        4          200      34       30       22    0    0 00:22:40       10
R2#show bgp ipv6 unicast summary
BGP router identifier 2.2.2.2, local AS number 100
BGP table version is 26, main routing table version 26
11 network entries using 2992 bytes of memory
12 path entries using 1728 bytes of memory
8/8 BGP path/bestpath attribute entries using 1984 bytes of memory
1 BGP AS-PATH entries using 24 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 6728 total bytes of memory
BGP activity 30/6 prefixes, 36/10 paths, scan interval 60 secs


Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
2001:DB8:ACAD:2::2
                4          200      37       31       26    0    0 00:22:38        8
R2#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1           1   FULL/BDR        00:00:35    10.0.0.1        GigabitEthernet0/0/0
R2#show ip ospf
 Routing Process "ospf 1" with ID 2.2.2.2
 Start time: 02:45:07.103, Time elapsed: 00:23:58.656
 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,
      bgp 100 with metric mapped to 10000000, includes subnets in redistribution
   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 9. Checksum Sum 0x077160
   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 BACKBONE(0)
          Number of interfaces in this area is 3 (1 loopback)
          Area has no authentication
          SPF algorithm last executed 00:22:48.757 ago
          SPF algorithm executed 5 times
          Area ranges are
          Number of LSA 3. Checksum Sum 0x00DC40
          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
Loopback0 is up, line protocol is up
  Internet Address 192.168.1.1/30, Area 0, Attached via Network Statement
  Process ID 1, Router ID 2.2.2.2, Network Type LOOPBACK, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0            1       no          no             Base
  Loopback interface is treated as a stub Host
GigabitEthernet0/0/1 is up, line protocol is up
  Internet Address 10.0.0.5/30, Area 0, Attached via Network Statement
  Process ID 1, Router ID 2.2.2.2, 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) 2.2.2.2, Interface address 10.0.0.5
  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 00:00:03
  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 10.0.0.2/30, Area 0, Attached via Network Statement
  Process ID 1, Router ID 2.2.2.2, 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) 2.2.2.2, Interface address 10.0.0.2
  Backup Designated router (ID) 1.1.1.1, Interface address 10.0.0.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:01
  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 3
  Last flood scan time is 0 msec, maximum is 1 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 ip ospf border-routers

          OSPF Router with ID (2.2.2.2) (Process ID 1)


            Base Topology (MTID 0)

Internal Router Routing Table
Codes: i - Intra-area route, I - Inter-area route

R2#show ipv6 ospf interface
Loopback0 is up, line protocol is up
  Link Local Address FE80::2, Interface ID 14
  Area 0, Process ID 10, Instance ID 0, Router ID 2.2.2.2
  Network Type LOOPBACK, Cost: 1
  Loopback interface is treated as a stub Host
GigabitEthernet0/0/1 is up, line protocol is up
  Link Local Address FE80::2, Interface ID 7
  Area 0, Process ID 10, 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::2
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:03
  Graceful restart helper support enabled
  Index 1/3/3, 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
  Link Local Address FE80::2, Interface ID 6
  Area 0, Process ID 10, 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::2
  Backup Designated router (ID) 1.1.1.1, local address FE80::1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:08
  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 1, maximum is 6
  Last flood scan time is 0 msec, maximum is 1 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 neighbor

          OSPFv3 Router with ID (2.2.2.2) (Process ID 10)

Neighbor ID     Pri   State           Dead Time   Interface ID   Interface
1.1.1.1           1   FULL/BDR        00:00:39    7              GigabitEthernet0/0/0
R2#show ipv6 ospf border-router
```

```
             OSPFv3 Router with ID (2.2.2.2) (Process ID 10)

Codes: i - Intra-area route, I - Inter-area route

R2#show ip prot
*** IP Routing is NSF aware ***

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

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 2.2.2.2
  It is an autonomous system boundary router
 Redistributing External Routes from,
    bgp 100 with metric mapped to 10000000, includes subnets in redistribution
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.0.0.0 0.0.0.3 area 0
    10.0.0.4 0.0.0.3 area 0
    192.168.1.0 0.0.0.255 area 0
  Passive Interface(s):
    Loopback0
  Routing Information Sources:
    Gateway         Distance      Last Update
    1.1.1.1            110        00:23:38
  Distance: (default is 110)

Routing Protocol is "bgp 100"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  IGP synchronization is disabled
  Automatic route summarization is disabled
  Redistributing: ospf 1 (internal)

  Neighbor(s):
    Address          FiltIn FiltOut DistIn DistOut Weight RouteMap
    10.0.0.6
  Maximum path: 1
  Routing Information Sources:
    Gateway         Distance      Last Update
    Gateway         Distance      Last Update
    10.0.0.6           20         00:09:11
  Distance: external 20 internal 200 local 200

R2#show ipv6 prot
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "ospf 10"
  Router ID 2.2.2.2
  Autonomous system boundary router
  Number of areas: 1 normal, 0 stub, 0 nssa
  Interfaces (Area 0):
    Loopback0
    GigabitEthernet0/0/1
    GigabitEthernet0/0/0
  Redistribution:
    Redistributing protocol bgp 100 with metric 10000000
IPv6 Routing Protocol is "bgp 100"
  IGP synchronization is disabled
  Redistribution:
```

```
     Redistributing protocol connected
     Redistributing protocol ospf 10 (internal)
   Neighbor(s):
     Address                    FiltIn FiltOut Weight RoutemapIn RoutemapOut
     2001:DB8:ACAD:2::2

R2#show ip bgp neighbor
BGP neighbor is 10.0.0.6,  remote AS 200, external link
   BGP version 4, remote router ID 3.3.3.3
   BGP state = Established, up for 00:30:53
   Last read 00:00:56, 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 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         17
     Keepalives:        35         25
     Route Refresh:      0          0
     Total:             39         43
   Do log neighbor state changes (via global configuration)
   Default minimum time between advertisement runs is 30 seconds

 For address family: IPv4 Unicast
  Session: 10.0.0.6
  BGP table version 22, neighbor version 22/0
  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:            4         10 (Consumes 1200 bytes)
    Prefixes Total:              4         14
    Implicit Withdraw:           0          0
    Explicit Withdraw:           0          4
    Used as bestpath:          n/a          9
    Used as multipath:         n/a          0

                            Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Bestpath from this peer:         13        n/a
    Total:                           13          0
  Number of NLRIs in the update sent: max 3, 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 10.0.0.6
   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: 10.0.0.5, Local port: 16694
Foreign host: 10.0.0.6, 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 0xB46FD4):
Timer          Starts    Wakeups          Next
Retrans            39         1           0x0
TimeWait            0         0           0x0
AckHold            42        39           0x0
SendWnd             0         0           0x0
KeepAlive           0         0           0x0
GiveUp              0         0           0x0
PmtuAger          980       979      0xB47024
DeadWait            0         0           0x0
Linger              0         0           0x0
ProcessQ            0         0           0x0

iss: 3641403094  snduna: 3641403960  sndnxt: 3641403960
irs: 2108471956  rcvnxt: 2108473321


sndwnd:  15519  scale:      0  maxrcvwnd:  16384
rcvwnd:  15020  scale:      0  delrcvwnd:   1364

SRTT: 993 ms, RTTO: 1052 ms, RTV: 59 ms, KRTT: 0 ms
minRTT: 2 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1855962 ms, Sent idletime: 15697 ms, Receive idletime: 15496 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6

Datagrams (max data segment is 1460 bytes):
Rcvd: 80 (out of order: 0), with data: 42, total data bytes: 1364
Sent: 79 (retransmit: 1, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 37, total data
bytes: 865

 Packets received in fast path: 0, fast processed: 0, slow path: 0
 fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7F32C5A81AE8  FREE

Router 3 Config:

R3#show run
Building configuration...


Current configuration : 2656 bytes
!
! Last configuration change at 18:30:51 UTC Wed Jan 5 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 FDO214328EH
!
spanning-tree extend system-id
!
!
redundancy
 mode none
!
!
vlan internal allocation policy ascending
!
!
!
!
!
!
interface Loopback0
 ip address 192.168.2.1 255.255.255.252
 ipv6 address FE80::3 link-local
 ipv6 address 2001:DB8:ACAD:C::1/64
 ipv6 eigrp 10
!
interface GigabitEthernet0/0/0
 ip address 10.0.0.6 255.255.255.252
 negotiation auto
 ipv6 address FE80::3 link-local
 ipv6 address 2001:DB8:ACAD:2::2/64
 ipv6 eigrp 10
!
interface GigabitEthernet0/0/1
 ip address 10.0.0.9 255.255.255.252
 negotiation auto
 ipv6 address FE80::3 link-local
 ipv6 address 2001:DB8:ACAD:3::1/64
 ipv6 eigrp 10
!
interface Serial0/1/0
```

```
 no ip address
 shutdown
!
interface Serial0/1/1
 no ip address
 shutdown
!
interface Service-Engine0/2/0
 no ip address
 shutdown
!
interface GigabitEthernet0
 vrf forwarding Mgmt-intf
 no ip address
 shutdown
 negotiation auto
!
interface Vlan1
 no ip address
 shutdown
!
!
router eigrp 1
 network 10.0.0.4 0.0.0.3
 network 10.0.0.8 0.0.0.3
 network 192.168.2.0
 redistribute bgp 200 metric 100000 1 255 1 1500
 passive-interface Loopback0
 eigrp router-id 3.3.3.3
!
router bgp 200
 bgp router-id 3.3.3.3
 bgp log-neighbor-changes
 neighbor 10.0.0.5 remote-as 100
 neighbor 10.0.0.14 remote-as 200
 neighbor 10.0.0.14 update-source Loopback0
 neighbor 2001:DB8:ACAD:2::1 remote-as 100
 neighbor 2001:DB8:ACAD:4::2 remote-as 200
 neighbor 2001:DB8:ACAD:4::2 update-source Loopback0
 !
 address-family ipv4
  redistribute eigrp 1
  neighbor 10.0.0.5 activate
  neighbor 10.0.0.14 activate
  no neighbor 2001:DB8:ACAD:2::1 activate
  neighbor 2001:DB8:ACAD:4::2 activate
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  redistribute eigrp 10
  neighbor 2001:DB8:ACAD:2::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 10
 passive-interface Loopback0
 eigrp router-id 3.3.3.3
 redistribute bgp 200 metric 1000000 1 255 1 1500
!
!
!
!
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

      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
B        10.0.0.0/30 [20/0] via 10.0.0.5, 00:26:44
C        10.0.0.4/30 is directly connected, GigabitEthernet0/0/0
L        10.0.0.6/32 is directly connected, GigabitEthernet0/0/0
C        10.0.0.8/30 is directly connected, GigabitEthernet0/0/1
L        10.0.0.9/32 is directly connected, GigabitEthernet0/0/1
D        10.0.0.12/30 [90/3072] via 10.0.0.10, 00:17:34, GigabitEthernet0/0/1
D        10.0.0.16/30 [90/3328] via 10.0.0.10, 00:16:12, GigabitEthernet0/0/1
D EX     10.0.0.20/30
            [170/26368] via 10.0.0.10, 00:14:14, GigabitEthernet0/0/1
      192.168.0.0/32 is subnetted, 1 subnets
B        192.168.0.1 [20/2] via 10.0.0.5, 00:26:44
      192.168.1.0/30 is subnetted, 1 subnets
B        192.168.1.0 [20/0] via 10.0.0.5, 00:26:44
      192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.2.0/30 is directly connected, Loopback0
L        192.168.2.1/32 is directly connected, Loopback0
      192.168.3.0/30 is subnetted, 1 subnets
D        192.168.3.0 [90/130816] via 10.0.0.10, 00:26:04, GigabitEthernet0/0/1
      192.168.4.0/30 is subnetted, 1 subnets
D        192.168.4.0 [90/131072] via 10.0.0.10, 00:17:29, GigabitEthernet0/0/1
      192.168.5.0/30 is subnetted, 1 subnets
D EX     192.168.5.0 [170/26368] via 10.0.0.10, 00:15:00, GigabitEthernet0/0/1
      192.168.6.0/32 is subnetted, 1 subnets
D EX     192.168.6.1 [170/26368] via 10.0.0.10, 00:13:30, GigabitEthernet0/0/1
R3>show ipv6 route
IPv6 Routing Table - default - 17 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:1::/64 [20/0]
     via FE80::2, GigabitEthernet0/0/0
C   2001:DB8:ACAD:2::/64 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2001:DB8:ACAD:2::2/128 [0/0]
     via GigabitEthernet0/0/0, receive
C   2001:DB8:ACAD:3::/64 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2001:DB8:ACAD:3::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
D   2001:DB8:ACAD:4::/64 [90/3072]
     via FE80::4, GigabitEthernet0/0/1
D   2001:DB8:ACAD:5::/64 [90/3328]
     via FE80::4, GigabitEthernet0/0/1
EX  2001:DB8:ACAD:6::/64 [170/26368]
     via FE80::4, GigabitEthernet0/0/1
B   2001:DB8:ACAD:A::1/128 [20/1]
     via FE80::2, GigabitEthernet0/0/0
B   2001:DB8:ACAD:B::/64 [20/0]
```

```
          via FE80::2, GigabitEthernet0/0/0
C    2001:DB8:ACAD:C::/64 [0/0]
          via Loopback0, directly connected
L    2001:DB8:ACAD:C::1/128 [0/0]
          via Loopback0, receive
D    2001:DB8:ACAD:D::/64 [90/130816]
          via FE80::4, GigabitEthernet0/0/1
D    2001:DB8:ACAD:E::/64 [90/131072]
          via FE80::4, GigabitEthernet0/0/1
EX   2001:DB8:ACAD:F::/64 [170/26368]
          via FE80::4, GigabitEthernet0/0/1
EX   2001:DB8:ACAD:AA::1/128 [170/26368]
          via FE80::4, GigabitEthernet0/0/1
L    FF00::/8 [0/0]
          via Null0, receive

R3#show ip bgp
BGP table version is 22, local router ID is 3.3.3.3
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
 *>  10.0.0.0/30      10.0.0.5                 0             0 100 ?
 *   10.0.0.4/30      10.0.0.5                 0             0 100 ?
 *>                   0.0.0.0                  0         32768 ?
 *>  10.0.0.8/30      0.0.0.0                  0         32768 ?
 *>i 10.0.0.12/30     10.0.0.10             3072         32768 ?
 *>i 10.0.0.16/30     10.0.0.10             3328         32768 ?
 *>i 10.0.0.20/30     10.0.0.10            26368         32768 ?
 *>  192.168.0.1/32   10.0.0.5                 2             0 100 ?
 *>  192.168.1.0/30   10.0.0.5                 0             0 100 ?
 *>  192.168.2.0/30   0.0.0.0                  0         32768 ?
 *>i 192.168.3.0/30   10.0.0.10           130816         32768 ?
 *>i 192.168.4.0/30   10.0.0.10           131072         32768 ?
 *>i 192.168.5.0/30   10.0.0.10            26368         32768 ?
 *>i 192.168.6.1/32   10.0.0.10            26368         32768 ?
R3# show bgp ipv6
BGP table version is 25, local router ID is 3.3.3.3
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:1::/64
                      2001:DB8:ACAD:2::1
                                              0             0 100 ?
 *   2001:DB8:ACAD:2::/64
                      2001:DB8:ACAD:2::1
                                              0             0 100 ?
 *>                   ::                      0         32768 ?
 *>  2001:DB8:ACAD:3::/64
                      ::                      0         32768 ?
 *>i 2001:DB8:ACAD:4::/64
                      FE80::4               3072         32768 ?
 *>i 2001:DB8:ACAD:5::/64
                      FE80::4               3328         32768 ?
 *>i 2001:DB8:ACAD:6::/64
                      FE80::4               3650         32768 ?

 *>  2001:DB8:ACAD:A::1/128
                      2001:DB8:ACAD:2::1
                                              1             0 100 ?
 *>  2001:DB8:ACAD:B::/64
                      2001:DB8:ACAD:2::1
                                              0             0 100 ?
 *>  2001:DB8:ACAD:C::/64
                      ::                      0         32768 ?
 *>i 2001:DB8:ACAD:D::/64
```

```
                            FE80::4              130816        32768 ?
 *>i 2001:DB8:ACAD:E::/64
                            FE80::4              131072        32768 ?
 *>i 2001:DB8:ACAD:F::/64
                            FE80::4              131251        32768 ?

 *>i 2001:DB8:ACAD:AA::1/128
                            FE80::4               26368        32768 ?
% NOTE: This command is deprecated. Please use 'show bgp ipv6 unicast'
R3#show bgp ipv6 unicast neighbors
BGP neighbor is 2001:DB8:ACAD:2::1,  remote AS 100, external link
  BGP version 4, remote router ID 2.2.2.2
  BGP state = Established, up for 00:28:12
  Last read 00:00:09, last write 00:00:55, 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:               16          5
    Keepalives:            25         32
    Route Refresh:          0          0
    Total:                 42         38
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds

 For address family: IPv6 Unicast
  Session: 2001:DB8:ACAD:2::1
  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:            8           4 (Consumes 576 bytes)
    Prefixes Total:             14           8
    Implicit Withdraw:           2           4
    Explicit Withdraw:           4           0
    Used as bestpath:          n/a           3
    Used as multipath:         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 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 2001:DB8:ACAD:2::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: 2001:DB8:ACAD:2::2, Local port: 179
Foreign host: 2001:DB8:ACAD:2::1, Foreign port: 34359
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 0xB20C35):
Timer          Starts    Wakeups          Next
Retrans            41         0           0x0
TimeWait            0         0           0x0
AckHold            34        32           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: 1014810708   snduna: 1014812523   sndnxt: 1014812523
irs:  399757082   rcvnxt:  399758197


sndwnd:  16018  scale:     0  maxrcvwnd:  16384
rcvwnd:  15270  scale:     0  delrcvwnd:  1114

SRTT: 996 ms, RTTO: 1031 ms, RTV: 35 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1692616 ms, Sent idletime: 8802 ms, Receive idletime: 9002 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: 75 (out of order: 0), with data: 35, total data bytes: 1114
Sent: 76 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 76, total data
bytes: 4862

 Packets received in fast path: 0, fast processed: 0, slow path: 0
 fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FE90517F540  FREE

R3# show ip bgp summary
BGP router identifier 3.3.3.3, local AS number 200
BGP table version is 22, main routing table version 22
13 network entries using 3224 bytes of memory
14 path entries using 1680 bytes of memory
8/8 BGP path/bestpath attribute entries using 1984 bytes of memory
1 BGP AS-PATH entries using 24 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 6912 total bytes of memory
BGP activity 30/6 prefixes, 36/10 paths, scan interval 60 secs

Neighbor        V         AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.5        4        100      36      41       22    0    0 00:28:31        4
10.0.0.14       4        200       0       0        1    0    0 never    Idle
2001:DB8:ACAD:4::2
                4        200       0       0        1    0    0 never    Idle
R3#show bgp ipv6 unicast summary
BGP router identifier 3.3.3.3, local AS number 200
BGP table version is 25, main routing table version 25
11 network entries using 2992 bytes of memory
12 path entries using 1728 bytes of memory
8/8 BGP path/bestpath attribute entries using 1984 bytes of memory
```

```
1 BGP AS-PATH entries using 24 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 6728 total bytes of memory
BGP activity 30/6 prefixes, 36/10 paths, scan interval 60 secs


Neighbor         V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
2001:DB8:ACAD:2::1
                 4         100      38      43      25    0    0 00:28:35        4
R3#show ip eigrp neighbor
EIGRP-IPv4 Neighbors for AS(1)
H   Address               Interface          Hold Uptime   SRTT   RTO  Q  Seq
                                             (sec)         (ms)      Cnt Num
0   10.0.0.10             Gi0/0/1             11 00:27:09    1   100  0  26
R3#show ip eigrp interface
EIGRP-IPv4 Interfaces for AS(1)
                                 Xmit Queue   PeerQ       Mean  Pacing Time  Multicast    Pending
Interface            Peers  Un/Reliable  Un/Reliable  SRTT  Un/Reliable  Flow Timer   Routes
Gi0/0/0                0      0/0          0/0          0      0/0          0            0
Gi0/0/1                1      0/0          0/0          1      0/0          50           0
R3#show ip eigrp border-routers
                    ^
% Invalid input detected at '^' marker.

R3#show ip eigrp border-routers
                ^
% Invalid input detected at '^' marker.


R3#show ipv6 eigrp neighbor
EIGRP-IPv6 Neighbors for AS(10)
H   Address               Interface          Hold Uptime   SRTT   RTO  Q  Seq
                                             (sec)         (ms)      Cnt Num
0   Link-local address:   Gi0/0/1             14 00:27:37    1   100  0  23
    FE80::4
R3#show ipv6 interface
GigabitEthernet0/0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::3
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:ACAD:2::2, subnet is 2001:DB8:ACAD:2::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::A
    FF02::1:FF00:2
    FF02::1:FF00:3
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 30000)
  ND advertised reachable time is 0 (unspecified)
  ND advertised retransmit interval is 0 (unspecified)
  ND router advertisements are sent every 200 seconds
  ND router advertisements live for 1800 seconds
  ND advertised default router preference is Medium
  Hosts use stateless autoconfig for addresses.
GigabitEthernet0/0/1 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::3
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:ACAD:3::1, subnet is 2001:DB8:ACAD:3::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::A
    FF02::1:FF00:1
    FF02::1:FF00:3
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
```

```
    ND DAD is enabled, number of DAD attempts: 1
    ND reachable time is 30000 milliseconds (using 30000)
    ND advertised reachable time is 0 (unspecified)
    ND advertised retransmit interval is 0 (unspecified)
    ND router advertisements are sent every 200 seconds
    ND router advertisements live for 1800 seconds
    ND advertised default router preference is Medium
    Hosts use stateless autoconfig for addresses.
Loopback0 is up, line protocol is up
    IPv6 is enabled, link-local address is FE80::3
    No Virtual link-local address(es):
    Global unicast address(es):
      2001:DB8:ACAD:C::1, subnet is 2001:DB8:ACAD:C::/64
    Joined group address(es):
      FF02::1
      FF02::2
      FF02::A
      FF02::1:FF00:1
      FF02::1:FF00:3
    MTU is 1514 bytes
    ICMP error messages limited to one every 100 milliseconds
    ICMP redirects are enabled
    ICMP unreachables are sent
    ND DAD is not supported
    ND reachable time is 30000 milliseconds (using 30000)
    ND advertised reachable time is 0 (unspecified)
    ND advertised retransmit interval is 0 (unspecified)
    ND router advertisements live for 1800 seconds
    ND advertised default router preference is Medium
    ND RAs are suppressed (periodic)
    Hosts use stateless autoconfig for addresses.
R3# show ip prot
*** IP Routing is NSF aware ***

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

Routing Protocol is "eigrp 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  Redistributing: bgp 200
  EIGRP-IPv4 Protocol for AS(1)
    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: 3.3.3.3
    Topology : 0 (base)
      Active Timer: 3 min
      Distance: internal 90 external 170
      Maximum path: 4
      Maximum hopcount 100
      Maximum metric variance 1

  Automatic Summarization: disabled
  Maximum path: 4
  Routing for Networks:
    10.0.0.4/30
    10.0.0.8/30
    192.168.2.0
  Passive Interface(s):
```

```
    Loopback0
  Routing Information Sources:
    Gateway         Distance      Last Update
    10.0.0.10            90         00:15:13
  Distance: internal 90 external 170

Routing Protocol is "bgp 200"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  IGP synchronization is disabled
  Automatic route summarization is disabled
  Redistributing: eigrp 1
  Neighbor(s):
    Address          FiltIn FiltOut DistIn DistOut Weight RouteMap
    10.0.0.5
    10.0.0.14
    2001:DB8:ACAD:4::2
  Maximum path: 1
  Routing Information Sources:
    Gateway         Distance      Last Update
    10.0.0.5             20         00:28:29
  Distance: external 20 internal 200 local 200

R3#show ipv6 prot
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "bgp 200"
  IGP synchronization is disabled
  Redistribution:
    Redistributing protocol connected
    Redistributing protocol eigrp 10
  Neighbor(s):
    Address                  FiltIn FiltOut Weight RoutemapIn RoutemapOut
    2001:DB8:ACAD:2::1
IPv6 Routing Protocol is "eigrp 10"
EIGRP-IPv6 Protocol for AS(10)
  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: 3.3.3.3
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1

  Interfaces:
    GigabitEthernet0/0/0
    GigabitEthernet0/0/1
    Loopback0 (passive)
  Redistribution:
    Redistributing protocol bgp 200 with metric 1000000 1 255 1 1500
R3# show ip bgp neighbor
BGP neighbor is 10.0.0.5,  remote AS 100, external link
  BGP version 4, remote router ID 2.2.2.2
  BGP state = Established, up for 00:30:02
  Last read 00:00:19, last write 00:00:04, 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:             17           3
     Keepalives:          25          34
     Route Refresh:        0           0
     Total:               43          38
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds

 For address family: IPv4 Unicast
  Session: 10.0.0.5
  BGP table version 22, neighbor version 22/0
  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:          10           4 (Consumes 480 bytes)
    Prefixes Total:            14           4
    Implicit Withdraw:          0           0
    Explicit Withdraw:          4           0
    Used as bestpath:         n/a           3
    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 10.0.0.5
  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: 10.0.0.6, Local port: 179
Foreign host: 10.0.0.5, Foreign port: 16694
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 0xB397E9):
Timer          Starts    Wakeups          Next
Retrans            42         0           0x0
TimeWait            0         0           0x0
AckHold            36        35           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: 2108471956  snduna: 2108473321  sndnxt: 2108473321
irs: 3641403094  rcvnxt: 3641403941


sndwnd:  15020  scale:        0  maxrcvwnd:  16384
rcvwnd:  15538  scale:        0  delrcvwnd:    846

SRTT: 996 ms, RTTO: 1027 ms, RTV: 31 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 1802164 ms, Sent idletime: 4921 ms, Receive idletime: 4719 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: 78 (out of order: 0), with data: 36, total data bytes: 846
Sent: 79 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 42, total data
bytes: 1364

 Packets received in fast path: 0, fast processed: 0, slow path: 0
 fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FE90517F600  FREE

BGP neighbor is 10.0.0.14,  remote AS 200, internal link
  BGP version 4, remote router ID 0.0.0.0
  BGP state = Idle
  Neighbor sessions:
    0 active, is not multisession capable (disabled)
    Stateful switchover support enabled: NO
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds

 For address family: IPv4 Unicast
  BGP table version 22, neighbor version 1/22
  Output queue size : 0
  Index 0, Advertise bit 0
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                Sent       Rcvd
  Prefix activity:             ----       ----
    Prefixes Current:             0          0
    Prefixes Total:               0          0
    Implicit Withdraw:            0          0
    Explicit Withdraw:            0          0
    Used as bestpath:           n/a          0
    Used as multipath:          n/a          0

                              Outbound   Inbound
  Local Policy Denied Prefixes:    --------    -------
    Total:                          0          0
  Number of NLRIs in the update sent: max 0, 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 10.0.0.14
  Connections established 0; 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
  No active TCP connection
```

```
BGP neighbor is 2001:DB8:ACAD:4::2,  remote AS 200, internal link
  BGP version 4, remote router ID 0.0.0.0
  BGP state = Idle
  Neighbor sessions:
    0 active, is not multisession capable (disabled)
    Stateful switchover support enabled: NO
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds

 For address family: IPv4 Unicast
  BGP table version 22, neighbor version 1/22
  Output queue size : 0
  Index 0, Advertise bit 0
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                Sent      Rcvd
  Prefix activity:              ----      ----
    Prefixes Current:              0         0
    Prefixes Total:                0         0
    Implicit Withdraw:             0         0
    Explicit Withdraw:             0         0
    Used as bestpath:            n/a         0
    Used as multipath:           n/a         0

                                Outbound   Inbound
  Local Policy Denied Prefixes:  --------   -------
    Total:                             0         0
  Number of NLRIs in the update sent: max 0, 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 2001:DB8:ACAD:4::2
  Connections established 0; 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
  No active TCP connection

R4 Config:

R4#show run
Building configuration...


Current configuration : 1998 bytes
!
! Last configuration change at 18:16:45 UTC Wed Jan 5 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 FDO210907U3
!
spanning-tree extend system-id
!
!
redundancy
 mode none
!
!
vlan internal allocation policy ascending
!
!
!
!
!
!
interface Loopback0
 ip address 192.168.3.1 255.255.255.252
 ipv6 address FE80::4 link-local
 ipv6 address 2001:DB8:ACAD:D::1/64
 ipv6 eigrp 10
!
interface GigabitEthernet0/0/0
 ip address 10.0.0.10 255.255.255.252
 negotiation auto
 ipv6 address FE80::4 link-local
 ipv6 address 2001:DB8:ACAD:3::2/64
 ipv6 eigrp 10
!
interface GigabitEthernet0/0/1
 ip address 10.0.0.13 255.255.255.252
 negotiation auto
 ipv6 address FE80::4 link-local
 ipv6 address 2001:DB8:ACAD:4::1/64
```

```
 ipv6 eigrp 10
!
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
!
interface Vlan1
 no ip address
 shutdown
!
!
router eigrp 1
 network 10.0.0.8 0.0.0.3
 network 10.0.0.12 0.0.0.3
 network 192.168.3.0
 passive-interface Loopback0
 eigrp router-id 4.4.4.4
!
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface GigabitEthernet0
!
!
ipv6 router eigrp 10
 passive-interface Loopback0
 eigrp 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

      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D EX     10.0.0.0/30 [170/26112] via 10.0.0.9, 00:30:06, GigabitEthernet0/0/0
D        10.0.0.4/30 [90/3072] via 10.0.0.9, 00:30:06, GigabitEthernet0/0/0
C        10.0.0.8/30 is directly connected, GigabitEthernet0/0/0
L        10.0.0.10/32 is directly connected, GigabitEthernet0/0/0
C        10.0.0.12/30 is directly connected, GigabitEthernet0/0/1
L        10.0.0.13/32 is directly connected, GigabitEthernet0/0/1
D        10.0.0.16/30 [90/3072] via 10.0.0.14, 00:20:11, GigabitEthernet0/0/1
D EX     10.0.0.20/30
           [170/26112] via 10.0.0.14, 00:18:13, GigabitEthernet0/0/1
      192.168.0.0/32 is subnetted, 1 subnets
D EX     192.168.0.1 [170/26112] via 10.0.0.9, 00:30:06, GigabitEthernet0/0/0
      192.168.1.0/30 is subnetted, 1 subnets
D EX     192.168.1.0 [170/26112] via 10.0.0.9, 00:30:06, GigabitEthernet0/0/0
      192.168.2.0/30 is subnetted, 1 subnets
D        192.168.2.0 [90/130816] via 10.0.0.9, 00:30:06, GigabitEthernet0/0/0
      192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.3.0/30 is directly connected, Loopback0
L        192.168.3.1/32 is directly connected, Loopback0
      192.168.4.0/30 is subnetted, 1 subnets
D        192.168.4.0 [90/130816] via 10.0.0.14, 00:21:27, GigabitEthernet0/0/1
      192.168.5.0/30 is subnetted, 1 subnets
D EX     192.168.5.0 [170/26112] via 10.0.0.14, 00:18:59, GigabitEthernet0/0/1
      192.168.6.0/32 is subnetted, 1 subnets
D EX     192.168.6.1 [170/26112] via 10.0.0.14, 00:17:28, GigabitEthernet0/0/1

R4#show ipv6 route
IPv6 Routing Table - default - 17 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:1::/64 [170/3072]
     via FE80::3, GigabitEthernet0/0/0
D   2001:DB8:ACAD:2::/64 [90/3072]
     via FE80::3, GigabitEthernet0/0/0
C   2001:DB8:ACAD:3::/64 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2001:DB8:ACAD:3::2/128 [0/0]
     via GigabitEthernet0/0/0, receive
C   2001:DB8:ACAD:4::/64 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2001:DB8:ACAD:4::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
D   2001:DB8:ACAD:5::/64 [90/3072]
     via FE80::5, GigabitEthernet0/0/1
EX  2001:DB8:ACAD:6::/64 [170/26112]
     via FE80::5, GigabitEthernet0/0/1
EX  2001:DB8:ACAD:A::1/128 [170/3072]
     via FE80::3, GigabitEthernet0/0/0
EX  2001:DB8:ACAD:B::/64 [170/3072]
     via FE80::3, GigabitEthernet0/0/0
D   2001:DB8:ACAD:C::/64 [90/130816]
     via FE80::3, GigabitEthernet0/0/0
C   2001:DB8:ACAD:D::/64 [0/0]
     via Loopback0, directly connected
L   2001:DB8:ACAD:D::1/128 [0/0]
     via Loopback0, receive
D   2001:DB8:ACAD:E::/64 [90/130816]
     via FE80::5, GigabitEthernet0/0/1
EX  2001:DB8:ACAD:F::/64 [170/26112]
     via FE80::5, GigabitEthernet0/0/1
EX  2001:DB8:ACAD:AA::1/128 [170/26112]
     via FE80::5, GigabitEthernet0/0/1
L   FF00::/8 [0/0]
     via Null0, receive
```

```
R4#show ip eigrp
% Incomplete command.

R4#show ip eigrp neighbors
EIGRP-IPv4 Neighbors for AS(1)
H   Address                 Interface           Hold Uptime   SRTT   RTO  Q  Seq
                                                (sec)         (ms)        Cnt Num
1   10.0.0.14               Gi0/0/1             10 00:21:53   1      100  0  7
0   10.0.0.9                Gi0/0/0             14 00:30:28   1      100  0  16
R4#show ip eigrp interface
EIGRP-IPv4 Interfaces for AS(1)
                              Xmit Queue   PeerQ       Mean  Pacing Time  Multicast    Pending
Interface            Peers  Un/Reliable  Un/Reliable  SRTT  Un/Reliable  Flow Timer   Routes
Gi0/0/0                1     0/0          0/0          1     0/0          50           0
Gi0/0/1                1     0/0          0/0          1     0/0          50           0
R4# show ipv6 interface
GigabitEthernet0/0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::4
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:ACAD:3::2, subnet is 2001:DB8:ACAD:3::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::A
    FF02::1:FF00:2
    FF02::1:FF00:4
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 30000)
  ND advertised reachable time is 0 (unspecified)
  ND advertised retransmit interval is 0 (unspecified)
  ND router advertisements are sent every 200 seconds
  ND router advertisements live for 1800 seconds
  ND advertised default router preference is Medium
  Hosts use stateless autoconfig for addresses.
GigabitEthernet0/0/1 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::4
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:ACAD:4::1, subnet is 2001:DB8:ACAD:4::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::A
    FF02::1:FF00:1
    FF02::1:FF00:4
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 30000)
  ND advertised reachable time is 0 (unspecified)
  ND advertised retransmit interval is 0 (unspecified)
  ND router advertisements are sent every 200 seconds
  ND router advertisements live for 1800 seconds
  ND advertised default router preference is Medium
  Hosts use stateless autoconfig for addresses.
Loopback0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::4
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:ACAD:D::1, subnet is 2001:DB8:ACAD:D::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::A
    FF02::1:FF00:1
```

```
    FF02::1:FF00:4
  MTU is 1514 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is not supported
  ND reachable time is 30000 milliseconds (using 30000)
  ND advertised reachable time is 0 (unspecified)
  ND advertised retransmit interval is 0 (unspecified)
  ND router advertisements live for 1800 seconds
  ND advertised default router preference is Medium
  ND RAs are suppressed (periodic)
  Hosts use stateless autoconfig for addresses.
R4#show ipv6 eigrp neighbor
EIGRP-IPv6 Neighbors for AS(10)
H   Address                 Interface        Hold Uptime   SRTT   RTO  Q  Seq
                                             (sec)         (ms)       Cnt Num
1   Link-local address:     Gi0/0/1           12 00:22:16    1   100  0  5
    FE80::5
0   Link-local address:     Gi0/0/0           13 00:30:48    5   100  0  15
    FE80::3
R4#show ipv6 eigrp border-routers
                        ^
% Invalid input detected at '^' marker.

R4#show ip prot
*** IP Routing is NSF aware ***

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

Routing Protocol is "eigrp 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP-IPv4 Protocol for AS(1)
    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: 4.4.4.4
    Topology : 0 (base)
      Active Timer: 3 min
      Distance: internal 90 external 170
      Maximum path: 4
      Maximum hopcount 100
      Maximum metric variance 1

  Automatic Summarization: disabled
  Maximum path: 4
  Routing for Networks:
    10.0.0.8/30
    10.0.0.12/30
    192.168.3.0
  Passive Interface(s):
    Loopback0
  Routing Information Sources:
    Gateway         Distance      Last Update
    10.0.0.9             90        00:18:20
    10.0.0.14            90        00:18:20
  Distance: internal 90 external 170
```

```
R4#    show ipv6 prot
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 10"
EIGRP-IPv6 Protocol for AS(10)
  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: 4.4.4.4
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1

  Interfaces:
    GigabitEthernet0/0/0
    GigabitEthernet0/0/1
    Loopback0 (passive)
  Redistribution:
    None

R5 Config:

R5#show run
Building configuration...


Current configuration : 2884 bytes
!
! Last configuration change at 18:41:41 UTC Wed Jan 5 2022
!
version 15.5
service timestamps debug datetime msec
service timestamps log datetime msec
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
!
!
!
!
!
!
!
!
!
!
!


!
```

```
!
!
login on-success log
ipv6 unicast-routing
!
!
!
!
!
!
!
subscriber templating
multilink bundle-name authenticated
!
!
!
crypto pki trustpoint TP-self-signed-3458782570
 enrollment selfsigned
 subject-name cn=IOS-Self-Signed-Certificate-3458782570
 revocation-check none
 rsakeypair TP-self-signed-3458782570
!
!
crypto pki certificate chain TP-self-signed-3458782570
license udi pid ISR4321/K9 sn FDO214421CH
!
spanning-tree extend system-id
!
!
redundancy
 mode none
!
!
vlan internal allocation policy ascending
!
!
!
!
!
!
interface Loopback0
 ip address 192.168.4.1 255.255.255.252
 ipv6 address FE80::5 link-local
 ipv6 address 2001:DB8:ACAD:E::1/64
 ipv6 eigrp 10
!
interface GigabitEthernet0/0/0
 ip address 10.0.0.14 255.255.255.252
 negotiation auto
 ipv6 address FE80::5 link-local
 ipv6 address 2001:DB8:ACAD:4::2/64
 ipv6 eigrp 10
!
interface GigabitEthernet0/0/1
 ip address 10.0.0.17 255.255.255.252
 negotiation auto
 ipv6 address FE80::5 link-local
 ipv6 address 2001:DB8:ACAD:5::1/64
 ipv6 eigrp 10
!
interface Serial0/1/0
!
interface Serial0/1/1
!
interface Service-Engine0/2/0
 no ip address
!
interface GigabitEthernet0
 vrf forwarding Mgmt-intf
 no ip address
 shutdown
 negotiation auto
!
```

```
interface Vlan1
 no ip address
 shutdown
!
!
router eigrp 1
 network 10.0.0.12 0.0.0.3
 network 10.0.0.16 0.0.0.3
 network 192.168.4.0
 redistribute bgp 200 metric 100000 1 255 1 1500
 passive-interface Loopback0
 eigrp router-id 5.5.5.5
!
router bgp 200
 bgp router-id 5.5.5.5
 bgp log-neighbor-changes
 neighbor 10.0.0.9 remote-as 200
 neighbor 10.0.0.9 update-source Loopback0
 neighbor 10.0.0.18 remote-as 100
 neighbor 2001:DB8:ACAD:3::1 remote-as 200
 neighbor 2001:DB8:ACAD:3::1 update-source Loopback0
 neighbor 2001:DB8:ACAD:5::2 remote-as 100
 !
 address-family ipv4
  redistribute eigrp 1
  neighbor 10.0.0.9 activate
  neighbor 10.0.0.18 activate
  neighbor 2001:DB8:ACAD:3::1 activate
  no neighbor 2001:DB8:ACAD:5::2 activate
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  redistribute eigrp 10
  neighbor 2001:DB8:ACAD:5::2 activate
 exit-address-family
!
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
!
!
ipv6 router eigrp 10
 passive-interface Loopback0
 eigrp router-id 5.5.5.5
 redistribute bgp 200 metric 100000 1 255 1 1500
!
!
!
!
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


      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D EX    10.0.0.0/30 [170/26368] via 10.0.0.13, 00:56:14, GigabitEthernet0/0/0
D       10.0.0.4/30 [90/3328] via 10.0.0.13, 00:56:14, GigabitEthernet0/0/0
D       10.0.0.8/30 [90/3072] via 10.0.0.13, 00:56:14, GigabitEthernet0/0/0
C       10.0.0.12/30 is directly connected, GigabitEthernet0/0/0
L       10.0.0.14/32 is directly connected, GigabitEthernet0/0/0
C       10.0.0.16/30 is directly connected, GigabitEthernet0/0/1
L       10.0.0.17/32 is directly connected, GigabitEthernet0/0/1
B       10.0.0.20/30 [20/0] via 10.0.0.18, 00:52:57
      192.168.0.0/32 is subnetted, 1 subnets
D EX    192.168.0.1 [170/26368] via 10.0.0.13, 00:56:14, GigabitEthernet0/0/0
      192.168.1.0/30 is subnetted, 1 subnets
D EX    192.168.1.0 [170/26368] via 10.0.0.13, 00:56:14, GigabitEthernet0/0/0
      192.168.2.0/30 is subnetted, 1 subnets
D       192.168.2.0 [90/131072] via 10.0.0.13, 00:56:14, GigabitEthernet0/0/0
      192.168.3.0/30 is subnetted, 1 subnets
D       192.168.3.0 [90/130816] via 10.0.0.13, 00:56:14, GigabitEthernet0/0/0
      192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/30 is directly connected, Loopback0
L       192.168.4.1/32 is directly connected, Loopback0
      192.168.5.0/30 is subnetted, 1 subnets
B       192.168.5.0 [20/0] via 10.0.0.18, 00:53:42
      192.168.6.0/32 is subnetted, 1 subnets
B       192.168.6.1 [20/2] via 10.0.0.18, 00:52:12
R5#                                              show ipv6 route
IPv6 Routing Table - default - 17 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:1::/64 [170/3328]
     via FE80::4, GigabitEthernet0/0/0
D   2001:DB8:ACAD:2::/64 [90/3328]
     via FE80::4, GigabitEthernet0/0/0
D   2001:DB8:ACAD:3::/64 [90/3072]
     via FE80::4, GigabitEthernet0/0/0
C   2001:DB8:ACAD:4::/64 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2001:DB8:ACAD:4::2/128 [0/0]
     via GigabitEthernet0/0/0, receive
C   2001:DB8:ACAD:5::/64 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2001:DB8:ACAD:5::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
B   2001:DB8:ACAD:6::/64 [20/0]
     via FE80::6, GigabitEthernet0/0/1
EX  2001:DB8:ACAD:A::1/128 [170/3328]
     via FE80::4, GigabitEthernet0/0/0
EX  2001:DB8:ACAD:B::/64 [170/3328]
     via FE80::4, GigabitEthernet0/0/0
D   2001:DB8:ACAD:C::/64 [90/131072]
     via FE80::4, GigabitEthernet0/0/0
D   2001:DB8:ACAD:D::/64 [90/130816]
     via FE80::4, GigabitEthernet0/0/0
C   2001:DB8:ACAD:E::/64 [0/0]
     via Loopback0, directly connected
L   2001:DB8:ACAD:E::1/128 [0/0]
     via Loopback0, receive
B   2001:DB8:ACAD:F::/64 [20/0]
     via FE80::6, GigabitEthernet0/0/1
B   2001:DB8:ACAD:AA::1/128 [20/1]
     via FE80::6, GigabitEthernet0/0/1
L   FF00::/8 [0/0]
     via Null0, receive
R5#show ip bgp
BGP table version is 14, local router ID is 5.5.5.5
```

```
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 10.0.0.0/30      10.0.0.13            26368         32768 ?
 *>i 10.0.0.4/30      10.0.0.13             3328         32768 ?
 *>i 10.0.0.8/30      10.0.0.13             3072         32768 ?
 *>  10.0.0.12/30     0.0.0.0                  0         32768 ?
 *   10.0.0.16/30     10.0.0.18                0             0 100 ?
 *>                   0.0.0.0                  0         32768 ?
 *>  10.0.0.20/30     10.0.0.18                0             0 100 ?
 *>i 192.168.0.1/32   10.0.0.13            26368         32768 ?
 *>i 192.168.1.0/30   10.0.0.13            26368         32768 ?
 *>i 192.168.2.0/30   10.0.0.13           131072         32768 ?
 *>i 192.168.3.0/30   10.0.0.13           130816         32768 ?
 *>  192.168.4.0/30   0.0.0.0                  0         32768 ?
 *>  192.168.5.0/30   10.0.0.18                0             0 100 ?
 *>  192.168.6.1/32   10.0.0.18                2             0 100 ?
R5# show bgp ipv6
BGP table version is 39, local router ID is 5.5.5.5
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:1::/64
                      FE80::4               3328         32768 ?
 *>i 2001:DB8:ACAD:2::/64
                      FE80::4               3328         32768 ?
 *>i 2001:DB8:ACAD:3::/64
                      FE80::4               3072         32768 ?
 *>  2001:DB8:ACAD:4::/64
                      ::                       0         32768 ?
 *   2001:DB8:ACAD:5::/64
                   2001:DB8:ACAD:5::2
                                            0             0 100 ?
 *>                   ::                      0         32768 ?
 *>  2001:DB8:ACAD:6::/64
                   2001:DB8:ACAD:5::2
                                            0             0 100 ?
     Network          Next Hop            Metric LocPrf Weight Path
 *>i 2001:DB8:ACAD:A::1/128
                      FE80::4               3328         32768 ?
 *>i 2001:DB8:ACAD:B::/64
                      FE80::4               3328         32768 ?
 *>i 2001:DB8:ACAD:C::/64
                      FE80::4             131072         32768 ?
 *>i 2001:DB8:ACAD:D::/64
                      FE80::4             130816         32768 ?
 *>  2001:DB8:ACAD:E::/64
                      ::                       0         32768 ?
 *>  2001:DB8:ACAD:F::/64
                   2001:DB8:ACAD:5::2
                                            0             0 100 ?
 *>  2001:DB8:ACAD:AA::1/128
                   2001:DB8:ACAD:5::2
                                            1             0 100 ?
% NOTE: This command is deprecated. Please use 'show bgp ipv6 unicast'
R5#show ip bgp neighbors
BGP neighbor is 10.0.0.9,  remote AS 200, internal link
  BGP version 4, remote router ID 0.0.0.0
  BGP state = Idle
  Neighbor sessions:
    0 active, is not multisession capable (disabled)
    Stateful switchover support enabled: NO
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds
```

```
 For address family: IPv4 Unicast
  BGP table version 14, neighbor version 1/14
  Output queue size : 0
  Index 0, Advertise bit 0
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                Sent       Rcvd
  Prefix activity:              ----       ----
    Prefixes Current:              0          0
    Prefixes Total:                0          0
    Implicit Withdraw:             0          0
    Explicit Withdraw:             0          0
    Used as bestpath:            n/a          0
    Used as multipath:           n/a          0

                             Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Total:                              0          0
  Number of NLRIs in the update sent: max 0, 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 10.0.0.9
  Connections established 0; 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
  No active TCP connection

 BGP neighbor is 10.0.0.18,  remote AS 100, external link
   BGP version 4, remote router ID 6.6.6.6
   BGP state = Established, up for 00:55:18
   Last read 00:00:35, 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 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:           7          4
     Keepalives:       61         60
     Route Refresh:     0          0
     Total:            69         65
   Do log neighbor state changes (via global configuration)
   Default minimum time between advertisement runs is 30 seconds

  For address family: IPv4 Unicast
   Session: 10.0.0.18
   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:                10         4 (Consumes 480 bytes)
    Prefixes Total:                  10         4
    Implicit Withdraw:                0         0
    Explicit Withdraw:                0         0
    Used as bestpath:               n/a        3
    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 3, 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 10.0.0.18
  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: 10.0.0.17, Local port: 179
Foreign host: 10.0.0.18, Foreign port: 31695
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 0x369C11):
Timer          Starts    Wakeups          Next
Retrans            63         0           0x0
TimeWait            0         0           0x0
AckHold            64        63           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:  198311293  snduna:  198312883  sndnxt:  198312883
irs:  355780732  rcvnxt:  355782123


sndwnd:  16270  scale:      0  maxrcvwnd:  16384
rcvwnd:  14994  scale:      0  delrcvwnd:  1390

SRTT: 1000 ms, RTTO: 1003 ms, RTV: 3 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 3318018 ms, Sent idletime: 35564 ms, Receive idletime: 35764 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: 128 (out of order: 0), with data: 64, total data bytes: 1390
```

```
  Sent: 128 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 63, total data
bytes: 1589

 Packets received in fast path: 0, fast processed: 0, slow path: 0
 fast lock acquisition failures: 0, slow path: 0
TCP Semaphore       0x7FE18AE09620  FREE

BGP neighbor is 2001:DB8:ACAD:3::1,  remote AS 200, internal link
  BGP version 4, remote router ID 0.0.0.0
  BGP state = Idle
  Neighbor sessions:
    0 active, is not multisession capable (disabled)
    Stateful switchover support enabled: NO
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 0 seconds

 For address family: IPv4 Unicast
  BGP table version 14, neighbor version 1/14
  Output queue size : 0
  Index 0, Advertise bit 0
  Slow-peer detection is disabled
  Slow-peer split-update-group dynamic is disabled
                                Sent       Rcvd
  Prefix activity:              ----       ----
    Prefixes Current:              0          0
    Prefixes Total:                0          0
    Implicit Withdraw:             0          0
    Explicit Withdraw:             0          0
    Used as bestpath:            n/a          0
    Used as multipath:           n/a          0

                               Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Total:                             0          0
  Number of NLRIs in the update sent: max 0, 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 2001:DB8:ACAD:3::1
  Connections established 0; 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
  No active TCP connection

R5#$                              show bgp ipv6 unicast neighbors
BGP neighbor is 2001:DB8:ACAD:5::2,  remote AS 100, external link
  BGP version 4, remote router ID 6.6.6.6
  BGP state = Established, up for 00:55:33
  Last read 00:00:03, 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:                  17           5
    Keepalives:               62          61
    Route Refresh:             0           0
    Total:                    80          67
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds

 For address family: IPv6 Unicast
  Session: 2001:DB8:ACAD:5::2
  BGP table version 39, neighbor version 39/0
  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:            10           4 (Consumes 576 bytes)
    Prefixes Total:              31           8
    Implicit Withdraw:           21           4
    Explicit Withdraw:            0           0
    Used as bestpath:           n/a          3
    Used as multipath:          n/a          0

                               Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Bestpath from this peer:         7          n/a
    Total:                           7            0
  Number of NLRIs in the update sent: max 4, 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 2001:DB8:ACAD:5::2
  Connections established 1; dropped 0
  Last reset never
  External BGP neighbor configured for connected checks (single-hop no-disable-connected-check)
  Interface associated: GigabitEthernet0/0/1 (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: 2001:DB8:ACAD:5::1, Local port: 24000
Foreign host: 2001:DB8:ACAD:5::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 0x36DCF2):
Timer          Starts    Wakeups          Next
Retrans            67         0           0x0
TimeWait            0         0           0x0
AckHold            65        60           0x0
SendWnd             0         0           0x0
KeepAlive           0         0           0x0
GiveUp              0         0           0x0
PmtuAger         2460      2459        0x36DD51
DeadWait            0         0           0x0
Linger              0         0           0x0
```

```
ProcessQ                0         0            0x0

iss: 3944683959  snduna: 3944686855  sndnxt: 3944686855
irs: 2945266886  rcvnxt: 2945268552

sndwnd: 16384  scale:      0  maxrcvwnd:  16384
rcvwnd: 16251  scale:      0  delrcvwnd:    133

SRTT: 1000 ms, RTTO: 1003 ms, RTV: 3 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 3333094 ms, Sent idletime: 3020 ms, Receive idletime: 3220 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6

Datagrams (max data segment is 1440 bytes):
Rcvd: 133 (out of order: 0), with data: 66, total data bytes: 1665
Sent: 132 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 132, total data
bytes: 8183

 Packets received in fast path: 0, fast processed: 0, slow path: 0
 fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FE18AE096E0  FREE


R5# show ip eigrp neighbor
EIGRP-IPv4 Neighbors for AS(1)
H   Address                Interface          Hold Uptime   SRTT   RTO  Q  Seq
                                              (sec)         (ms)        Cnt Num
0   10.0.0.13              Gi0/0/0            12 00:57:10    1      100  0  25
R5#show ip eigrp interface
EIGRP-IPv4 Interfaces for AS(1)
                          Xmit Queue   PeerQ        Mean  Pacing Time  Multicast    Pending
Interface        Peers  Un/Reliable  Un/Reliable  SRTT  Un/Reliable  Flow Timer   Routes
Gi0/0/0            1       0/0          0/0          1      0/0           50          0
Gi0/0/1            0       0/0          0/0          0      0/0            0          0
R5#show ipv6 eigrp neighbor
EIGRP-IPv6 Neighbors for AS(10)
H   Address                Interface          Hold Uptime   SRTT   RTO  Q  Seq
                                              (sec)         (ms)        Cnt Num
0   Link-local address:    Gi0/0/0            10 00:57:13   156    936  0  25
    FE80::4
R5#show ip eigrp interface
EIGRP-IPv4 Interfaces for AS(1)
                          Xmit Queue   PeerQ        Mean  Pacing Time  Multicast    Pending
Interface        Peers  Un/Reliable  Un/Reliable  SRTT  Un/Reliable  Flow Timer   Routes
Gi0/0/0            1       0/0          0/0          1      0/0           50          0
Gi0/0/1            0       0/0          0/0          0      0/0            0          0
R5#show ip prot
*** IP Routing is NSF aware ***

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

Routing Protocol is "eigrp 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  Redistributing: bgp 200
  EIGRP-IPv4 Protocol for AS(1)
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
    Soft SIA disabled
    NSF-aware route hold timer is 240

R5#show ipv6 prot
```

```
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "bgp 200"
  IGP synchronization is disabled
  Redistribution:
    Redistributing protocol connected
    Redistributing protocol eigrp 10
  Neighbor(s):
    Address                 FiltIn FiltOut Weight RoutemapIn RoutemapOut
    2001:DB8:ACAD:5::2
IPv6 Routing Protocol is "eigrp 10"
EIGRP-IPv6 Protocol for AS(10)
  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: 5.5.5.5
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1

  Interfaces:
    GigabitEthernet0/0/0
    GigabitEthernet0/0/1
    Loopback0 (passive)
  Redistribution:
    Redistributing protocol bgp 200 with metric 100000 1 255 1 1500

R6 Config:

R6#show run
Building configuration...


Current configuration : 2729 bytes
!
! Last configuration change at 19:22:03 UTC Wed Jan 5 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 system flash bootflash:isr4300-universalk9.16.09.08.SPA.bin
boot-end-marker
!
!
vrf definition Mgmt-intf
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
!
no aaa new-model
!
!
!
!
!
!
!
```

```
!
!
!
!


!
ip dhcp pool webuidhcp
!
!
!
login on-success log
ipv6 unicast-routing
!
!
!
!
!
!
!
subscriber templating
multilink bundle-name authenticated
!
!
!
crypto pki trustpoint TP-self-signed-3632327409
 enrollment selfsigned
 subject-name cn=IOS-Self-Signed-Certificate-3632327409
 revocation-check none
 rsakeypair TP-self-signed-3632327409
!
!
crypto pki certificate chain TP-self-signed-3632327409
license udi pid ISR4321/K9 sn FDO214414VU
!
spanning-tree extend system-id
!
!
redundancy
 mode none
!
!
vlan internal allocation policy ascending
!
!
!
!
!
!
interface Loopback0
 ip address 192.168.5.1 255.255.255.252
 ipv6 address FE80::6 link-local
 ipv6 address 2001:DB8:ACAD:F::1/64
 ipv6 ospf 10 area 1
!
interface GigabitEthernet0/0/0
 ip address 10.0.0.18 255.255.255.252
 negotiation auto
 ipv6 address FE80::6 link-local
 ipv6 address 2001:DB8:ACAD:5::2/64
 ipv6 ospf 10 area 1
!
interface GigabitEthernet0/0/1
 ip address 10.0.0.21 255.255.255.252
 negotiation auto
 ipv6 address FE80::6 link-local
 ipv6 address 2001:DB8:ACAD:6::1/64
 ipv6 ospf 10 area 1
!
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 1
 router-id 6.6.6.6
 redistribute bgp 100 metric 100000 subnets
 passive-interface Loopback0
 network 10.0.0.16 0.0.0.3 area 1
 network 10.0.0.20 0.0.0.3 area 1
 network 192.168.5.0 0.0.0.255 area 1
!
router bgp 100
 bgp router-id 6.6.6.6
 bgp log-neighbor-changes
 neighbor 10.0.0.17 remote-as 200
 neighbor 2001:DB8:ACAD:5::1 remote-as 200
 !
 address-family ipv4
  redistribute connected
  redistribute ospf 1
  neighbor 10.0.0.17 activate
  no neighbor 2001:DB8:ACAD:5::1 activate
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  redistribute ospf 10
  neighbor 2001:DB8:ACAD:5::1 activate
 exit-address-family
!
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
!
!
ipv6 router ospf 10
 router-id 6.6.6.6
 passive-interface Loopback0
 redistribute bgp 100 metric 1000000
!
!
!
!
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


      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
B        10.0.0.0/30 [20/26368] via 10.0.0.17, 00:55:50
B        10.0.0.4/30 [20/3328] via 10.0.0.17, 00:55:50
B        10.0.0.8/30 [20/3072] via 10.0.0.17, 00:55:50
B        10.0.0.12/30 [20/0] via 10.0.0.17, 00:55:50
C        10.0.0.16/30 is directly connected, GigabitEthernet0/0/0
L        10.0.0.18/32 is directly connected, GigabitEthernet0/0/0
C        10.0.0.20/30 is directly connected, GigabitEthernet0/0/1
L        10.0.0.21/32 is directly connected, GigabitEthernet0/0/1
      192.168.0.0/32 is subnetted, 1 subnets
B        192.168.0.1 [20/26368] via 10.0.0.17, 00:55:50
      192.168.1.0/30 is subnetted, 1 subnets
B        192.168.1.0 [20/26368] via 10.0.0.17, 00:55:50
      192.168.2.0/30 is subnetted, 1 subnets
B        192.168.2.0 [20/131072] via 10.0.0.17, 00:55:50
      192.168.3.0/30 is subnetted, 1 subnets
B        192.168.3.0 [20/130816] via 10.0.0.17, 00:55:50
      192.168.4.0/30 is subnetted, 1 subnets
B        192.168.4.0 [20/0] via 10.0.0.17, 00:55:50
      192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.5.0/30 is directly connected, Loopback0
L        192.168.5.1/32 is directly connected, Loopback0
      192.168.6.0/32 is subnetted, 1 subnets
O        192.168.6.1 [110/2] via 10.0.0.22, 00:54:20, GigabitEthernet0/0/1
R6#                              show ipv6 route
IPv6 Routing Table - default - 17 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:1::/64 [20/3328]
     via FE80::5, GigabitEthernet0/0/0
B   2001:DB8:ACAD:2::/64 [20/3328]
     via FE80::5, GigabitEthernet0/0/0
B   2001:DB8:ACAD:3::/64 [20/3072]
     via FE80::5, GigabitEthernet0/0/0
B   2001:DB8:ACAD:4::/64 [20/0]
     via FE80::5, GigabitEthernet0/0/0
C   2001:DB8:ACAD:5::/64 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2001:DB8:ACAD:5::2/128 [0/0]
     via GigabitEthernet0/0/0, receive
C   2001:DB8:ACAD:6::/64 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2001:DB8:ACAD:6::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
B   2001:DB8:ACAD:A::1/128 [20/3328]
     via FE80::5, GigabitEthernet0/0/0
B   2001:DB8:ACAD:B::/64 [20/3328]
     via FE80::5, GigabitEthernet0/0/0
B   2001:DB8:ACAD:C::/64 [20/131072]
     via FE80::5, GigabitEthernet0/0/0
B   2001:DB8:ACAD:D::/64 [20/130816]
     via FE80::5, GigabitEthernet0/0/0
B   2001:DB8:ACAD:E::/64 [20/0]
     via FE80::5, GigabitEthernet0/0/0
C   2001:DB8:ACAD:F::/64 [0/0]
     via Loopback0, directly connected
L   2001:DB8:ACAD:F::1/128 [0/0]
     via Loopback0, receive
O   2001:DB8:ACAD:AA::1/128 [110/1]
     via FE80::7, GigabitEthernet0/0/1
L   FF00::/8 [0/0]
     via Null0, receive
R6#                       show ip bgp
```

```
BGP table version is 14, local router ID is 6.6.6.6
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
 *>  10.0.0.0/30      10.0.0.17          26368             0 200 ?
 *>  10.0.0.4/30      10.0.0.17           3328             0 200 ?
 *>  10.0.0.8/30      10.0.0.17           3072             0 200 ?
 *>  10.0.0.12/30     10.0.0.17              0             0 200 ?
 *   10.0.0.16/30     10.0.0.17              0             0 200 ?
 *>                   0.0.0.0                0         32768 ?
 *>  10.0.0.20/30     0.0.0.0                0         32768 ?
 *>  192.168.0.1/32   10.0.0.17          26368             0 200 ?
 *>  192.168.1.0/30   10.0.0.17          26368             0 200 ?
 *>  192.168.2.0/30   10.0.0.17         131072             0 200 ?
 *>  192.168.3.0/30   10.0.0.17         130816             0 200 ?
 *>  192.168.4.0/30   10.0.0.17              0             0 200 ?
 *>  192.168.5.0/30   0.0.0.0                0         32768 ?
 *>  192.168.6.1/32   10.0.0.22              2         32768 ?
R6#show bgp ipv7
              ^
% Invalid input detected at '^' marker.

R6#show bgp ipv6
BGP table version is 38, local router ID is 6.6.6.6
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:1::/64
                      2001:DB8:ACAD:5::1
                                          3328             0 200 ?
 *>  2001:DB8:ACAD:2::/64
                      2001:DB8:ACAD:5::1
                                          3328             0 200 ?
 *>  2001:DB8:ACAD:3::/64
                      2001:DB8:ACAD:5::1
                                          3072             0 200 ?
 *>  2001:DB8:ACAD:4::/64
                      2001:DB8:ACAD:5::1
                                             0             0 200 ?
 *>  2001:DB8:ACAD:5::/64
                      ::                     0         32768 ?
 *                    2001:DB8:ACAD:5::1
     Network          Next Hop          Metric LocPrf Weight Path
                                             0             0 200 ?
 *>  2001:DB8:ACAD:6::/64
                      ::                     0         32768 ?
 *>  2001:DB8:ACAD:A::1/128
                      2001:DB8:ACAD:5::1
                                          3328             0 200 ?
 *>  2001:DB8:ACAD:B::/64
                      2001:DB8:ACAD:5::1
                                          3328             0 200 ?
 *>  2001:DB8:ACAD:C::/64
                      2001:DB8:ACAD:5::1
                                        131072             0 200 ?
 *>  2001:DB8:ACAD:D::/64
                      2001:DB8:ACAD:5::1
                                        130816             0 200 ?
 *>  2001:DB8:ACAD:E::/64
                      2001:DB8:ACAD:5::1
                                             0             0 200 ?
 *>  2001:DB8:ACAD:F::/64
                      ::                     0         32768 ?
 *>  2001:DB8:ACAD:AA::1/128
                      FE80::7                1         32768 ?
```

```
     Network          Next Hop          Metric LocPrf Weight Path
% NOTE: This command is deprecated. Please use 'show bgp ipv6 unicast'
R6#   show ip bgp neighbors
BGP neighbor is 10.0.0.17,  remote AS 200, external link
  BGP version 4, remote router ID 5.5.5.5
  BGP state = Established, up for 00:57:22
  Last read 00:00:57, 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 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:            4          7
    Keepalives:        62         63
    Route Refresh:      0          0
    Total:             67         71
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds

 For address family: IPv4 Unicast
  Session: 10.0.0.17
  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:           4         10 (Consumes 1200 bytes)
    Prefixes Total:             4         10
    Implicit Withdraw:          0          0
    Explicit Withdraw:          0          0
    Used as bestpath:         n/a          9
    Used as multipath:        n/a          0

                            Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Bestpath from this peer:        9        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 10.0.0.17
  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: 10.0.0.18, Local port: 31695
Foreign host: 10.0.0.17, 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 0x38A904):
Timer          Starts    Wakeups          Next
Retrans            68          1           0x0
TimeWait            0          0           0x0
AckHold            65         62           0x0
SendWnd             0          0           0x0
KeepAlive           0          0           0x0
GiveUp              0          0           0x0
PmtuAger         2557       2556       0x38A9A6
DeadWait            0          0           0x0
Linger              0          0           0x0
ProcessQ            0          0           0x0

iss:  355780732  snduna:  355782161  sndnxt:  355782161
irs:  198311293  rcvnxt:  198312921

sndwnd:  14956  scale:      0  maxrcvwnd:  16384
rcvwnd:  16232  scale:      0  delrcvwnd:    152

SRTT: 1000 ms, RTTO: 1003 ms, RTV: 3 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 3444929 ms, Sent idletime: 42879 ms, Receive idletime: 42678 ms
Status Flags: active open
Option Flags: nagle, path mtu capable
IP Precedence value : 6

Datagrams (max data segment is 1460 bytes):
Rcvd: 132 (out of order: 0), with data: 65, total data bytes: 1627
Sent: 132 (retransmit: 1, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 66, total data
bytes: 1428

 Packets received in fast path: 0, fast processed: 0, slow path: 0
 fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FF2BE8EBE48  FREE

R6#$                                show bgp ipv6 unicast neighbors
BGP neighbor is 2001:DB8:ACAD:5::1,  remote AS 200, external link
  BGP version 4, remote router ID 5.5.5.5
  BGP state = Established, up for 00:57:31
  Last read 00:00:11, last write 00:00:20, 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         17
    Keepalives:       63         64
    Route Refresh:     0          0
    Total:            69         82
  Do log neighbor state changes (via global configuration)
  Default minimum time between advertisement runs is 30 seconds

 For address family: IPv6 Unicast
  Session: 2001:DB8:ACAD:5::1
```

```
  BGP table version 38, neighbor version 38/0
  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:             4         10 (Consumes 1440 bytes)
    Prefixes Total:               8         31
    Implicit Withdraw:            4         21
    Explicit Withdraw:            0          0
    Used as bestpath:           n/a          9
    Used as multipath:          n/a          0

                                 Outbound   Inbound
  Local Policy Denied Prefixes:  --------   -------
    Bestpath from this peer:        29        n/a
    Total:                          29          0
  Number of NLRIs in the update sent: max 3, 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 2001:DB8:ACAD:5::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: 2001:DB8:ACAD:5::2, Local port: 179
Foreign host: 2001:DB8:ACAD:5::1, Foreign port: 24000
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 0x38CF34):
Timer          Starts    Wakeups          Next
Retrans            67         0           0x0
TimeWait            0         0           0x0
AckHold            68        64           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: 2945266886  snduna: 2945268590  sndnxt: 2945268590
irs: 3944683959  rcvnxt: 3944686893

sndwnd:  16213  scale:      0  maxrcvwnd:  16384
rcvwnd:  16346  scale:      0  delrcvwnd:     38

SRTT: 1000 ms, RTTO: 1003 ms, RTV: 3 ms, KRTT: 0 ms
minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms
uptime: 3451163 ms, Sent idletime: 11020 ms, Receive idletime: 11220 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: 136 (out of order: 0), with data: 69, total data bytes: 2933
Sent: 137 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 137, total data
bytes: 7191

 Packets received in fast path: 0, fast processed: 0, slow path: 0
 fast lock acquisition failures: 0, slow path: 0
TCP Semaphore      0x7FF2BE8EBD88  FREE

R6#$                                              show ip bgp summary
BGP router identifier 6.6.6.6, local AS number 100
BGP table version is 14, main routing table version 14
13 network entries using 3224 bytes of memory
14 path entries using 1680 bytes of memory
8/8 BGP path/bestpath attribute entries using 1984 bytes of memory
1 BGP AS-PATH entries using 24 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 6912 total bytes of memory
BGP activity 26/0 prefixes, 28/0 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.17       4          200      72      68       14    0    0 00:57:41        10
R6#            show bgp ipv6 unicast summary
BGP router identifier 6.6.6.6, local AS number 100
BGP table version is 38, main routing table version 38
13 network entries using 3536 bytes of memory
14 path entries using 2016 bytes of memory
7/7 BGP path/bestpath attribute entries using 1736 bytes of memory
1 BGP AS-PATH entries using 24 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 7312 total bytes of memory
BGP activity 26/0 prefixes, 28/0 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
2001:DB8:ACAD:5::1
                4          200      82      69       38    0    0 00:57:47        10
R6#show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
7.7.7.7           1   FULL/DR         00:00:31    10.0.0.22       GigabitEthernet0/0/1
R6#show ip ospf
 Routing Process "ospf 1" with ID 6.6.6.6
 Start time: 00:03:44.756, Time elapsed: 00:58:41.520
 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,
    bgp 100 with metric mapped to 100000, includes subnets in redistribution
 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 9. Checksum Sum 0x02D7EF
 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 3 (1 loopback)
        Area has no authentication
        SPF algorithm last executed 00:55:15.480 ago
        SPF algorithm executed 4 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x021203
        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

R6#             show ip ospf interface
Loopback0 is up, line protocol is up
  Internet Address 192.168.5.1/30, Area 1, Attached via Network Statement
  Process ID 1, Router ID 6.6.6.6, Network Type LOOPBACK, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0           1        no          no            Base
  Loopback interface is treated as a stub Host
GigabitEthernet0/0/1 is up, line protocol is up
  Internet Address 10.0.0.21/30, Area 1, Attached via Network Statement
  Process ID 1, Router ID 6.6.6.6, 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) 7.7.7.7, Interface address 10.0.0.22
  Backup Designated router (ID) 6.6.6.6, Interface address 10.0.0.21
  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 10, maximum is 10
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 7.7.7.7  (Designated Router)
  Suppress hello for 0 neighbor(s)
GigabitEthernet0/0/0 is up, line protocol is up
  Internet Address 10.0.0.18/30, Area 1, Attached via Network Statement
  Process ID 1, Router ID 6.6.6.6, 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) 6.6.6.6, Interface address 10.0.0.18
  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 1/1/1, 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)
R6#$                                  show ip ospf border-routers

            OSPF Router with ID (6.6.6.6) (Process ID 1)


                Base Topology (MTID 0)
```

```
Internal Router Routing Table
Codes: i - Intra-area route, I - Inter-area route


R6#show ipv6 ospf neighbor

            OSPFv3 Router with ID (6.6.6.6) (Process ID 10)


Neighbor ID     Pri   State          Dead Time   Interface ID   Interface
7.7.7.7          1    FULL/DR        00:00:39    6              GigabitEthernet0/0/1
R6#    show ipv6 ospf
 Routing Process "ospfv3 10" with ID 6.6.6.6
 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,
    bgp 100 with metric 1000000
 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
 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
 Retransmission limit dc 24 non-dc 24
 EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300
 Number of external LSA 9. Checksum Sum 0x0397BD
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Graceful restart helper support enabled
 Reference bandwidth unit is 100 mbps
 RFC1583 compatibility enabled
    Area 1
        Number of interfaces in this area is 3
        SPF algorithm executed 2 times
        Number of LSA 9. Checksum Sum 0x03523B
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R6#      show ipv6 ospf interface
Loopback0 is up, line protocol is up
  Link Local Address FE80::6, Interface ID 12
  Area 1, Process ID 10, Instance ID 0, Router ID 6.6.6.6
  Network Type LOOPBACK, Cost: 1
  Loopback interface is treated as a stub Host
GigabitEthernet0/0/1 is up, line protocol is up
  Link Local Address FE80::6, Interface ID 7
  Area 1, Process ID 10, Instance ID 0, Router ID 6.6.6.6
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 7.7.7.7, local address FE80::7
  Backup Designated router (ID) 6.6.6.6, local address FE80::6
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:09
  Graceful restart helper support enabled
  Index 1/3/3, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 2, maximum is 10
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 7.7.7.7  (Designated Router)
  Suppress hello for 0 neighbor(s)
GigabitEthernet0/0/0 is up, line protocol is up
  Link Local Address FE80::6, Interface ID 6
  Area 1, Process ID 10, Instance ID 0, Router ID 6.6.6.6
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 6.6.6.6, local address FE80::6
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
```

```
    Hello due in 00:00:08
  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 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)
R6#       show ipv6 ospf border-routers

            OSPFv3 Router with ID (6.6.6.6) (Process ID 10)

Codes: i - Intra-area route, I - Inter-area route

R6#  show ip prot
*** IP Routing is NSF aware ***

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

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 6.6.6.6
  It is an autonomous system boundary router
 Redistributing External Routes from,
    bgp 100 with metric mapped to 100000, includes subnets in redistribution
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.0.0.16 0.0.0.3 area 1
    10.0.0.20 0.0.0.3 area 1
    192.168.5.0 0.0.0.255 area 1
  Passive Interface(s):
    Loopback0
  Routing Information Sources:
    Gateway         Distance      Last Update
    7.7.7.7              110       00:55:53
  Distance: (default is 110)

Routing Protocol is "bgp 100"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  IGP synchronization is disabled
  Automatic route summarization is disabled
  Redistributing: connected, ospf 1 (internal)

  Neighbor(s):
    Address          FiltIn FiltOut DistIn DistOut Weight RouteMap
    10.0.0.17
  Maximum path: 1
  Routing Information Sources:
    Gateway         Distance      Last Update
    Gateway         Distance      Last Update
    10.0.0.17            20        00:57:24
  Distance: external 20 internal 200 local 200

R6#          show ipv6 prot
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "ospf 10"
  Router ID 6.6.6.6
  Autonomous system boundary router
  Number of areas: 1 normal, 0 stub, 0 nssa
```

```
  Interfaces (Area 1):
    Loopback0
    GigabitEthernet0/0/1
    GigabitEthernet0/0/0
  Redistribution:
    Redistributing protocol bgp 100 with metric 1000000
IPv6 Routing Protocol is "bgp 100"
  IGP synchronization is disabled
  Redistribution:
    Redistributing protocol connected
    Redistributing protocol ospf 10 (internal)
  Neighbor(s):
    Address                    FiltIn FiltOut Weight RoutemapIn RoutemapOut
    2001:DB8:ACAD:5::1
R6#

R7 Config:

R6#show run
Building configuration...


Current configuration : 1813 bytes
!
! Last configuration change at 18:34:57 UTC Wed Jan 5 2022
!
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 FDO21442167
!
spanning-tree extend system-id
!
!
redundancy
 mode none
!
!
vlan internal allocation policy ascending
!
!
!
!
!
!
interface Loopback0
 ip address 192.168.6.1 255.255.255.252
```

```
 ipv6 address FE80::7 link-local
 ipv6 address 2001:DB8:ACAD:AA::1/64
 ipv6 ospf 10 area 1
!
interface GigabitEthernet0/0/0
 ip address 10.0.0.22 255.255.255.252
 negotiation auto
 ipv6 address FE80::7 link-local
 ipv6 address 2001:DB8:ACAD:6::2/64
 ipv6 ospf 10 area 1
!
interface GigabitEthernet0/0/1
 no ip address
 shutdown
 negotiation auto
 ipv6 address FE80::7 link-local
 ipv6 address 2001:DB8:ACAD:7::1/64
!
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 1
 router-id 7.7.7.7
 passive-interface Loopback0
 network 10.0.0.20 0.0.0.3 area 1
 network 192.168.6.0 0.0.0.255 area 1
!
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface GigabitEthernet0
!
!
ipv6 router ospf 10
 router-id 7.7.7.7
 passive-interface Loopback0
!
!
!
!
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

      10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks
O E2    10.0.0.0/30
           [110/100000] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
O E2    10.0.0.4/30
           [110/100000] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
O E2    10.0.0.8/30
           [110/100000] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
O E2    10.0.0.12/30
           [110/100000] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
O       10.0.0.16/30 [110/2] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
C       10.0.0.20/30 is directly connected, GigabitEthernet0/0/0
L       10.0.0.22/32 is directly connected, GigabitEthernet0/0/0
      192.168.0.0/32 is subnetted, 1 subnets
O E2    192.168.0.1
           [110/100000] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
      192.168.1.0/30 is subnetted, 1 subnets
O E2    192.168.1.0
           [110/100000] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
      192.168.2.0/30 is subnetted, 1 subnets
O E2    192.168.2.0
           [110/100000] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
      192.168.3.0/30 is subnetted, 1 subnets
O E2    192.168.3.0
           [110/100000] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
      192.168.4.0/30 is subnetted, 1 subnets
O E2    192.168.4.0
           [110/100000] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
      192.168.5.0/32 is subnetted, 1 subnets
O       192.168.5.1 [110/2] via 10.0.0.21, 00:56:39, GigabitEthernet0/0/0
      192.168.6.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.6.0/30 is directly connected, Loopback0
L       192.168.6.1/32 is directly connected, Loopback0
R7#          show ipv6 route
IPv6 Routing Table - default - 16 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
OE2 2001:DB8:ACAD:1::/64 [110/1000000]
     via FE80::6, GigabitEthernet0/0/0
OE2 2001:DB8:ACAD:2::/64 [110/1000000]
     via FE80::6, GigabitEthernet0/0/0
OE2 2001:DB8:ACAD:3::/64 [110/1000000]
     via FE80::6, GigabitEthernet0/0/0
OE2 2001:DB8:ACAD:4::/64 [110/1000000]
     via FE80::6, GigabitEthernet0/0/0
O   2001:DB8:ACAD:5::/64 [110/2]
     via FE80::6, GigabitEthernet0/0/0
C   2001:DB8:ACAD:6::/64 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2001:DB8:ACAD:6::2/128 [0/0]
     via GigabitEthernet0/0/0, receive
OE2 2001:DB8:ACAD:A::1/128 [110/1000000]
     via FE80::6, GigabitEthernet0/0/0
OE2 2001:DB8:ACAD:B::/64 [110/1000000]
     via FE80::6, GigabitEthernet0/0/0
OE2 2001:DB8:ACAD:C::/64 [110/1000000]
     via FE80::6, GigabitEthernet0/0/0
OE2 2001:DB8:ACAD:D::/64 [110/1000000]
     via FE80::6, GigabitEthernet0/0/0
OE2 2001:DB8:ACAD:E::/64 [110/1000000]
     via FE80::6, GigabitEthernet0/0/0
O   2001:DB8:ACAD:F::1/128 [110/1]
```

```
      via FE80::6, GigabitEthernet0/0/0
C    2001:DB8:ACAD:AA::/64 [0/0]
      via Loopback0, directly connected
L    2001:DB8:ACAD:AA::1/128 [0/0]
      via Loopback0, receive
L    FF00::/8 [0/0]
      via Null0, receive
R7#           show ip ospf
 Routing Process "ospf 1" with ID 7.7.7.7
 Start time: 00:07:32.548, Time elapsed: 00:57:50.290
 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 9. Checksum Sum 0x02D7EF
 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 (1 loopback)
        Area has no authentication
        SPF algorithm last executed 00:56:47.856 ago
        SPF algorithm executed 3 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x021203
        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

R7#          show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
6.6.6.6          1    FULL/BDR        00:00:33    10.0.0.21       GigabitEthernet0/0/0
R7#  show ip ospf interface
Loopback0 is up, line protocol is up
  Internet Address 192.168.6.1/30, Area 1, Attached via Network Statement
  Process ID 1, Router ID 7.7.7.7, Network Type LOOPBACK, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0           1        no          no            Base
  Loopback interface is treated as a stub Host
GigabitEthernet0/0/0 is up, line protocol is up
  Internet Address 10.0.0.22/30, Area 1, Attached via Network Statement
  Process ID 1, Router ID 7.7.7.7, 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) 7.7.7.7, Interface address 10.0.0.22
  Backup Designated router (ID) 6.6.6.6, Interface address 10.0.0.21
  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 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 2, 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 6.6.6.6  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
R7#                               show ip ospf border-rout

          OSPF Router with ID (7.7.7.7) (Process ID 1)


              Base Topology (MTID 0)

Internal Router Routing Table
Codes: i - Intra-area route, I - Inter-area route

i 6.6.6.6 [1] via 10.0.0.21, GigabitEthernet0/0/0, ASBR, Area 1, SPF 3
R7# show ipv6 ospf neighbor

          OSPFv3 Router with ID (7.7.7.7) (Process ID 10)

Neighbor ID     Pri   State          Dead Time   Interface ID   Interface
6.6.6.6           1   FULL/BDR       00:00:36    7              GigabitEthernet0/0/0
R7#show ipv6 ospf interface
Loopback0 is up, line protocol is up
  Link Local Address FE80::7, Interface ID 12
  Area 1, Process ID 10, Instance ID 0, Router ID 7.7.7.7
  Network Type LOOPBACK, Cost: 1
  Loopback interface is treated as a stub Host
GigabitEthernet0/0/0 is up, line protocol is up
  Link Local Address FE80::7, Interface ID 6
  Area 1, Process ID 10, Instance ID 0, Router ID 7.7.7.7
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 7.7.7.7, local address FE80::7
  Backup Designated router (ID) 6.6.6.6, local address FE80::6
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:02
  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 0, maximum is 5
  Last flood scan time is 1 msec, maximum is 1 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 6.6.6.6  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
R7#   show ipv6 ospf border-routers

          OSPFv3 Router with ID (7.7.7.7) (Process ID 10)

Codes: i - Intra-area route, I - Inter-area route

i 6.6.6.6 [1] via FE80::6, GigabitEthernet0/0/0, ASBR, Area 1, SPF 3
R7#show ip prot
*** IP Routing is NSF aware ***

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

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
```

```
   Incoming update filter list for all interfaces is not set
   Router ID 7.7.7.7
   Number of areas in this router is 1. 1 normal 0 stub 0 nssa
   Maximum path: 4
   Routing for Networks:
     10.0.0.20 0.0.0.3 area 1
     192.168.6.0 0.0.0.255 area 1
   Passive Interface(s):
     Loopback0
   Routing Information Sources:
     Gateway         Distance      Last Update
     6.6.6.6             110        00:57:23
   Distance: (default is 110)

R7#show ipv6 prot
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "application"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "ospf 10"
   Router ID 7.7.7.7
   Number of areas: 1 normal, 0 stub, 0 nssa
   Interfaces (Area 1):
     Loopback0
     GigabitEthernet0/0/0
   Redistribution:
     None
```