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|  | | | | | | | | |
|  | | IBGP | | | | |  | |
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|  | | | | Weizhen Chen |  | | | |
|  | | | | —CCNP—Jeffery Mason &Michael Hansen |  | | | |
|  | | |  | | |  | | |

Purpose

The objective of the lab was to use 7 routers to configure a BGP (Border Gateway Protocol) system where two autonomous systems both with two routers connected to another autonomous system with three routers with EBGP. The autonomous system with three routers also requires an IBGP connection between two end routers. s. All the autonomous systems need to be configured in OSPF or EIGRP however, they can’t all have the same protocol. Also, it requires ipv4 and ipv6 with full dual stack and loopbacks.

Background information

BGP is a standardized exterior gateway protocol that is designed to exchange routing and path vector information between autonomous systems on the network and is used on the Internet. It is used to determine the best route to an address in the network. Each BGP peer manages a table with all the routes it knows for each network to exchange routing information with its neighboring peers in the form of network prefix announcements. Then the peer analyzes the data and sets one of its peers as the next stop to forward packets. Through this, an autonomous system collects all the routing information from its neighboring autonomous systems and advertises that information further to determine the best route. IBGP is two routers that exchange routing and path vector information in the same BGP autonomous system.

Lab summary

Before I started to configure the lab equipment, I first opened a notepad to create a topology with the configurations for the routers. I created six subnet masks with the correct IP address for the router interfaces and networks. Next, we connected the 7 routers with a copper cross-over cable through the gigabit ethernet and connected the routers to the computer with the console cable. In the configuration we would first enter user exec mode through the enable command and then enter global configuration mode through the config terminal command. In the global configuration mode, I would give the correct Ipv4 and Ipv6 address according to the topology for the gigabit ethernet interfaces that I created. After that I then applied a separate set of Ip addresses for the loopback on each of the7 routers. Then I would configure OSPF on routers 1-2 and 3-5, next I configure EIGRP on routers 5-7. On routers 2 to 3 and 5 to 6 I would config EBGP to connect the autonomous system together. On routers 3 and 5 we would set up we would then enter BGP router config mode and set the same AS number with the router bgp command. Then associate network with BGP through network command, next I would add the ip address of the neighbor to the BGP with the neighbor remote-as command. Finally, I would need to configure a router id with bgp router-id and enable neighbor to exchange prefixes with the neighbor activate command.

To show that IBGP was working we used the show run command to show the configuration, used the show ip bgp command to display entries in the BGP routing table, show ip neighbors command to display information about BGP and TCP connections to neighbors, show ip bgp summary command to display the status of all BGP, show bgp ipv6 neighbor command to display information about ipv6 BGP and TCP connections to neighbors, show bgp ipv6 summary command to display the status of all ipv6 BGP connection and finally show ip route command to show the routing table.

Lab commands

**router bgp [*autonomous-system-number*]**: Enters router configuration mode for the specified routing process.

**network [ip address] [*wildcard mask*]**: Associates a network with an BGP routing process.

**neighbor [ip address] remote-as [*autonomous-system-number*]**: Adds the IP address or peer group name of the neighbor in the specified autonomous system to the IPv4 or IPv6 multiprotocol BGP neighbor table of the local router.

**bgp** **router-id [ip address]**: Configures a fixed router ID for the local BGP routing process.

**neighbor [ip address] activate**: Enables the neighbor to exchange prefixes for the IPv4 unicast address family with the local router.

**show ip bgp [ip address]**: To display entries in the Border Gateway Protocol (BGP) routing table.

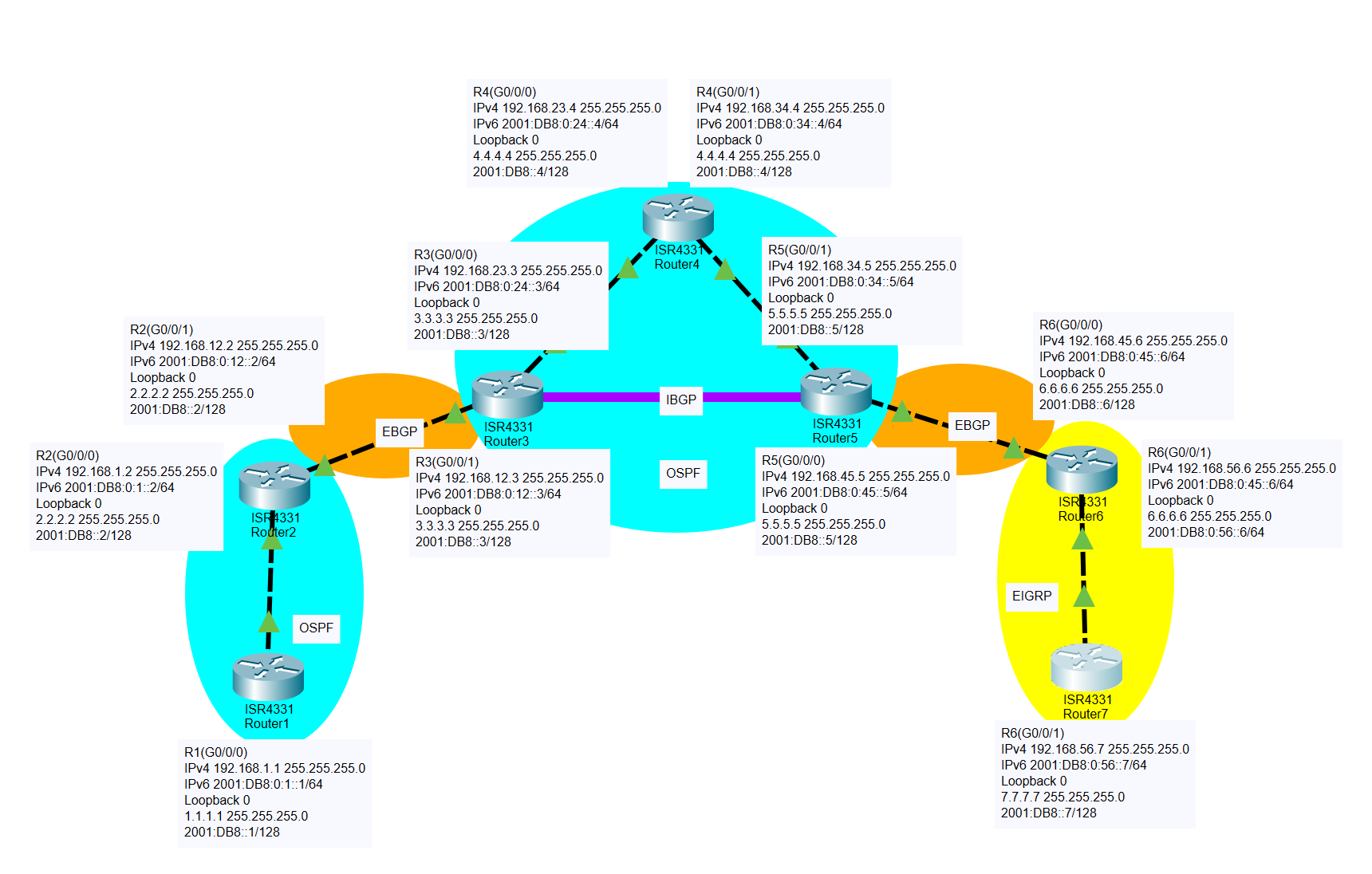
**show ip bgp [ip address] neighbors**: To display information about Border Gateway Protocol (BGP) and TCP connections to neighbors.

**show ip bgp [ip address] summary**: To display the status of all Border Gateway Protocol (BGP) connections.

**show bgp ipv6 [ip address] neighbors**: To display information about IPv6 Border Gateway Protocol (BGP) and TCP connections to neighbors.

**show bgp ipv6 [ip address] summary**: To display the status of all IPv6 Border Gateway Protocol (BGP) connections.

Network diagram



|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Router** | **Interface** | **Ipv4** | **Ipv6** | **Subnet Mask** | **Subnet** | **Linked- Device** | **Protocol** | **Loopback** |
| Router 1 | G 0/0/0 | 192.168.1.1 | 2001:DB8:0:1::1/64 | 255.255.255.0 | /64 | R2 G0/0/0 | OSPF 1 | 1.1.1.1 |
| Router 2 | G 0/0/0 | 192.168.1.2 | 2001:DB8:0:1::2/64 | 255.255.255.0 | /64 | R1 G0/0/0 | OSPF 1 | 2.2.2.2 |
| Router 2 | G 0/0/1 | 192.168.12.2 | 2001:DB8:0:12::2/64 | 255.255.255.0 | /64 | R3 G0/0/1 | BGP 11 | 2.2.2.2 |
| Router 3 | G 0/0/1 | 192.168.12.3 | 2001:DB8:0:12::3/64 | 255.255.255.0 | /64 | R2 G0/0/1 | BGP 12 | 3.3.3.3 |
| Router 3 | G 0/0/0 | 192.168.23.3 | 2001:DB8:0:23::3/64 | 255.255.255.0 | /64 | R4 G0/0/0 | OSPF 1 | 3.3.3.3 |
| Router 4 | G 0/0/0 | 192.168.23.4 | 2001:DB8:0:23::4/64 | 255.255.255.0 | /64 | R3 G0/0/0 | OSPF 1 | 4.4.4.4 |
| Router 4 | G 0/0/1 | 192.168.34.4 | 2001:DB8:0:34::4/64 | 255.255.255.0 | /64 | R5 G0/0/1 | OSPF 1 | 4.4.4.4 |
| Router 5 | G 0/0/1 | 192.168.34.5 | 2001:DB8:0:34::5/64 | 255.255.255.0 | /64 | R4 G0/0/1 | OSPF 1 | 5.5.5.5 |
| Router 5 | G 0/0/0 | 192.168.45.5 | 2001:DB8:0:45::5/64 | 255.255.255.0 | /64 | R6 G0/0/0 | BGP 12 | 5.5.5.5 |
| Router 6 | G 0/0/0 | 192.168.45.6 | 2001:DB8:0:45::6/64 | 255.255.255.0 | /64 | R5 G0/0/0 | BGP 13 | 6.6.6.6 |
| Router 6 | G 0/0/1 | 192.168.56.6 | 2001:DB8:0:56::6/64 | 255.255.255.0 | /64 | R7 G0/0/1 | EIGRP 1 | 6.6.6.6 |
| Router 7 | G 0/0/1 | 192.168.56.7 | 2001:DB8:0:56::7/64 | 255.255.255.0 | /64 | R7 G0/0/0 | EIGRP 1 | 7.7.7.7 |

Configurations

**Router 1:**

R1#Show run

Building configuration...

Current configuration : 1594 bytes

Last configuration change at 18:37:16 UTC Fri Jan 14 2022

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 FDO21482HZX

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 1.1.1.1 255.255.255.0

ipv6 address 2001:DB8::1/128

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/0

ip address 192.168.1.1 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:1::1/64

ipv6 enable

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/1

no ip address

shutdown

negotiation auto

interface Serial0/1/0

no ip address

shutdown

interface Serial0/1/1

no ip address

shutdown

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

interface Vlan1

no ip address

shutdown

router ospf 1

network 1.1.1.1 0.0.0.0 area 0

network 192.168.1.0 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 1

router-id 1.1.1.1

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

1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 1.1.1.0/24 is directly connected, Loopback0

L 1.1.1.1/32 is directly connected, Loopback0

2.0.0.0/32 is subnetted, 1 subnets

O 2.2.2.2 [110/2] via 192.168.1.2, 00:08:30, GigabitEthernet0/0/0

192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.1.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.1.1/32 is directly connected, GigabitEthernet0/0/0

R1#Show ip ospf

Routing Process "ospf 1" with ID 1.1.1.1

Start time: 00:12:44.195, Time elapsed: 00:11:35.053

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 5000 msecs

Minimum hold time between two consecutive SPFs 10000 msecs

Maximum wait time between two consecutive SPFs 10000 msecs

Incremental-SPF disabled

Minimum LSA interval 5 secs

Minimum LSA arrival 1000 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 2 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:08:49.871 ago

SPF algorithm executed 5 times

Area ranges are

Number of LSA 3. Checksum Sum 0x00978B

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 1.1.1.1/24, 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

GigabitEthernet0/0/0 is up, line protocol is up

Internet Address 192.168.1.1/24, 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 192.168.1.2

Backup Designated router (ID) 1.1.1.1, Interface address 192.168.1.1

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:00

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/2/2, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 1

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 2.2.2.2 (Designated Router)

Suppress hello for 0 neighbor(s)

R1#show ip ospf neighbor

Neighbor ID Pri State Dead Time Address Interface

2.2.2.2 1 FULL/DR 00:00:30 192.168.1.2 GigabitEthernet0/0/0

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

R1#Show ipv6 ospf

Routing Process "ospfv3 1" with ID 1.1.1.1

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

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 0. Checksum Sum 0x000000

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 BACKBONE(0)

Number of interfaces in this area is 2

SPF algorithm executed 2 times

Number of LSA 8. Checksum Sum 0x04C00E

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R1#Show ipv6 ospf interface

Loopback0 is up, line protocol is up

Link Local Address FE80::267E:12FF:FE4D:F6E0, Interface ID 12

Area 0, Process ID 1, Instance ID 0, Router ID 1.1.1.1

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::267E:12FF:FE4D:F6E0, Interface ID 6

Area 0, Process ID 1, Instance ID 0, Router ID 1.1.1.1

Network Type BROADCAST, Cost: 1

Transmit Delay is 1 sec, State BDR, Priority 1

Designated Router (ID) 2.2.2.2, local address FE80::267E:12FF:FE4D:F770

Backup Designated router (ID) 1.1.1.1, local address FE80::267E:12FF:FE4D:F6E0

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

Hello due in 00:00:01

Graceful restart helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 1

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 2.2.2.2 (Designated Router)

Suppress hello for 0 neighbor(s)

R1#Show ipv6 route

IPv6 Routing Table - default - 5 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

LC 2001:DB8::1/128 [0/0]

via Loopback0, receive

O 2001:DB8::2/128 [110/1]

via FE80::267E:12FF:FE4D:F770, GigabitEthernet0/0/0

C 2001:DB8:0:1::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:0:1::1/128 [0/0]

via GigabitEthernet0/0/0, receive

L FF00::/8 [0/0]

via Null0, receive

R1#show ip protocols

\*\*\* IP Routing is NSF aware \*\*\*

Routing Protocol is "application"

Sending updates every 0 seconds

Invalid after 0 seconds, hold down 0, flushed after 0

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Maximum path: 32

Routing for Networks:

Routing Information Sources:

Gateway Distance Last Update

Distance: (default is 4)

Routing Protocol is "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:

1.1.1.1 0.0.0.0 area 0

192.168.1.0 0.0.0.255 area 0

Routing Information Sources:

Gateway Distance Last Update

2.2.2.2 110 00:10:05

Distance: (default is 110)

R1#show ipv6 protocols

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "application"

IPv6 Routing Protocol is "ND"

IPv6 Routing Protocol is "ospf 1"

Router ID 1.1.1.1

Number of areas: 1 normal, 0 stub, 0 nssa

Interfaces (Area 0):

Loopback0

GigabitEthernet0/0/0

Redistribution:

None

**Router 2:**

R2#Show run

Building configuration...

Current configuration : 2046 bytes

Last configuration change at 18:40:11 UTC Fri Jan 14 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 FDO21482DWJ

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 2.2.2.2 255.255.255.0

ipv6 address 2001:DB8::2/128

ipv6 enable

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/0

ip address 192.168.1.2 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:1::2/64

ipv6 enable

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/1

ip address 192.168.12.2 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:12::2/64

ipv6 enable

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

network 2.2.2.2 0.0.0.0 area 0

network 192.168.1.0 0.0.0.255 area 0

router bgp 11

bgp router-id 2.2.2.2

bgp log-neighbor-changes

neighbor 2001:DB8:0:12::3 remote-as 12

neighbor 192.168.12.3 remote-as 12

address-family ipv4

network 2.2.2.0 mask 255.255.255.0

no neighbor 2001:DB8:0:12::3 activate

neighbor 192.168.12.3 activate

exit-address-family

address-family ipv6

neighbor 2001:DB8:0:12::3 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 1

router-id 2.2.2.2

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

1.0.0.0/32 is subnetted, 1 subnets

O 1.1.1.1 [110/2] via 192.168.1.1, 00:11:40, GigabitEthernet0/0/0

2.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 2.2.2.0/24 is directly connected, Loopback0

L 2.2.2.2/32 is directly connected, Loopback0

3.0.0.0/24 is subnetted, 1 subnets

B 3.3.3.0 [20/0] via 192.168.12.3, 00:09:43

5.0.0.0/24 is subnetted, 1 subnets

B 5.5.5.0 [20/0] via 192.168.12.3, 00:04:28

192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.1.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.1.2/32 is directly connected, GigabitEthernet0/0/0

192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.12.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.12.2/32 is directly connected, GigabitEthernet0/0/1

R2#Show ip ospf

Routing Process "ospf 1" with ID 2.2.2.2

Start time: 00:14:21.928, Time elapsed: 00:12:43.691

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 5000 msecs

Minimum hold time between two consecutive SPFs 10000 msecs

Maximum wait time between two consecutive SPFs 10000 msecs

Incremental-SPF disabled

Minimum LSA interval 5 secs

Minimum LSA arrival 1000 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 2 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:11:51.319 ago

SPF algorithm executed 3 times

Area ranges are

Number of LSA 3. Checksum Sum 0x00978B

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 2.2.2.2/24, 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

GigabitEthernet0/0/0 is up, line protocol is up

Internet Address 192.168.1.2/24, 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 192.168.1.2

Backup Designated router (ID) 1.1.1.1, Interface address 192.168.1.1

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 1/2/2, 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 1.1.1.1 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

R2#show ip ospf neighbor

Neighbor ID Pri State Dead Time Address Interface

1.1.1.1 1 FULL/BDR 00:00:30 192.168.1.1 GigabitEthernet0/0/0

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

Routing Process "ospfv3 1" with ID 2.2.2.2

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

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 0. Checksum Sum 0x000000

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 BACKBONE(0)

Number of interfaces in this area is 2

SPF algorithm executed 2 times

Number of LSA 8. Checksum Sum 0x04C00E

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R2#Show ipv6 ospf interface

Loopback0 is up, line protocol is up

Link Local Address FE80::267E:12FF:FE4D:F770, Interface ID 12

Area 0, Process ID 1, Instance ID 0, Router ID 2.2.2.2

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::267E:12FF:FE4D:F770, Interface ID 6

Area 0, Process ID 1, Instance ID 0, Router ID 2.2.2.2

Network Type BROADCAST, Cost: 1

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 2.2.2.2, local address FE80::267E:12FF:FE4D:F770

Backup Designated router (ID) 1.1.1.1, local address FE80::267E:12FF:FE4D:F6E0

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

Hello due in 00:00:04

Graceful restart helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 4

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 1.1.1.1 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

R2#Show ipv6 route

IPv6 Routing Table - default - 7 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

O 2001:DB8::1/128 [110/1]

via FE80::267E:12FF:FE4D:F6E0, GigabitEthernet0/0/0

LC 2001:DB8::2/128 [0/0]

via Loopback0, receive

C 2001:DB8:0:1::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:0:1::2/128 [0/0]

via GigabitEthernet0/0/0, receive

C 2001:DB8:0:12::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:0:12::2/128 [0/0]

via GigabitEthernet0/0/1, receive

L FF00::/8 [0/0]

via Null0, receive

R2#show ip protocols

\*\*\* IP Routing is NSF aware \*\*\*

Routing Protocol is "application"

Sending updates every 0 seconds

Invalid after 0 seconds, hold down 0, flushed after 0

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Maximum path: 32

Routing for Networks:

Routing Information Sources:

Gateway Distance Last Update

Distance: (default is 4)

Routing Protocol is "bgp 11"

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

Neighbor(s):

Address FiltIn FiltOut DistIn DistOut Weight RouteMap

192.168.12.3

Maximum path: 1

Routing Information Sources:

Gateway Distance Last Update

192.168.12.3 20 00:06:00

Distance: external 20 internal 200 local 200

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

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Maximum path: 4

Routing for Networks:

2.2.2.2 0.0.0.0 area 0

192.168.1.0 0.0.0.255 area 0

Routing Information Sources:

Gateway Distance Last Update

1.1.1.1 110 00:13:12

Distance: (default is 110)

R2#show ipv6 protocols

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "application"

IPv6 Routing Protocol is "ND"

IPv6 Routing Protocol is "ospf 1"

Router ID 2.2.2.2

Number of areas: 1 normal, 0 stub, 0 nssa

Interfaces (Area 0):

Loopback0

GigabitEthernet0/0/0

Redistribution:

None

IPv6 Routing Protocol is "bgp 11"

IGP synchronization is disabled

Redistribution:

None

Neighbor(s):

Address FiltIn FiltOut Weight RoutemapIn RoutemapOut

2001:DB8:0:12::3

R2#show ip bgp

BGP table version is 4, 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

\*> 2.2.2.0/24 0.0.0.0 0 32768 i

\*> 3.3.3.0/24 192.168.12.3 0 0 12 i

\*> 5.5.5.0/24 192.168.12.3 0 12 I

R2#show ip bgp neighbor

BGP neighbor is 192.168.12.3, remote AS 12, external link

BGP version 4, remote router ID 3.3.3.3

BGP state = Established, up for 00:12:56

Last read 00:00:35, 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 IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 2 4

Keepalives: 15 13

Route Refresh: 0 0

Total: 18 18

Do log neighbor state changes (via global configuration)

Default minimum time between advertisement runs is 30 seconds

For address family: IPv4 Unicast

Session: 192.168.12.3

BGP table version 4, neighbor version 4/0

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: 1 2 (Consumes 240 bytes)

Prefixes Total: 1 3

Implicit Withdraw: 0 1

Explicit Withdraw: 0 0

Used as bestpath: n/a 2

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 2 n/a

Total: 2 0

Number of NLRIs in the update sent: max 1, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 192.168.12.3

Connections established 1; dropped 0

Last reset never

External BGP neighbor configured for connected checks (single-hop no-disable-connected-check)

Interface associated: GigabitEthernet0/0/1 (peering address in same link)

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

SSO is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1

Local host: 192.168.12.2, Local port: 179

Foreign host: 192.168.12.3, Foreign port: 29343

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 0x1A83F6):

Timer Starts Wakeups Next

Retrans 16 0 0x0

TimeWait 0 0 0x0

AckHold 17 16 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 0 0 0x0

DeadWait 0 0 0x0

Linger 0 0 0x0

ProcessQ 0 0 0x0

iss: 1521207012 snduna: 1521207432 sndnxt: 1521207432

irs: 4004229074 rcvnxt: 4004229550

sndwnd: 15965 scale: 0 maxrcvwnd: 16384

rcvwnd: 15909 scale: 0 delrcvwnd: 475

SRTT: 882 ms, RTTO: 1768 ms, RTV: 886 ms, KRTT: 0 ms

minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms

uptime: 776580 ms, Sent idletime: 20874 ms, Receive idletime: 20673 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: 34 (out of order: 0), with data: 17, total data bytes: 475

Sent: 35 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 17, total data bytes: 419

Packets received in fast path: 0, fast processed: 0, slow path: 0

fast lock acquisition failures: 0, slow path: 0

TCP Semaphore 0x7F2B58F81BB0 FREE

R2#show ip bgp summary

BGP router identifier 2.2.2.2, local AS number 11

BGP table version is 4, main routing table version 4

3 network entries using 744 bytes of memory

3 path entries using 360 bytes of memory

3/3 BGP path/bestpath attribute entries using 744 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 1872 total bytes of memory

BGP activity 3/0 prefixes, 3/0 paths, scan interval 60 secs

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

192.168.12.3 4 12 19 18 4 0 0 00:13:20 2

R2#show bgp ipv6 neighbor

BGP neighbor is 2001:DB8:0:12::3, remote AS 12, external link

BGP version 4, remote router ID 3.3.3.3

BGP state = Established, up for 00:13:36

Last read 00:00:05, last write 00:00:09, 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: 1 1

Keepalives: 17 17

Route Refresh: 0 0

Total: 19 19

Do log neighbor state changes (via global configuration)

Default minimum time between advertisement runs is 30 seconds

For address family: IPv6 Unicast

Session: 2001:DB8:0:12::3

BGP table version 1, neighbor version 1/0

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: 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:DB8:0:12::3

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:DB8:0:12::2, Local port: 47686

Foreign host: 2001:DB8:0:12::3, 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 0x1B2237):

Timer Starts Wakeups Next

Retrans 19 0 0x0

TimeWait 0 0 0x0

AckHold 18 15 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 128 127 0x1B26FC

DeadWait 0 0 0x0

Linger 0 0 0x0

ProcessQ 0 0 0x0

iss: 1161199615 snduna: 1161200025 sndnxt: 1161200025

irs: 1502392085 rcvnxt: 1502392495

sndwnd: 15975 scale: 0 maxrcvwnd: 16384

rcvwnd: 15975 scale: 0 delrcvwnd: 409

SRTT: 921 ms, RTTO: 1531 ms, RTV: 610 ms, KRTT: 0 ms

minRTT: 2 ms, maxRTT: 1000 ms, ACK hold: 200 ms

uptime: 816145 ms, Sent idletime: 5738 ms, Receive idletime: 5939 ms

Status Flags: active open

Option Flags: nagle, path mtu capable

IP Precedence value : 6

Datagrams (max data segment is 1440 bytes):

Rcvd: 34 (out of order: 0), with data: 19, total data bytes: 409

Sent: 38 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 38, total data bytes: 1937

Packets received in fast path: 0, fast processed: 0, slow path: 0

fast lock acquisition failures: 0, slow path: 0

TCP Semaphore 0x7F2B58F81AF0 FREE

R2#show bgp ipv6 summary

BGP router identifier 2.2.2.2, local AS number 11

BGP table version is 1, main routing table version 1

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

2001:DB8:0:12::3

4 12 20 20 1 0 0 00:14:27 0

**Router 3:**

R3#Show run

Building configuration...

Current configuration : 2221 bytes

Last configuration change at 18:37:41 UTC Fri Jan 14 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

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214420HW

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 3.3.3.3 255.255.255.0

ipv6 address 2001:DB8::3/128

ipv6 enable

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/0

ip address 192.168.23.3 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:24::3/64

ipv6 enable

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/1

ip address 192.168.12.3 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:12::3/64

ipv6 enable

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

network 3.3.3.3 0.0.0.0 area 1

network 192.168.23.0 0.0.0.255 area 1

router bgp 12

bgp router-id 3.3.3.3

bgp log-neighbor-changes

neighbor 5.5.5.5 remote-as 12

neighbor 5.5.5.5 update-source Loopback0

neighbor 2001:DB8:0:12::2 remote-as 11

neighbor 192.168.12.2 remote-as 11

address-family ipv4

network 3.3.3.0 mask 255.255.255.0

neighbor 5.5.5.5 activate

neighbor 5.5.5.5 next-hop-self

no neighbor 2001:DB8:0:12::2 activate

neighbor 192.168.12.2 activate

exit-address-family

address-family ipv6

neighbor 2001:DB8:0:12::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 1

router-id 3.3.3.3

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R3#Show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

2.0.0.0/24 is subnetted, 1 subnets

B 2.2.2.0 [20/0] via 192.168.12.2, 00:15:07

3.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 3.3.3.0/24 is directly connected, Loopback0

L 3.3.3.3/32 is directly connected, Loopback0

4.0.0.0/32 is subnetted, 1 subnets

O 4.4.4.4 [110/2] via 192.168.23.4, 00:14:16, GigabitEthernet0/0/0

5.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

B 5.5.5.0/24 [200/0] via 5.5.5.5, 00:09:48

O 5.5.5.5/32 [110/3] via 192.168.23.4, 00:11:06, GigabitEthernet0/0/0

192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.12.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.12.3/32 is directly connected, GigabitEthernet0/0/1

192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.23.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.23.3/32 is directly connected, GigabitEthernet0/0/0

O 192.168.34.0/24 [110/2] via 192.168.23.4, 00:11:06, GigabitEthernet0/0/0

R3#Show ip ospf

Routing Process "ospf 1" with ID 3.3.3.3

Start time: 00:15:31.623, Time elapsed: 00:16:41.501

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 5000 msecs

Minimum hold time between two consecutive SPFs 10000 msecs

Maximum wait time between two consecutive SPFs 10000 msecs

Incremental-SPF disabled

Minimum LSA interval 5 secs

Minimum LSA arrival 1000 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area 1

Number of interfaces in this area is 2 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:11:20.345 ago

SPF algorithm executed 8 times

Area ranges are

Number of LSA 5. Checksum Sum 0x01F568

Number of opaque link LSA 0. Checksum Sum 0x000000

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R3#Show ip ospf interface

Loopback0 is up, line protocol is up

Internet Address 3.3.3.3/24, Area 1, Attached via Network Statement

Process ID 1, Router ID 3.3.3.3, 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 192.168.23.3/24, Area 1, Attached via Network Statement

Process ID 1, Router ID 3.3.3.3, 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) 4.4.4.4, Interface address 192.168.23.4

Backup Designated router (ID) 3.3.3.3, Interface address 192.168.23.3

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:06

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/2/2, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 1

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 4.4.4.4 (Designated Router)

Suppress hello for 0 neighbor(s)

R3#show ip ospf neighbor

Neighbor ID Pri State Dead Time Address Interface

4.4.4.4 1 FULL/DR 00:00:33 192.168.23.4 GigabitEthernet0/0/0

R3#show ip ospf border-routers

OSPF Router with ID (3.3.3.3) (Process ID 1)

Base Topology (MTID 0)

Internal Router Routing Table

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

R3#Show ipv6 ospf

Routing Process "ospfv3 1" with ID 3.3.3.3

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

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 0. Checksum Sum 0x000000

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 2

SPF algorithm executed 3 times

Number of LSA 12. Checksum Sum 0x056D1E

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R3#Show ipv6 ospf interface

Loopback0 is up, line protocol is up

Link Local Address FE80::227:90FF:FED5:FAD0, Interface ID 12

Area 1, Process ID 1, Instance ID 0, Router ID 3.3.3.3

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::227:90FF:FED5:FAD0, Interface ID 6

Area 1, Process ID 1, Instance ID 0, Router ID 3.3.3.3

Network Type BROADCAST, Cost: 1

Transmit Delay is 1 sec, State BDR, Priority 1

Designated Router (ID) 4.4.4.4, local address FE80::B6A8:B9FF:FE01:B990

Backup Designated router (ID) 3.3.3.3, local address FE80::227:90FF:FED5:FAD0

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

Hello due in 00:00:00

Graceful restart helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 2, maximum is 2

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 4.4.4.4 (Designated Router)

Suppress hello for 0 neighbor(s)

R3#Show ipv6 route

IPv6 Routing Table - default - 9 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

LC 2001:DB8::3/128 [0/0]

via Loopback0, receive

O 2001:DB8::4/128 [110/1]

via FE80::B6A8:B9FF:FE01:B990, GigabitEthernet0/0/0

O 2001:DB8::5/128 [110/2]

via FE80::B6A8:B9FF:FE01:B990, GigabitEthernet0/0/0

C 2001:DB8:0:12::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:0:12::3/128 [0/0]

via GigabitEthernet0/0/1, receive

C 2001:DB8:0:24::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:0:24::3/128 [0/0]

via GigabitEthernet0/0/0, receive

O 2001:DB8:0:34::/64 [110/2]

via FE80::B6A8:B9FF:FE01:B990, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

R3#show ip protocols

\*\*\* IP Routing is NSF aware \*\*\*

Routing Protocol is "application"

Sending updates every 0 seconds

Invalid after 0 seconds, hold down 0, flushed after 0

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Maximum path: 32

Routing for Networks:

Routing Information Sources:

Gateway Distance Last Update

Distance: (default is 4)

Routing Protocol is "bgp 12"

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

Neighbor(s):

Address FiltIn FiltOut DistIn DistOut Weight RouteMap

5.5.5.5

192.168.12.2

Maximum path: 1

Routing Information Sources:

Gateway Distance Last Update

5.5.5.5 200 00:11:27

192.168.12.2 20 00:16:47

Distance: external 20 internal 200 local 200

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 3.3.3.3

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Maximum path: 4

Routing for Networks:

3.3.3.3 0.0.0.0 area 1

192.168.23.0 0.0.0.255 area 1

Routing Information Sources:

Gateway Distance Last Update

5.5.5.5 110 00:12:45

4.4.4.4 110 00:13:29

Distance: (default is 110)

R3#show ipv6 protocols

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "application"

IPv6 Routing Protocol is "ND"

IPv6 Routing Protocol is "ospf 1"

Router ID 3.3.3.3

Number of areas: 1 normal, 0 stub, 0 nssa

Interfaces (Area 1):

Loopback0

GigabitEthernet0/0/0

Redistribution:

None

IPv6 Routing Protocol is "bgp 12"

IGP synchronization is disabled

Redistribution:

None

Neighbor(s):

Address FiltIn FiltOut Weight RoutemapIn RoutemapOut

2001:DB8:0:12::2

R3#show ip bgp

BGP table version is 5, 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

\*> 2.2.2.0/24 192.168.12.2 0 0 11 i

\*> 3.3.3.0/24 0.0.0.0 0 32768 i

\*>i 5.5.5.0/24 5.5.5.5 0 100 0 i

R3#show ip bgp neighbor

BGP neighbor is 5.5.5.5, remote AS 12, internal link

BGP version 4, remote router ID 5.5.5.5

BGP state = Established, up for 00:13:15

Last read 00:00:03, last write 00:00:36, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 3 2

Keepalives: 16 15

Route Refresh: 0 0

Total: 20 18

Do log neighbor state changes (via global configuration)

Default minimum time between advertisement runs is 0 seconds

For address family: IPv4 Unicast

Session: 5.5.5.5

BGP table version 5, neighbor version 5/0

Output queue size : 0

Index 2, Advertise bit 1

2 update-group member

NEXT\_HOP is always this router for eBGP paths

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 2 1 (Consumes 120 bytes)

Prefixes Total: 2 1

Implicit Withdraw: 0 0

Explicit Withdraw: 0 0

Used as bestpath: n/a 1

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 2 n/a

Total: 2 0

Number of NLRIs in the update sent: max 1, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 5.5.5.5

Connections established 1; dropped 0

Last reset never

Interface associated: (none) (peering address NOT in same link)

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

SSO is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255

Local host: 3.3.3.3, Local port: 179

Foreign host: 5.5.5.5, Foreign port: 33908

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 0x1F4B17):

Timer Starts Wakeups Next

Retrans 17 0 0x0

TimeWait 0 0 0x0

AckHold 16 13 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: 704270382 snduna: 704270883 sndnxt: 704270883

irs: 1390141709 rcvnxt: 1390142130

sndwnd: 15884 scale: 0 maxrcvwnd: 16384

rcvwnd: 15964 scale: 0 delrcvwnd: 420

SRTT: 897 ms, RTTO: 1680 ms, RTV: 783 ms, KRTT: 0 ms

minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms

uptime: 795988 ms, Sent idletime: 3190 ms, Receive idletime: 3390 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: 35 (out of order: 0), with data: 17, total data bytes: 420

Sent: 34 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 18, total data bytes: 500

Packets received in fast path: 0, fast processed: 0, slow path: 0

fast lock acquisition failures: 0, slow path: 0

TCP Semaphore 0x7F55B678DD00 FREE

BGP neighbor is 192.168.12.2, remote AS 11, external link

BGP version 4, remote router ID 2.2.2.2

BGP state = Established, up for 00:18:30

Last read 00:00:34, last write 00:00:27, 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 2

Keepalives: 19 21

Route Refresh: 0 0

Total: 24 24

Do log neighbor state changes (via global configuration)

Default minimum time between advertisement runs is 30 seconds

For address family: IPv4 Unicast

Session: 192.168.12.2

BGP table version 5, neighbor version 5/0

Output queue size : 0

Index 1, Advertise bit 0

1 update-group member

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 2 1 (Consumes 120 bytes)

Prefixes Total: 3 1

Implicit Withdraw: 1 0

Explicit Withdraw: 0 0

Used as bestpath: n/a 1

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 1 n/a

Total: 1 0

Number of NLRIs in the update sent: max 1, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 192.168.12.2

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: 192.168.12.3, Local port: 29343

Foreign host: 192.168.12.2, 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 0x1F4B17):

Timer Starts Wakeups Next

Retrans 25 1 0x0

TimeWait 0 0 0x0

AckHold 22 19 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 327 326 0x1F4E9E

DeadWait 0 0 0x0

Linger 0 0 0x0

ProcessQ 0 0 0x0

iss: 4004229074 snduna: 4004229664 sndnxt: 4004229664

irs: 1521207012 rcvnxt: 1521207546

sndwnd: 15795 scale: 0 maxrcvwnd: 16384

rcvwnd: 15851 scale: 0 delrcvwnd: 533

SRTT: 954 ms, RTTO: 1319 ms, RTV: 365 ms, KRTT: 0 ms

minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms

uptime: 1112404 ms, Sent idletime: 27863 ms, Receive idletime: 27662 ms

Status Flags: active open

Option Flags: nagle, path mtu capable

IP Precedence value : 6

Datagrams (max data segment is 1460 bytes):

Rcvd: 47 (out of order: 0), with data: 23, total data bytes: 533

Sent: 46 (retransmit: 1, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 23, total data bytes: 589

Packets received in fast path: 0, fast processed: 0, slow path: 0

fast lock acquisition failures: 0, slow path: 0

TCP Semaphore 0x7F55B678DE80 FREE

R3#show ip bgp summary

BGP router identifier 3.3.3.3, local AS number 12

BGP table version is 5, main routing table version 5

3 network entries using 744 bytes of memory

3 path entries using 360 bytes of memory

3/3 BGP path/bestpath attribute entries using 744 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 1872 total bytes of memory

BGP activity 3/0 prefixes, 3/0 paths, scan interval 60 secs

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

5.5.5.5 4 12 18 21 5 0 0 00:13:51 1

192.168.12.2 4 11 25 25 5 0 0 00:19:05 1

R3#show bgp ipv6 neighbor

BGP neighbor is 2001:DB8:0:12::2, remote AS 11, external link

BGP version 4, remote router ID 2.2.2.2

BGP state = Established, up for 00:19:17

Last read 00:00:27, 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: 1 1

Keepalives: 23 23

Route Refresh: 0 0

Total: 25 25

Do log neighbor state changes (via global configuration)

Default minimum time between advertisement runs is 30 seconds

For address family: IPv6 Unicast

Session: 2001:DB8:0:12::2

BGP table version 1, neighbor version 1/0

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: 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:DB8:0:12::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:DB8:0:12::3, Local port: 179

Foreign host: 2001:DB8:0:12::2, Foreign port: 47686

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 0x200818):

Timer Starts Wakeups Next

Retrans 24 0 0x0

TimeWait 0 0 0x0

AckHold 24 18 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: 1502392085 snduna: 1502392609 sndnxt: 1502392609

irs: 1161199615 rcvnxt: 1161200139

sndwnd: 15861 scale: 0 maxrcvwnd: 16384

rcvwnd: 15861 scale: 0 delrcvwnd: 523

SRTT: 959 ms, RTTO: 1279 ms, RTV: 320 ms, KRTT: 0 ms

minRTT: 0 ms, maxRTT: 1000 ms, ACK hold: 200 ms

uptime: 1157836 ms, Sent idletime: 27052 ms, Receive idletime: 27252 ms

Status Flags: passive open, gen tcbs

Option Flags: nagle, path mtu capable

IP Precedence value : 6

Datagrams (max data segment is 1440 bytes):

Rcvd: 50 (out of order: 0), with data: 25, total data bytes: 523

Sent: 46 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 46, total data bytes: 2371

Packets received in fast path: 0, fast processed: 0, slow path: 0

fast lock acquisition failures: 0, slow path: 0

TCP Semaphore 0x7F55B678DDC0 FREE

R3#show bgp ipv6 summary

BGP router identifier 3.3.3.3, local AS number 12

BGP table version is 1, main routing table version 1

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

2001:DB8:0:12::2

4 11 26 26 1 0 0 00:20:09 0

**Router 4:**

R4#Show run

Building configuration...

Current configuration : 1755 bytes

Last configuration change at 18:32:46 UTC Fri Jan 14 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

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214421D1

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 4.4.4.4 255.255.255.0

ipv6 address 2001:DB8::4/128

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/0

ip address 192.168.23.4 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:24::4/64

ipv6 enable

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/1

ip address 192.168.34.4 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:34::4/64

ipv6 enable

ipv6 ospf 1 area 1

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

network 4.4.4.4 0.0.0.0 area 1

network 192.168.23.0 0.0.0.255 area 1

network 192.168.34.0 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 1

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

3.0.0.0/32 is subnetted, 1 subnets

O 3.3.3.3 [110/2] via 192.168.23.3, 00:20:46, GigabitEthernet0/0/0

4.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 4.4.4.0/24 is directly connected, Loopback0

L 4.4.4.4/32 is directly connected, Loopback0

5.0.0.0/32 is subnetted, 1 subnets

O 5.5.5.5 [110/2] via 192.168.34.5, 00:17:36, GigabitEthernet0/0/1

192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.23.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.23.4/32 is directly connected, GigabitEthernet0/0/0

192.168.34.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.34.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.34.4/32 is directly connected, GigabitEthernet0/0/1

R4#Show ip ospf

Routing Process "ospf 1" with ID 4.4.4.4

Start time: 00:16:19.132, Time elapsed: 00:21:54.310

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 5000 msecs

Minimum hold time between two consecutive SPFs 10000 msecs

Maximum wait time between two consecutive SPFs 10000 msecs

Incremental-SPF disabled

Minimum LSA interval 5 secs

Minimum LSA arrival 1000 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area 1

Number of interfaces in this area is 3 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:17:47.500 ago

SPF algorithm executed 6 times

Area ranges are

Number of LSA 5. Checksum Sum 0x01F568

Number of opaque link LSA 0. Checksum Sum 0x000000

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R4#Show ip ospf interface

Loopback0 is up, line protocol is up

Internet Address 4.4.4.4/24, Area 1, Attached via Network Statement

Process ID 1, Router ID 4.4.4.4, 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 192.168.34.4/24, Area 1, Attached via Network Statement

Process ID 1, Router ID 4.4.4.4, 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) 5.5.5.5, Interface address 192.168.34.5

Backup Designated router (ID) 4.4.4.4, Interface address 192.168.34.4

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 1/3/3, 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 5.5.5.5 (Designated Router)

Suppress hello for 0 neighbor(s)

GigabitEthernet0/0/0 is up, line protocol is up

Internet Address 192.168.23.4/24, Area 1, Attached via Network Statement

Process ID 1, Router ID 4.4.4.4, 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) 4.4.4.4, Interface address 192.168.23.4

Backup Designated router (ID) 3.3.3.3, Interface address 192.168.23.3

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:00

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/2/2, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 3

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 3.3.3.3 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

R4#show ip ospf neighbor

Neighbor ID Pri State Dead Time Address Interface

5.5.5.5 1 FULL/DR 00:00:34 192.168.34.5 GigabitEthernet0/0/1

3.3.3.3 1 FULL/BDR 00:00:31 192.168.23.3 GigabitEthernet0/0/0

R4#show ip ospf border-routers

OSPF Router with ID (4.4.4.4) (Process ID 1)

Base Topology (MTID 0)

Internal Router Routing Table

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

R4#Show ipv6 ospf

Routing Process "ospfv3 1" with ID 4.4.4.4

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

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 0. Checksum Sum 0x000000

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 3 times

Number of LSA 14. Checksum Sum 0x05CF5F

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R4#Show ipv6 ospf interface

Loopback0 is up, line protocol is up

Link Local Address FE80::B6A8:B9FF:FE01:B990, Interface ID 12

Area 1, Process ID 1, Instance ID 0, Router ID 4.4.4.4

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::B6A8:B9FF:FE01:B991, Interface ID 7

Area 1, Process ID 1, Instance ID 0, Router ID 4.4.4.4

Network Type BROADCAST, Cost: 1

Transmit Delay is 1 sec, State BDR, Priority 1

Designated Router (ID) 5.5.5.5, local address FE80::CE7F:76FF:FECE:9BF1

Backup Designated router (ID) 4.4.4.4, local address FE80::B6A8:B9FF:FE01:B991

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

Hello due in 00:00:00

Graceful restart helper support enabled

Index 1/2/2, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 2, maximum is 2

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 5.5.5.5 (Designated Router)

Suppress hello for 0 neighbor(s)

GigabitEthernet0/0/0 is up, line protocol is up

Link Local Address FE80::B6A8:B9FF:FE01:B990, Interface ID 6

Area 1, Process ID 1, Instance ID 0, Router ID 4.4.4.4

Network Type BROADCAST, Cost: 1

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 4.4.4.4, local address FE80::B6A8:B9FF:FE01:B990

Backup Designated router (ID) 3.3.3.3, local address FE80::227:90FF:FED5:FAD0

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

Hello due in 00:00:00

Graceful restart helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 6

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 3.3.3.3 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

R4#Show ipv6 route

IPv6 Routing Table - default - 8 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

O 2001:DB8::3/128 [110/1]

via FE80::227:90FF:FED5:FAD0, GigabitEthernet0/0/0

LC 2001:DB8::4/128 [0/0]

via Loopback0, receive

O 2001:DB8::5/128 [110/1]

via FE80::CE7F:76FF:FECE:9BF1, GigabitEthernet0/0/1

C 2001:DB8:0:24::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:0:24::4/128 [0/0]

via GigabitEthernet0/0/0, receive

C 2001:DB8:0:34::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:0:34::4/128 [0/0]

via GigabitEthernet0/0/1, receive

L FF00::/8 [0/0]

via Null0, receive

R4#show ip protocols

\*\*\* IP Routing is NSF aware \*\*\*

Routing Protocol is "application"

Sending updates every 0 seconds

Invalid after 0 seconds, hold down 0, flushed after 0

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Maximum path: 32

Routing for Networks:

Routing Information Sources:

Gateway Distance Last Update

Distance: (default is 4)

Routing Protocol is "ospf 1"

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Router ID 4.4.4.4

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Maximum path: 4

Routing for Networks:

4.4.4.4 0.0.0.0 area 1

192.168.23.0 0.0.0.255 area 1

192.168.34.0 0.0.0.255 area 1

Routing Information Sources:

Gateway Distance Last Update

5.5.5.5 110 00:19:31

3.3.3.3 110 00:22:42

Distance: (default is 110)

R4#show ipv6 protocols

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "application"

IPv6 Routing Protocol is "ND"

IPv6 Routing Protocol is "ospf 1"

Router ID 4.4.4.4

Number of areas: 1 normal, 0 stub, 0 nssa

Interfaces (Area 1):

Loopback0

GigabitEthernet0/0/1

GigabitEthernet0/0/0

Redistribution:

None

**Router 5:**

R5#Show run

Building configuration...

Current configuration : 4500 bytes

Last configuration change at 18:35:10 UTC Fri Jan 14 2022

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname 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

subscriber templating

ipv6 unicast-routing

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-859896477

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-859896477

revocation-check none

rsakeypair TP-self-signed-859896477

crypto pki certificate chain TP-self-signed-859896477

certificate self-signed 01

3082032E 30820216 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

30312E30 2C060355 04031325 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 38353938 39363437 37301E17 0D323230 31313431 38333335

395A170D 33303031 30313030 30303030 5A303031 2E302C06 03550403 1325494F

532D5365 6C662D53 69676E65 642D4365 72746966 69636174 652D3835 39383936

34373730 82012230 0D06092A 864886F7 0D010101 05000382 010F0030 82010A02

82010100 B1884176 82881FF8 B65E8ED3 217DC503 8A3CBEE7 79426822 B91DCEB9

5B390BEE DDBB988E 52F74159 05516ED6 4EDF26B4 C67FBCA1 882BC4F3 2E9F8AE6

83406B03 02F65C77 83533E17 1E3473F6 5C8AFBCD 050A2FD8 0FDDB658 1779D6E0

6E6166F8 6E9F3FC8 3933FDF9 D8E79970 BC8ABBE2 F0BF8D6B 0A18E9A1 AAF59F84

0509600D 57542454 5B95BBE9 0C9EEB50 4E34EED8 53DB737F 016A55DB DE36195C

EB0E73D3 63099C43 CF727D87 E6445D56 2358C1AA 11AD8119 F2F39D21 D8F9C7A0

E7B17BC1 8AEC45FA 4D797F5C 5D25AFD8 36E8432F EB45DD92 95625F1D DC3CDFBE

1383AA34 2C62FF3E 6DD5CB44 56402B0B E72DDEC2 0C1C3035 655BE7A8 AFBE4DA1

BE509205 02030100 01A35330 51300F06 03551D13 0101FF04 05300301 01FF301F

0603551D 23041830 1680146D D2766C97 0467D1A8 D5B51E18 71677E8F 9641C530

1D060355 1D0E0416 04146DD2 766C9704 67D1A8D5 B51E1871 677E8F96 41C5300D

06092A86 4886F70D 01010505 00038201 010010A6 69913B3D 6180FBFC A60F2B68

0DB51D4B 73801AFB BB9509C3 E19F4678 04C9813D EE5FCCE2 AD6A1984 E94D6253

864023B1 9B618E12 8638ACFD EE6C6070 38E7853D 86382993 C6087815 1BBCDFAD

A54B05F1 E64CEBC0 E44BE665 390B5A66 6D4AF893 053F5D20 0D367BF7 65F15621

B60A1B71 46998F6D 99B22870 DA31489B 9E8C2E8F 60B4B190 BD12793B 11E3924F

602713D4 A033074D 9DB0E594 3F1973F8 8E3A6059 76877C7E 796AD533 EF9AEAE3

48734DC1 B8BED52E 0EFDBEF5 5A14AEFA 0030FB1A 0123A9C8 282CA3A4 62858241

C8872CF5 C0F12E3E 46B2DDBB 8157B172 D0F0CB57 99658360 F0C7259C 0D173B59

2459E86C AA5255F9 969D9252 AB1C84EB 622A

quit

license udi pid ISR4321/K9 sn FLM240608PJ

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

ip address 5.5.5.5 255.255.255.0

ipv6 address 2001:DB8::5/128

ipv6 enable

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/0

ip address 192.168.45.5 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:45::5/64

ipv6 enable

interface GigabitEthernet0/0/1

ip address 192.168.34.5 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:34::5/64

ipv6 enable

ipv6 ospf 1 area 1

interface GigabitEthernet0/1/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/1/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router ospf 1

network 5.5.5.5 0.0.0.0 area 1

network 192.168.34.0 0.0.0.255 area 1

router bgp 12

bgp router-id 5.5.5.5

bgp log-neighbor-changes

neighbor 3.3.3.3 remote-as 12

neighbor 3.3.3.3 update-source Loopback0

neighbor 2001:DB8:0:45::6 remote-as 13

neighbor 192.168.45.6 remote-as 13

address-family ipv4

network 5.5.5.0 mask 255.255.255.0

neighbor 3.3.3.3 activate

neighbor 3.3.3.3 next-hop-self

no neighbor 2001:DB8:0:45::6 activate

neighbor 192.168.45.6 activate

exit-address-family

address-family ipv6

neighbor 2001:DB8:0:45::6 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 1

router-id 5.5.5.5

control-plane

line con 0

transport input none

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

2.0.0.0/24 is subnetted, 1 subnets

B 2.2.2.0 [200/0] via 3.3.3.3, 00:19:43

3.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

B 3.3.3.0/24 [200/0] via 3.3.3.3, 00:19:43

O 3.3.3.3/32 [110/3] via 192.168.34.4, 00:21:00, GigabitEthernet0/0/1

4.0.0.0/32 is subnetted, 1 subnets

O 4.4.4.4 [110/2] via 192.168.34.4, 00:21:00, GigabitEthernet0/0/1

5.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 5.5.5.0/24 is directly connected, Loopback0

L 5.5.5.5/32 is directly connected, Loopback0

O 192.168.23.0/24 [110/2] via 192.168.34.4, 00:21:00, GigabitEthernet0/0/1

192.168.34.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.34.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.34.5/32 is directly connected, GigabitEthernet0/0/1

192.168.45.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.45.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.45.5/32 is directly connected, GigabitEthernet0/0/0

R5#Show ip ospf

Routing Process "ospf 1" with ID 5.5.5.5

Start time: 00:19:06.789, Time elapsed: 00:22:04.994

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 50 msecs

Minimum hold time between two consecutive SPFs 200 msecs

Maximum wait time between two consecutive SPFs 5000 msecs

Incremental-SPF disabled

Initial LSA throttle delay 50 msecs

Minimum hold time for LSA throttle 200 msecs

Maximum wait time for LSA throttle 5000 msecs

Minimum LSA arrival 100 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area 1

Number of interfaces in this area is 2 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:21:10.711 ago

SPF algorithm executed 6 times

Area ranges are

Number of LSA 5. Checksum Sum 0x01F568

Number of opaque link LSA 0. Checksum Sum 0x000000

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R5#Show ip ospf interface

Loopback0 is up, line protocol is up

Internet Address 5.5.5.5/24, Interface ID 11, Area 1

Attached via Network Statement

Process ID 1, Router ID 5.5.5.5, 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 192.168.34.5/24, Interface ID 7, Area 1

Attached via Network Statement

Process ID 1, Router ID 5.5.5.5, 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) 5.5.5.5, Interface address 192.168.34.5

Backup Designated router (ID) 4.4.4.4, Interface address 192.168.34.4

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:06

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/2/2, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 1

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 4.4.4.4 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

R5#show ip ospf neighbor

Neighbor ID Pri State Dead Time Address Interface

4.4.4.4 1 FULL/BDR 00:00:38 192.168.34.4 GigabitEthernet0/0/1

R5#show ip ospf border-routers

OSPF Router with ID (5.5.5.5) (Process ID 1)

Base Topology (MTID 0)

Internal Router Routing Table

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

R5#Show ipv6 ospf

Routing Process "ospfv3 1" with ID 5.5.5.5

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 50 msecs

Minimum hold time between two consecutive SPFs 200 msecs

Maximum wait time between two consecutive SPFs 5000 msecs

Initial LSA throttle delay 50 msecs

Minimum hold time for LSA throttle 200 msecs

Maximum wait time for LSA throttle 5000 msecs

Minimum LSA arrival 100 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

Retransmission limit dc 24 non-dc 24

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

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 2

SPF algorithm executed 7 times

Number of LSA 12. Checksum Sum 0x043C5F

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R5#Show ipv6 ospf interface

Loopback0 is up, line protocol is up

Link Local Address FE80::CE7F:76FF:FECE:9BF0, Interface ID 11

Area 1, Process ID 1, Instance ID 0, Router ID 5.5.5.5

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::CE7F:76FF:FECE:9BF1, Interface ID 7

Area 1, Process ID 1, Instance ID 0, Router ID 5.5.5.5

Network Type BROADCAST, Cost: 1

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 5.5.5.5, local address FE80::CE7F:76FF:FECE:9BF1

Backup Designated router (ID) 4.4.4.4, local address FE80::B6A8:B9FF:FE01:B991

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

Hello due in 00:00:01

Graceful restart helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 2

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 4.4.4.4 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

R5#Show ipv6 route

IPv6 Routing Table - default - 9 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

O 2001:DB8::3/128 [110/2]

via FE80::B6A8:B9FF:FE01:B991, GigabitEthernet0/0/1

O 2001:DB8::4/128 [110/1]

via FE80::B6A8:B9FF:FE01:B991, GigabitEthernet0/0/1

LC 2001:DB8::5/128 [0/0]

via Loopback0, receive

O 2001:DB8:0:24::/64 [110/2]

via FE80::B6A8:B9FF:FE01:B991, GigabitEthernet0/0/1

C 2001:DB8:0:34::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:0:34::5/128 [0/0]

via GigabitEthernet0/0/1, receive

C 2001:DB8:0:45::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:0:45::5/128 [0/0]

via GigabitEthernet0/0/0, receive

L FF00::/8 [0/0]

via Null0, receive

R5#show ip protocols

\*\*\* IP Routing is NSF aware \*\*\*

Routing Protocol is "application"

Sending updates every 0 seconds

Invalid after 0 seconds, hold down 0, flushed after 0

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Maximum path: 32

Routing for Networks:

Routing Information Sources:

Gateway Distance Last Update

Distance: (default is 4)

Routing Protocol is "bgp 12"

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

Neighbor(s):

Address FiltIn FiltOut DistIn DistOut Weight RouteMap

3.3.3.3

192.168.45.6

Maximum path: 1

Routing Information Sources:

Gateway Distance Last Update

3.3.3.3 200 00:21:31

Distance: external 20 internal 200 local 200

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 5.5.5.5

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Maximum path: 4

Routing for Networks:

5.5.5.5 0.0.0.0 area 1

192.168.34.0 0.0.0.255 area 1

Routing Information Sources:

Gateway Distance Last Update

3.3.3.3 110 00:22:48

4.4.4.4 110 00:22:48

Distance: (default is 110)

R5#show ipv6 protocols

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "application"

IPv6 Routing Protocol is "ND"

IPv6 Routing Protocol is "ospf 1"

Router ID 5.5.5.5

Number of areas: 1 normal, 0 stub, 0 nssa

Interfaces (Area 1):

Loopback0

GigabitEthernet0/0/1

Redistribution:

None

IPv6 Routing Protocol is "bgp 12"

IGP synchronization is disabled

Redistribution:

None

Neighbor(s):

Address FiltIn FiltOut Weight RoutemapIn RoutemapOut

2001:DB8:0:45::6

Distance:

R5#show ip bgp

BGP table version is 4, 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,

t secondary path, L long-lived-stale,

Origin codes: i - IGP, e - EGP, ? - incomplete

RPKI validation codes: V valid, I invalid, N Not found

Network Next Hop Metric LocPrf Weight Path

\*>i 2.2.2.0/24 3.3.3.3 0 100 0 11 i

\*>i 3.3.3.0/24 3.3.3.3 0 100 0 i

\*> 5.5.5.0/24 0.0.0.0 0 32768 i

R5#show ip bgp neighbor

BGP neighbor is 3.3.3.3, remote AS 12, internal link

BGP version 4, remote router ID 3.3.3.3

BGP state = Established, up for 00:24:37

Last read 00:00:21, last write 00:00:27, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 2 3

Keepalives: 27 29

Route Refresh: 0 0

Total: 30 33

Do log neighbor state changes (via global configuration)

Default minimum time between advertisement runs is 0 seconds

For address family: IPv4 Unicast

Session: 3.3.3.3

BGP table version 4, neighbor version 4/0

Output queue size : 0

Index 1, Advertise bit 0

1 update-group member

NEXT\_HOP is always this router for eBGP paths

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 1 2 (Consumes 272 bytes)

Prefixes Total: 1 2

Implicit Withdraw: 0 0

Explicit Withdraw: 0 0

Used as bestpath: n/a 2

Used as multipath: n/a 0

Used as secondary: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 2 n/a

Total: 2 0

Number of NLRIs in the update sent: max 1, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 3.3.3.3

Route to peer address reachability Up: 1; Down: 0

Last notification 00:24:43

Connections established 1; dropped 0

Last reset never

Interface associated: (none) (peering address NOT in same link)

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

SSO is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255

Local host: 5.5.5.5, Local port: 33908

Foreign host: 3.3.3.3, 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 0x28EC6F):

Timer Starts Wakeups Next

Retrans 29 0 0x0

TimeWait 0 0 0x0

AckHold 30 27 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 611 610 0x28EF2F

DeadWait 0 0 0x0

Linger 0 0 0x0

ProcessQ 0 0 0x0

iss: 1390141709 snduna: 1390142358 sndnxt: 1390142358

irs: 704270382 rcvnxt: 704271130

sndwnd: 15736 scale: 0 maxrcvwnd: 16384

rcvwnd: 15637 scale: 0 delrcvwnd: 747

SRTT: 979 ms, RTTO: 1146 ms, RTV: 167 ms, KRTT: 0 ms

minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms

uptime: 1477137 ms, Sent idletime: 21618 ms, Receive idletime: 21819 ms

Status Flags: active open

Option Flags: nagle, path mtu capable

IP Precedence value : 6

Datagrams (max data segment is 1460 bytes):

Rcvd: 59 (out of order: 0), with data: 31, total data bytes: 747

Sent: 60 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 29, total data bytes: 648

Packets received in fast path: 0, fast processed: 0, slow path: 0

fast lock acquisition failures: 0, slow path: 0

TCP Semaphore 0x7F06BDA772C0 FREE

BGP neighbor is 192.168.45.6, remote AS 13, external link

BGP version 4, remote router ID 0.0.0.0

BGP state = Idle, down for never

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 30 seconds

For address family: IPv4 Unicast

BGP table version 4, neighbor version 1/4

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

Used as secondary: 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 192.168.45.6

Route to peer address reachability Up: 1; Down: 0

Last notification 00:24:57

Connections established 0; dropped 0

Last reset never

External BGP neighbor configured for connected checks (single-hop no-disable-connected-check)

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 ip bgp summary

BGP router identifier 5.5.5.5, local AS number 12

BGP table version is 4, main routing table version 4

3 network entries using 744 bytes of memory

3 path entries using 408 bytes of memory

3/3 BGP path/bestpath attribute entries using 840 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 2016 total bytes of memory

BGP activity 3/0 prefixes, 3/0 paths, scan interval 60 secs

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

3.3.3.3 4 12 33 30 4 0 0 00:25:05 2

192.168.45.6 4 13 0 0 1 0 0 never Idle

R5#show bgp ipv6 neighbor

% Command accepted but obsolete, unreleased or unsupported; see documentation.

BGP neighbor is 2001:DB8:0:45::6, remote AS 13, external link

BGP version 4, remote router ID 6.6.6.6

BGP state = Established, up for 00:25:35

Last read 00:00:22, last write 00:00:15, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv6 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 1 1

Keepalives: 29 29

Route Refresh: 0 0

Total: 31 31

Do log neighbor state changes (via global configuration)

Default minimum time between advertisement runs is 30 seconds

For address family: IPv6 Unicast

Session: 2001:DB8:0:45::6

BGP table version 1, neighbor version 1/0

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: 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

Used as secondary: 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:DB8:0:45::6

Route to peer address reachability Up: 1; Down: 0

Last notification 00:25:36

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:DB8:0:45::5, Local port: 179

Foreign host: 2001:DB8:0:45::6, Foreign port: 20026

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 0x298A20):

Timer Starts Wakeups Next

Retrans 30 0 0x0

TimeWait 0 0 0x0

AckHold 31 30 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: 122010960 snduna: 122011598 sndnxt: 122011598

irs: 2121494475 rcvnxt: 2121495113

sndwnd: 15747 scale: 0 maxrcvwnd: 16384

rcvwnd: 15747 scale: 0 delrcvwnd: 637

SRTT: 982 ms, RTTO: 1129 ms, RTV: 147 ms, KRTT: 0 ms

minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms

uptime: 1535872 ms, Sent idletime: 15187 ms, Receive idletime: 14986 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: 62 (out of order: 0), with data: 31, total data bytes: 637

Sent: 63 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 63, total data bytes: 3165

Packets received in fast path: 0, fast processed: 0, slow path: 0

fast lock acquisition failures: 0, slow path: 0

TCP Semaphore 0x7F06BDA77390 FREE

R5#show bgp ipv6 summary

% Command accepted but obsolete, unreleased or unsupported; see documentation.

BGP router identifier 5.5.5.5, local AS number 12

BGP table version is 1, main routing table version 1

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

2001:DB8:0:45::6

4 13 31 31 1 0 0 00:25:57 0

**Router 6:**

R6#Show run

Building configuration...

Current configuration : 4324 bytes

Last configuration change at 18:35:47 UTC Fri Jan 14 2022

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R6

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

login on-success log

subscriber templating

ipv6 unicast-routing

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-4288135047

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-4288135047

revocation-check none

rsakeypair TP-self-signed-4288135047

crypto pki certificate chain TP-self-signed-4288135047

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 34323838 31333530 3437301E 170D3232 30313134 31383138

34315A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D34 32383831

33353034 37308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100D5CD 6EDF3E39 681E1AAB CF8CE752 F9FB3172 385FE430 52067565

398689B3 D8019DF1 6415B964 3ADC7C1D 05691004 14F18725 99155257 6F01667D

BAC3DD9B 45EC677A 20D48C7F A24BE6D2 09898983 0DA9A092 AD159168 767B69BD

6E07F14F A51E0B4F 35EAA449 DC7E72BF 6732C5D4 7F1D0E75 DF55E766 38F9E854

639559BF 109C26D9 508B42EE A0306C24 BD12EF9F 26E68960 CBA0B511 2A072FD9

E4AE7253 08D552D3 3F99BB87 C1CD469A F7BA29E7 AD9BD7B8 97B1EF4D B92C1559

71C493A9 B523418F 0BA12113 D7147C9E BC0B08FE 656BCFA5 94D5C621 58D2A1AF

65B12748 D03FA01E 9104A4B4 92B9777A 52A06621 CC293296 1E0FABC2 EEC710AD

85B25892 41190203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 146ED013 5E73C3F0 A8B9A1A4 8B8DC44C ACB83081

0A301D06 03551D0E 04160414 6ED0135E 73C3F0A8 B9A1A48B 8DC44CAC B830810A

300D0609 2A864886 F70D0101 05050003 82010100 490E1E76 29D6FD9C 48277D8C

6A832F89 D4B9A8F3 CECDCF05 99512D16 EE059141 1ED5A9C9 9BEFEB82 ED422D9C

9A6FEDED 7BA78965 52DB7836 08BCA1F3 02A8710C 517779FC 692711C5 C0DB2EE2

344B5959 4CC05739 4784803E 06DABAB8 A611E576 024BA1B5 6231E4AA 2178404A

37ACEFFD 5F3136C0 BE72DC26 31E6FB0A 6F37092B CFD3C25B 05919A20 509B0ED1

E8DF31F2 10D08584 DA0C1983 5C8BBF49 35E6E0D5 0DB284C3 140040EF D63EBB3D

DA5F9960 CDAD85D7 9F10B303 13AF38B8 FC4A2E21 3945BB96 16A45672 4EEE5BD7

56B847CC 58D2525D 47EB687E 3CBA425C E2959697 F8D3A33A E9A37D3E B8029201

D303B3A3 DAC37264 1FD64846 796D7F28 C50E22BB

quit

license udi pid ISR4321/K9 sn FLM2406090M

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

ip address 6.6.6.6 255.255.255.0

ipv6 address 2001:DB8::6/128

ipv6 eigrp 1

interface GigabitEthernet0/0/0

ip address 192.168.45.6 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:45::6/64

ipv6 enable

interface GigabitEthernet0/0/1

ip address 192.168.56.6 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:56::6/64

ipv6 enable

ipv6 eigrp 1

interface GigabitEthernet0/1/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/1/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router eigrp 1

variance 128

network 192.168.56.0

router bgp 13

bgp router-id 6.6.6.6

bgp log-neighbor-changes

neighbor 2001:DB8:0:45::5 remote-as 12

neighbor 192.168.89.5 remote-as 12

address-family ipv4

network 6.6.6.0 mask 255.255.255.0

no neighbor 2001:DB8:0:45::5 activate

neighbor 192.168.89.5 activate

exit-address-family

address-family ipv6

neighbor 2001:DB8:0:45::5 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 1

eigrp router-id 6.6.6.6

control-plane

line con 0

transport input none

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

6.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 6.6.6.0/24 is directly connected, Loopback0

L 6.6.6.6/32 is directly connected, Loopback0

192.168.45.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.45.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.45.6/32 is directly connected, GigabitEthernet0/0/0

192.168.56.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.56.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.56.6/32 is directly connected, GigabitEthernet0/0/1

R6#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

Gi0/0/1 1 0/0 0/0 2 0/0 50 0

R6#show ip eigrp neighbor

EIGRP-IPv4 Neighbors for AS(1)

H Address Interface Hold Uptime SRTT RTO Q Seq

(sec) (ms) Cnt Num

0 192.168.56.7 Gi0/0/1 12 00:28:42 2 100 0 2

R6#show ip eigrp topology

EIGRP-IPv4 Topology Table for AS(1)/ID(6.6.6.6)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,

r - reply Status, s - sia Status

P 192.168.56.0/24, 1 successors, FD is 2816

via Connected, GigabitEthernet0/0/1

R6#Show ipv6 eigrp interface

EIGRP-IPv6 Interfaces for AS(1)

Xmit Queue PeerQ Mean Pacing Time Multicast Pending

Interface Peers Un/Reliable Un/Reliable SRTT Un/Reliable Flow Timer Routes

Gi0/0/1 1 0/0 0/0 1 0/0 50 0

Lo0 0 0/0 0/0 0 0/0 0 0

R6#Show ipv6 eigrp neighbor

EIGRP-IPv6 Neighbors for AS(1)

H Address Interface Hold Uptime SRTT RTO Q Seq

(sec) (ms) Cnt Num

0 Link-local address: Gi0/0/1 14 00:29:08 1 100 0 3

FE80::CE7F:76FF:FE6A:A981

R6#show ipv6 eigrp topology

EIGRP-IPv6 Topology Table for AS(1)/ID(6.6.6.6)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,

r - reply Status, s - sia Status

P 2001:DB8:0:56::/64, 1 successors, FD is 2816

via Connected, GigabitEthernet0/0/1

P 2001:DB8::6/128, 1 successors, FD is 128256

via Connected, Loopback0

P 2001:DB8::7/128, 1 successors, FD is 130816

via FE80::CE7F:76FF:FE6A:A981 (130816/128256), GigabitEthernet0/0/1

R6#Show ipv6 route

IPv6 Routing Table - default - 7 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

LC 2001:DB8::6/128 [0/0]

via Loopback0, receive

D 2001:DB8::7/128 [90/130816]

via FE80::CE7F:76FF:FE6A:A981, GigabitEthernet0/0/1

C 2001:DB8:0:45::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:0:45::6/128 [0/0]

via GigabitEthernet0/0/0, receive

C 2001:DB8:0:56::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:0:56::6/128 [0/0]

via GigabitEthernet0/0/1, receive

L FF00::/8 [0/0]

via Null0, receive

R6#show ip protocols

\*\*\* IP Routing is NSF aware \*\*\*

Routing Protocol is "application"

Sending updates every 0 seconds

Invalid after 0 seconds, hold down 0, flushed after 0

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Maximum path: 32

Routing for Networks:

Routing Information Sources:

Gateway Distance Last Update

Distance: (default is 4)

Routing Protocol is "bgp 13"

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

Neighbor(s):

Address FiltIn FiltOut DistIn DistOut Weight RouteMap

192.168.89.5

Maximum path: 1

Routing Information Sources:

Gateway Distance Last Update

Distance: external 20 internal 200 local 200

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: 6.6.6.6

Topology : 0 (base)

Active Timer: 3 min

Distance: internal 90 external 170

Maximum path: 4

Maximum hopcount 100

Maximum metric variance 128

Automatic Summarization: disabled

Maximum path: 4

Routing for Networks:

192.168.56.0

Routing Information Sources:

Gateway Distance Last Update

Distance: internal 90 external 170

R6#show ipv6 protocols

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "application"

IPv6 Routing Protocol is "ND"

IPv6 Routing Protocol is "bgp 13"

IGP synchronization is disabled

Redistribution:

None

Neighbor(s):

Address FiltIn FiltOut Weight RoutemapIn RoutemapOut

2001:DB8:0:45::5

Distance:

IPv6 Routing Protocol is "eigrp 1"

EIGRP-IPv6 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: 6.6.6.6

Topology : 0 (base)

Active Timer: 3 min

Distance: internal 90 external 170

Maximum path: 16

Maximum hopcount 100

Maximum metric variance 1

Interfaces:

GigabitEthernet0/0/1

Loopback0

Redistribution:

None

R6#show ip bgp

BGP table version is 2, 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,

t secondary path, L long-lived-stale,

Origin codes: i - IGP, e - EGP, ? - incomplete

RPKI validation codes: V valid, I invalid, N Not found

Network Next Hop Metric LocPrf Weight Path

\*> 6.6.6.0/24 0.0.0.0 0 32768 i

R6#show ip bgp

BGP table version is 2, 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,

t secondary path, L long-lived-stale,

Origin codes: i - IGP, e - EGP, ? - incomplete

RPKI validation codes: V valid, I invalid, N Not found

Network Next Hop Metric LocPrf Weight Path

\*> 6.6.6.0/24 0.0.0.0 0 32768 i

R6#show ip bgp neighbor

BGP neighbor is 192.168.89.5, remote AS 12, external link

BGP version 4, remote router ID 0.0.0.0

BGP state = Idle, down for never

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 30 seconds

For address family: IPv4 Unicast

BGP table version 2, neighbor version 1/2

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

Used as secondary: 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 192.168.89.5

Route to peer address reachability Up: 0; Down: 0

Last notification never

Connections established 0; dropped 0

Last reset never

External BGP neighbor not directly connected.

External BGP neighbor configured for connected checks (single-hop no-disable-connected-check)

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

R6#show ip bgp summary

BGP router identifier 6.6.6.6, local AS number 13

BGP table version is 2, main routing table version 2

1 network entries using 248 bytes of memory

1 path entries using 136 bytes of memory

1/1 BGP path/bestpath attribute entries using 280 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 664 total bytes of memory

BGP activity 1/0 prefixes, 1/0 paths, scan interval 60 secs

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

192.168.89.5 4 12 0 0 1 0 0 never Idle

R6#show bgp ipv6 neighbor

% Command accepted but obsolete, unreleased or unsupported; see documentation.

BGP neighbor is 2001:DB8:0:45::5, remote AS 12, external link

BGP version 4, remote router ID 5.5.5.5

BGP state = Established, up for 00:31:19

Last read 00:00:21, last write 00:00:30, 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: 1 1

Keepalives: 35 35

Route Refresh: 0 0

Total: 37 37

Do log neighbor state changes (via global configuration)

Default minimum time between advertisement runs is 30 seconds

For address family: IPv6 Unicast

Session: 2001:DB8:0:45::5

BGP table version 1, neighbor version 1/0

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: 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

Used as secondary: 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:DB8:0:45::5

Route to peer address reachability Up: 1; Down: 0

Last notification 00:31:20

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:DB8:0:45::6, Local port: 20026

Foreign host: 2001:DB8:0:45::5, 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 0x30B795):

Timer Starts Wakeups Next

Retrans 38 0 0x0

TimeWait 0 0 0x0

AckHold 36 33 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 1023 1022 0x30B9BF

DeadWait 0 0 0x0

Linger 0 0 0x0

ProcessQ 0 0 0x0

iss: 2121494475 snduna: 2121495227 sndnxt: 2121495227

irs: 122010960 rcvnxt: 122011712

sndwnd: 15633 scale: 0 maxrcvwnd: 16384

rcvwnd: 15633 scale: 0 delrcvwnd: 751

SRTT: 994 ms, RTTO: 1046 ms, RTV: 52 ms, KRTT: 0 ms

minRTT: 1 ms, maxRTT: 1000 ms, ACK hold: 200 ms

uptime: 1879195 ms, Sent idletime: 21388 ms, Receive idletime: 21588 ms

Status Flags: active open

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: 37, total data bytes: 751

Sent: 74 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0), with data: 74, total data bytes: 3719

Packets received in fast path: 0, fast processed: 0, slow path: 0

fast lock acquisition failures: 0, slow path: 0

TCP Semaphore 0x7FC8F2CD9D80 FREE

R6#show bgp ipv6 summary

% Command accepted but obsolete, unreleased or unsupported; see documentation.

BGP router identifier 6.6.6.6, local AS number 13

BGP table version is 1, main routing table version 1

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

2001:DB8:0:45::5

4 12 37 38 1 0 0 00:31:45 0

**Router 7:**

R7#Show run

Building configuration...

Current configuration : 3885 bytes

Last configuration change at 18:32:23 UTC Fri Jan 14 2022

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname 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

login on-success log

subscriber templating

ipv6 unicast-routing

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-2667303412

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-2667303412

revocation-check none

rsakeypair TP-self-signed-2667303412

crypto pki certificate chain TP-self-signed-2667303412

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 32363637 33303334 3132301E 170D3232 30313134 31383038

30315A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 36363733

30333431 32308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100A86B CE2CE1F4 B9F0C96D 5BC9551A 9B1FB8E3 48839C05 7E1CD3FF

BB7E59C1 6C248F05 06629187 B6FED7B6 3D9C79FC A4AE75C1 21E666BB 4F2D5314

7BFD7BAD 0F54A392 39154438 621E544F 02369B7F A69A1250 D1B30CE9 AA00EB37

C9695EAB 375A4C9C F5227FB1 2FC7702D EEAAF66B 76ED5A8A 6D58022C 4B87C901

A30B57BF 6BDD3257 8FE613AC 538257FD BE783747 5EB4E7F4 9DBC8F8C FFFD90F9

451B8D01 E2B1735C B9BA718B 02D52B10 2D4CA69B 42CEE6AF 32B535A8 00DFCE84

755F6325 9A830A9B 86706C8A 36E3053F 112AE3EF CB487A2A 813F644B 0C69699C

C7F497B1 029F281F 4657D0E8 0E52FF80 5DBF54D5 7D3F83E6 F1605E8E 68DE6E33

D1A7679E 61890203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 14D44D26 F97020B4 C7F13870 80A35CFD 771C3B5C

0F301D06 03551D0E 04160414 D44D26F9 7020B4C7 F1387080 A35CFD77 1C3B5C0F

300D0609 2A864886 F70D0101 05050003 82010100 58E2D333 F0D47421 50A002AE

C03267BB 5DC6A235 382F7AC3 36FAFB53 9D4467C2 1DF0A495 25C918C4 47BC2ECC

71672CCA 224265BE 35C41AF5 DCB14003 296B4076 9D76EF66 C30B7C74 C0E9685E

940925C0 67F32041 C1370B71 42A0E1A2 E62C5405 4889FC82 A3081080 2E966513

C7DB920D BE9AA0BD 80184C3F 983444D9 46AF7F62 B53C5108 0C884BD1 BD2E551E

F24D2A94 BF22E4AC F5F78022 795952B2 44FBBD34 A14BA812 4DDB1870 022D7E28

5906D739 3FE986B2 84D30EF4 7840785D 30C34519 97C42093 0E10AC87 2F1EB76D

9F3B6E29 DDB1A0F4 A4C5C550 0F0717C9 4551E678 8EE3E6FD 75FC8502 1E1A0DF5

D9F867C9 322FE88B 7011C73E 2EAF3E7C 14B5CE07

quit

license udi pid ISR4321/K9 sn FLM2407011F

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

ip address 7.7.7.7 255.255.255.0

ipv6 address 2001:DB8::7/128

ipv6 eigrp 1

interface GigabitEthernet0/0/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.56.7 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:0:56::7/64

ipv6 enable

ipv6 eigrp 1

interface GigabitEthernet0/1/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/1/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router eigrp 1

variance 128

network 192.168.56.0

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router eigrp 1

eigrp router-id 7.7.7.7

control-plane

line con 0

transport input none

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

7.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 7.7.7.0/24 is directly connected, Loopback0

L 7.7.7.7/32 is directly connected, Loopback0

192.168.56.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.56.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.56.7/32 is directly connected, GigabitEthernet0/0/1

R7#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

Gi0/0/1 1 0/0 0/0 0 0/0 50 0

R7#show ip eigrp neighbor

EIGRP-IPv4 Neighbors for AS(1)

H Address Interface Hold Uptime SRTT RTO Q Seq

(sec) (ms) Cnt Num

0 192.168.56.6 Gi0/0/1 11 00:33:30 1 4500 0 2

R7#show ip eigrp topology

EIGRP-IPv4 Topology Table for AS(1)/ID(7.7.7.7)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,

r - reply Status, s - sia Status

P 192.168.56.0/24, 1 successors, FD is 2816

via Connected, GigabitEthernet0/0/1

R7#Show ipv6 eigrp interface

EIGRP-IPv6 Interfaces for AS(1)

Xmit Queue PeerQ Mean Pacing Time Multicast Pending

Interface Peers Un/Reliable Un/Reliable SRTT Un/Reliable Flow Timer Routes

Gi0/0/1 1 0/0 0/0 1598 0/0 7992 0

Lo0 0 0/0 0/0 0 0/0 0 0

R7#Show ipv6 eigrp neighbor

EIGRP-IPv6 Neighbors for AS(1)

H Address Interface Hold Uptime SRTT RTO Q Seq

(sec) (ms) Cnt Num

0 Link-local address: Gi0/0/1 11 00:33:55 1598 5000 0 4

FE80::CE7F:76FF:FEC8:A1F1

R7#show ipv6 eigrp topology

EIGRP-IPv6 Topology Table for AS(1)/ID(7.7.7.7)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,

r - reply Status, s - sia Status

P 2001:DB8:0:56::/64, 1 successors, FD is 2816

via Connected, GigabitEthernet0/0/1

P 2001:DB8::6/128, 1 successors, FD is 130816

via FE80::CE7F:76FF:FEC8:A1F1 (130816/128256), GigabitEthernet0/0/1

P 2001:DB8::7/128, 1 successors, FD is 128256

via Connected, Loopback0

R7#Show ipv6 route

IPv6 Routing Table - default - 5 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

D 2001:DB8::6/128 [90/130816]

via FE80::CE7F:76FF:FEC8:A1F1, GigabitEthernet0/0/1

LC 2001:DB8::7/128 [0/0]

via Loopback0, receive

C 2001:DB8:0:56::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:0:56::7/128 [0/0]

via GigabitEthernet0/0/1, receive

L FF00::/8 [0/0]

via Null0, receive

R7#show ip protocols

\*\*\* IP Routing is NSF aware \*\*\*

Routing Protocol is "application"

Sending updates every 0 seconds

Invalid after 0 seconds, hold down 0, flushed after 0

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Maximum path: 32

Routing for Networks:

Routing Information Sources:

Gateway Distance Last Update

Distance: (default is 4)

Routing Protocol is "eigrp 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: 7.7.7.7

Topology : 0 (base)

Active Timer: 3 min

Distance: internal 90 external 170

Maximum path: 4

Maximum hopcount 100

Maximum metric variance 128

Automatic Summarization: disabled

Maximum path: 4

Routing for Networks:

192.168.56.0

Routing Information Sources:

Gateway Distance Last Update

Distance: internal 90 external 170

R7#show ipv6 protocols

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "application"

IPv6 Routing Protocol is "ND"

IPv6 Routing Protocol is "eigrp 1"

EIGRP-IPv6 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: 7.7.7.7

Topology : 0 (base)

Active Timer: 3 min

Distance: internal 90 external 170

Maximum path: 16

Maximum hopcount 100

Maximum metric variance 1

Interfaces:

GigabitEthernet0/0/1

Loopback0

Redistribution:

None

Problems

One of the biggest problems that I faced in the lab was that I wasn’t familiar with how to configure Internal Border Gateway Protocol (IBGP) system, so I looked at the cisco book along with the cisco website on IBGP configuration to understand how to properly configure an IBGP system. During the process of creating the IBGP, I didn’t encounter any minor problems in configuring IBGP except for not understanding how to configure IBGP initially.

Conclusion

The objective of the lab was to use 7 routers to configure a BGP (Border Gateway Protocol) system where two autonomous systems both with two routers connected to another autonomous system with three routers with EBGP. The autonomous system with three routers also requires an IBGP connection between two end routers. In the lab, I was able to learn how to correctly configure IBGP connections that could be applied to real networks. I was also able to learn about how EBGP and IBGP routing worked in a network. One skill that I learned was to use knowledge of previous lab configurations that are helpful to me then tweak it to fit my needs in the new lab. Personally, I thought this lab was helpful in understanding something new like IBGP routing and improving my general knowledge of cisco networking.