A circuit board

Description automatically generated

OSPF V3 Lab

focus on muLTi-area connections

Marcello Novak | CCNP

***Purpose***

In this last lab, we were asked to add an extra router and computer to our last lab’s topology, identical to the first four. We were then told to split the five computer/router connections into two areas, the first with three computers, and the second with the other two. The goal of the lab was to create two areas and configure the devices to be able to ping between them using OSPF v3.

***Background***

Multi-area OSPF is an expansion on OSPF v2, still doing things like flooding link-state information to all neighboring routers, which builds databases, and choosing routes based on the route cost. OSPF v2 works on a small scale, but multi-area OSPF is for larger topologies with more devices that need to communicate. If we use OSPF v2 for a larger network, for starters the LSDB (link-state database) will quickly grow out of hand. This also means whenever a packet needs to be sent out, the routers will have to search through the entire database, which could affect performance. Additionally, every time a router updates anything, updates are flooded throughout the entire network, forcing every router to re-run the OSPF algorithm. Multi-area OSPF is the solution to all these problems, but it adds some complexity.

First, area 0 needs to be set, or your backbone. Usually, this is the area all other areas are connected to and acts as a hub of sorts. Secondly, planning your subnetting is very important; as effective subnetting is the key to OSPF. Subnetting all like networks into unique areas and reflecting that in your IP schemes is what multi-area OSPF is designed for. Routers between areas act as “area border routers”, or ABRs. These routers, with interfaces crossing areas, act as a route to their respective areas. They do so by summarizing their areas in a route. For instance, if area one has all the 25.0.0.0 networks, the ABR will send a route to the backbone area with a route of 25.0.0.0 for example. This makes routing much easier, as you can send a packet to the border router and have the area router sort it out. This reduces the routing table and database sizes immensely, and updates are contained within their respective areas. An easy way to think about this is that OSPF v2 is like a spiderweb, getting larger and larger and harder to keep track of. OSPF v3 on the other hand is like a clustered graph, where each packet gets sorted along and dealt with every time it comes to an intersection by the router at that one intersection.

***Lab Summary***

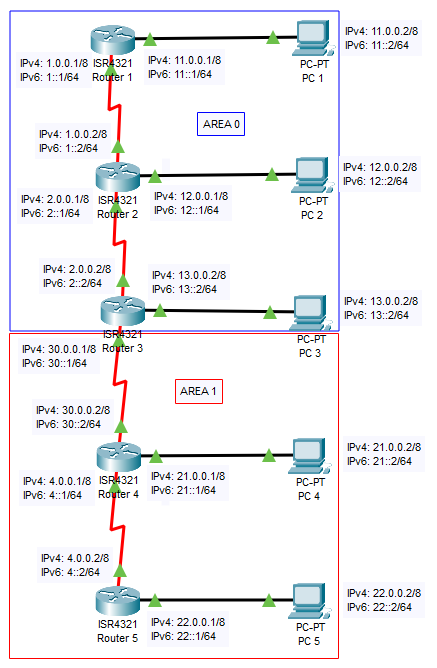
1. After creating the additional devices, I began by creating a new IP scheme on paper.
2. Once I had a good idea of where all the connections should fit, I added IPv4 and IPv6 addresses to all devices, enabled unicast routing, turned on all interfaces, and added the last clock rate interface.
3. After this completed, I enabled unicast routing on all routers, configured the area zones in the routers, and used network commands to assign an area to each network.
4. Finally, I enabled router OSPF 10, gave each router a unique ID, added FE80::1 link-local addresses to all routers, and was able to ping between each router.

***Lab Commands***

A good few new commands were being used in this lab, so I have prepared a small table with each command and its purpose to save on space and to make it much more readable. These commands primarily consist of OSPF and IPv6 configuration.

|  |  |
| --- | --- |
| IPv6 address X::X | Assigns an IPv6 address to an interface |
| IPv6 router OSPF **[*process-id*]** | Enables OSPF v3 on a router |
| Ipv6 OSPF **[*process-id*]** area **[*area-id*]** | Enables OSPF v3 on an interface |
| IPv6 unicast-routing | Enables IPv6 routing on a router |
| router-id [***x.x.x.x*]** | Assigns a router ID to a router |

***Network Topology***



***Configurations***

R1#show run

Building configuration...

Current configuration : 1083 bytes

version 15.4

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

hostname R1

no ip cef

ipv6 unicast-routing

no ipv6 cef

spanning-tree mode pvst

interface GigabitEthernet0/0/0

ip address 11.0.0.1 255.255.255.0

duplex auto

speed auto

ipv6 address FE80::1 link-local

ipv6 address 11::1/64

ipv6 ospf 10 area 0

interface GigabitEthernet0/0/1

no ip address

duplex auto

speed auto

shutdown

interface Serial0/1/0

ip address 1.0.0.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 1::1/64

ipv6 enable

ipv6 ospf 10 area 0

clock rate 56000

interface Serial0/1/1

no ip address

clock rate 2000000

shutdown

interface Vlan1

no ip address

shutdown

router ospf 1

log-adjacency-changes

network 1.0.0.0 0.0.0.255 area 0

router ospf 10

log-adjacency-changes

ipv6 router ospf 10

router-id 1.1.1.1

log-adjacency-changes

ip classless

ip flow-export version 9

line con 0

line aux 0

line vty 0 4

login

end

R1#show ipv6 route

IPv6 Routing Table - 12 entries

Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP

U - Per-user Static route, M - MIPv6

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

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

D - EIGRP, EX - EIGRP external

C 1::/64 [0/0]

via Serial0/1/0, directly connected

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

via Serial0/1/0, receive

O 2::/64 [110/128]

via FE80::1, Serial0/1/0

OI 4::/64 [110/256]

via FE80::1, Serial0/1/0

C 11::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 11::1/128 [0/0]

via GigabitEthernet0/0/0, receive

O 12::/64 [110/65]

via FE80::1, Serial0/1/0

O 13::/64 [110/129]

via FE80::1, Serial0/1/0

OI 21::/64 [110/193]

via FE80::1, Serial0/1/0

OI 22::/64 [110/257]

via FE80::1, Serial0/1/0

OI 30::/64 [110/192]

via FE80::1, Serial0/1/0

L FF00::/8 [0/0]

via Null0, receive

R1#show ipv6 ospf

Routing Process "ospfv3 10" with ID 1.1.1.1

SPF schedule delay 5 secs, Hold time between two SPFs 10 secs

Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

Number of external LSA 0. Checksum Sum 0x000000

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

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 2

SPF algorithm executed 105 times

Number of LSA 10. Checksum Sum 0x051c75

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R1# show ipv6 ospf interface

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

Link Local Address FE80::1, Interface ID 1

Area 0, Process ID 10, Instance ID 0, Router ID 1.1.1.1

Network Type BROADCAST, Cost: 1

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 1.1.1.1, local address FE80::1

No backup designated router on this network

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

Hello due in 00:00:02

Index 1/1, flood queue length 0

Next 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 0, Adjacent neighbor count is 0

Suppress hello for 0 neighbor(s)

Serial0/1/0 is up, line protocol is up

Link Local Address FE80::1, Interface ID 3

Area 0, Process ID 10, Instance ID 0, Router ID 1.1.1.1

Network Type POINT-TO-POINT, Cost: 64

Transmit Delay is 1 sec, State POINT-TO-POINT,

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

Hello due in 00:00:02

Index 2/2, flood queue length 0

Next 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

Suppress hello for 0 neighbor(s)

R2#show run

Building configuration...

Current configuration : 1126 bytes

version 15.4

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

hostname R2

ip cef

ipv6 unicast-routing

no ipv6 cef

spanning-tree mode pvst

interface GigabitEthernet0/0/0

ip address 12.0.0.1 255.255.255.0

duplex auto

speed auto

ipv6 address FE80::1 link-local

ipv6 address 12::1/64

ipv6 ospf 10 area 0

interface GigabitEthernet0/0/1

no ip address

duplex auto

speed auto

shutdown

interface Serial0/1/0

ip address 2.0.0.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 2::1/64

ipv6 ospf 10 area 0

clock rate 56000

interface Serial0/1/1

ip address 1.0.0.2 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 1::2/64

ipv6 ospf 10 area 0

interface Vlan1

no ip address

shutdown

router ospf 1

log-adjacency-changes

network 2.0.0.0 0.0.0.255 area 0

network 1.0.0.0 0.0.0.255 area 0

ipv6 router ospf 10

router-id 2.2.2.2

log-adjacency-changes

ip classless

ip flow-export version 9

line con 0

line aux 0

line vty 0 4

login

end

R2#show ipv6 route

IPv6 Routing Table - 13 entries

Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP

U - Per-user Static route, M - MIPv6

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

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

D - EIGRP, EX - EIGRP external

C 1::/64 [0/0]

via Serial0/1/1, directly connected

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

via Serial0/1/1, receive

C 2::/64 [0/0]

via Serial0/1/0, directly connected

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

via Serial0/1/0, receive

OI 4::/64 [110/192]

via FE80::1, Serial0/1/0

O 11::/64 [110/65]

via FE80::1, Serial0/1/1

C 12::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 12::1/128 [0/0]

via GigabitEthernet0/0/0, receive

O 13::/64 [110/65]

via FE80::1, Serial0/1/0

OI 21::/64 [110/129]

via FE80::1, Serial0/1/0

OI 22::/64 [110/193]

via FE80::1, Serial0/1/0

OI 30::/64 [110/128]

via FE80::1, Serial0/1/0

L FF00::/8 [0/0]

via Null0, receive

R2#show ipv6 ospf

Routing Process "ospfv3 10" with ID 2.2.2.2

SPF schedule delay 5 secs, Hold time between two SPFs 10 secs

Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

Number of external LSA 0. Checksum Sum 0x000000

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

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 3

SPF algorithm executed 78 times

Number of LSA 10. Checksum Sum 0x0454d3

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R2#show ipv6 ospf neighbor

Neighbor ID Pri State Dead Time Interface ID Interface

1.1.1.1 0 FULL/ - 00:00:37 3 Serial0/1/1

3.3.3.3 0 FULL/ - 00:00:37 4 Serial0/1/0

R2#show ipv6 ospf interface

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

Link Local Address FE80::1, Interface ID 1

Area 0, Process ID 10, Instance ID 0, Router ID 2.2.2.2

Network Type BROADCAST, Cost: 1

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 2.2.2.2, local address FE80::1

No backup designated router on this network

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

Hello due in 00:00:00

Index 1/1, flood queue length 0

Next 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 0, Adjacent neighbor count is 0

Suppress hello for 0 neighbor(s)

Serial0/1/1 is up, line protocol is up

Link Local Address FE80::1, Interface ID 4

Area 0, Process ID 10, Instance ID 0, Router ID 2.2.2.2

Network Type POINT-TO-POINT, Cost: 64

Transmit Delay is 1 sec, State POINT-TO-POINT,

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

Hello due in 00:00:00

Index 2/2, flood queue length 0

Next 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 1.1.1.1

Suppress hello for 0 neighbor(s)

Serial0/1/0 is up, line protocol is up

Link Local Address FE80::1, Interface ID 3

Area 0, Process ID 10, Instance ID 0, Router ID 2.2.2.2

Network Type POINT-TO-POINT, Cost: 64

Transmit Delay is 1 sec, State POINT-TO-POINT,

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

Hello due in 00:00:00

Index 3/3, flood queue length 0

Next 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 3.3.3.3

Suppress hello for 0 neighbor(s)

R3#show run

Building configuration...

Current configuration : 1164 bytes

version 15.4

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

hostname R3

ip cef

ipv6 unicast-routing

no ipv6 cef

spanning-tree mode pvst

interface GigabitEthernet0/0/0

ip address 13.0.0.1 255.255.255.0

duplex auto

speed auto

ipv6 address FE80::1 link-local

ipv6 address 13::1/64

ipv6 ospf 10 area 0

interface GigabitEthernet0/0/1

no ip address

duplex auto

speed auto

shutdown

interface Serial0/1/0

ip address 30.0.0.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 30::1/64

ipv6 ospf 10 area 1

clock rate 56000

interface Serial0/1/1

ip address 2.0.0.2 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 2::2/64

ipv6 ospf 10 area 0

interface Vlan1

no ip address

shutdown

router ospf 1

log-adjacency-changes

network 2.0.0.0 0.0.0.255 area 0

network 13.0.0.0 0.0.0.255 area 0

network 30.0.0.0 0.0.0.255 area 1

ipv6 router ospf 10

router-id 3.3.3.3

log-adjacency-changes

ip classless

ip flow-export version 9

line con 0

line aux 0

line vty 0 4

login

end

R3#show ipv6 route

IPv6 Routing Table - 13 entries

Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP

U - Per-user Static route, M - MIPv6

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

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

D - EIGRP, EX - EIGRP external

O 1::/64 [110/128]

via FE80::1, Serial0/1/1

C 2::/64 [0/0]

via Serial0/1/1, directly connected

L 2::2/128 [0/0]

via Serial0/1/1, receive

O 4::/64 [110/128]

via FE80::1, Serial0/1/0

O 11::/64 [110/129]

via FE80::1, Serial0/1/1

O 12::/64 [110/65]

via FE80::1, Serial0/1/1

C 13::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 13::1/128 [0/0]

via GigabitEthernet0/0/0, receive

O 21::/64 [110/65]

via FE80::1, Serial0/1/0

O 22::/64 [110/129]

via FE80::1, Serial0/1/0

C 30::/64 [0/0]

via Serial0/1/0, directly connected

L 30::1/128 [0/0]

via Serial0/1/0, receive

L FF00::/8 [0/0]

via Null0, receive

R3#show ipv6 ospf

Routing Process "ospfv3 10" with ID 3.3.3.3

SPF schedule delay 5 secs, Hold time between two SPFs 10 secs

Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

Number of external LSA 0. Checksum Sum 0x000000

Number of areas in this router is 2. 2 normal 0 stub 0 nssa

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 2

SPF algorithm executed 67 times

Number of LSA 10. Checksum Sum 0x051c75

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

Area 1

Number of interfaces in this area is 1

SPF algorithm executed 70 times

Number of LSA 11. Checksum Sum 0x0643f5

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R3#show ipv6 ospf neighbor

Neighbor ID Pri State Dead Time Interface ID Interface

2.2.2.2 0 FULL/ - 00:00:35 3 Serial0/1/1

4.4.4.4 0 FULL/ - 00:00:35 4 Serial0/1/0

R3#show ipv6 ospf interface

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

Link Local Address FE80::1, Interface ID 1

Area 0, Process ID 10, Instance ID 0, Router ID 3.3.3.3

Network Type BROADCAST, Cost: 1

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 3.3.3.3, local address FE80::1

No backup designated router on this network

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

Hello due in 00:00:07

Index 1/1, flood queue length 0

Next 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 0, Adjacent neighbor count is 0

Suppress hello for 0 neighbor(s)

Serial0/1/1 is up, line protocol is up

Link Local Address FE80::1, Interface ID 4

Area 0, Process ID 10, Instance ID 0, Router ID 3.3.3.3

Network Type POINT-TO-POINT, Cost: 64

Transmit Delay is 1 sec, State POINT-TO-POINT,

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

Hello due in 00:00:07

Index 2/2, flood queue length 0

Next 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

Suppress hello for 0 neighbor(s)

Serial0/1/0 is up, line protocol is up

Link Local Address FE80::1, Interface ID 3

Area 1, Process ID 10, Instance ID 0, Router ID 3.3.3.3

Network Type POINT-TO-POINT, Cost: 64

Transmit Delay is 1 sec, State POINT-TO-POINT,

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

Hello due in 00:00:07

Index 3/3, flood queue length 0

Next 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

Suppress hello for 0 neighbor(s)

R4#show run

Building configuration...

Current configuration : 1129 bytes

version 15.4

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

hostname R4

ip cef

ipv6 unicast-routing

no ipv6 cef

spanning-tree mode pvst

interface GigabitEthernet0/0/0

ip address 21.0.0.1 255.255.255.0

duplex auto

speed auto

ipv6 address FE80::1 link-local

ipv6 address 21::1/64

ipv6 ospf 10 area 1

interface GigabitEthernet0/0/1

no ip address

duplex auto

speed auto

shutdown

interface Serial0/1/0

ip address 4.0.0.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 4::1/64

ipv6 ospf 10 area 1

clock rate 56000

interface Serial0/1/1

ip address 30.0.0.2 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 30::2/64

ipv6 ospf 10 area 1

interface Vlan1

no ip address

shutdown

router ospf 1

log-adjacency-changes

network 4.0.0.0 0.0.0.255 area 1

network 30.0.0.0 0.0.0.255 area 1

ipv6 router ospf 10

router-id 4.4.4.4

log-adjacency-changes

ip classless

ip flow-export version 9

line con 0

line aux 0

line vty 0 4

login

end

R4#show ipv6 route

IPv6 Routing Table - 13 entries

Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP

U - Per-user Static route, M - MIPv6

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

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

D - EIGRP, EX - EIGRP external

OI 1::/64 [110/192]

via FE80::1, Serial0/1/1

OI 2::/64 [110/128]

via FE80::1, Serial0/1/1

C 4::/64 [0/0]

via Serial0/1/0, directly connected

L 4::1/128 [0/0]

via Serial0/1/0, receive

OI 11::/64 [110/193]

via FE80::1, Serial0/1/1

OI 12::/64 [110/129]

via FE80::1, Serial0/1/1

OI 13::/64 [110/65]

via FE80::1, Serial0/1/1

C 21::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 21::1/128 [0/0]

via GigabitEthernet0/0/0, receive

O 22::/64 [110/65]

via FE80::1, Serial0/1/0

C 30::/64 [0/0]

via Serial0/1/1, directly connected

L 30::2/128 [0/0]

via Serial0/1/1, receive

L FF00::/8 [0/0]

via Null0, receive

R4#show ipv6 ospf

Routing Process "ospfv3 10" with ID 4.4.4.4

SPF schedule delay 5 secs, Hold time between two SPFs 10 secs

Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

Number of external LSA 0. Checksum Sum 0x000000

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

Reference bandwidth unit is 100 mbps

Area 1

Number of interfaces in this area is 3

SPF algorithm executed 88 times

Number of LSA 11. Checksum Sum 0x062fff

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R4# show ipv6 ospf neighbor

Neighbor ID Pri State Dead Time Interface ID Interface

5.5.5.5 0 FULL/ - 00:00:31 4 Serial0/1/0

3.3.3.3 0 FULL/ - 00:00:30 3 Serial0/1/1

R4#show ipv6 ospf interface

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

Link Local Address FE80::1, Interface ID 1

Area 1, Process ID 10, 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::1

No backup designated router on this network

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

Hello due in 00:00:07

Index 1/1, flood queue length 0

Next 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 0, Adjacent neighbor count is 0

Suppress hello for 0 neighbor(s)

Serial0/1/0 is up, line protocol is up

Link Local Address FE80::1, Interface ID 3

Area 1, Process ID 10, Instance ID 0, Router ID 4.4.4.4

Network Type POINT-TO-POINT, Cost: 64

Transmit Delay is 1 sec, State POINT-TO-POINT,

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

Hello due in 00:00:07

Index 2/2, flood queue length 0

Next 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

Suppress hello for 0 neighbor(s)

Serial0/1/1 is up, line protocol is up

Link Local Address FE80::1, Interface ID 4

Area 1, Process ID 10, Instance ID 0, Router ID 4.4.4.4

Network Type POINT-TO-POINT, Cost: 64

Transmit Delay is 1 sec, State POINT-TO-POINT,

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

Hello due in 00:00:07

Index 3/3, flood queue length 0

Next 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 3.3.3.3

Suppress hello for 0 neighbor(s)

R5#show run

Building configuration...

Current configuration : 1009 bytes

version 15.4

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

hostname R5

ip cef

ipv6 unicast-routing

no ipv6 cef

spanning-tree mode pvst

interface GigabitEthernet0/0/0

ip address 22.0.0.1 255.255.255.0

duplex auto

speed auto

ipv6 address FE80::1 link-local

ipv6 address 22::1/64

ipv6 ospf 10 area 1

interface GigabitEthernet0/0/1

no ip address

duplex auto

speed auto

shutdown

interface Serial0/1/0

no ip address

clock rate 2000000

shutdown

interface Serial0/1/1

ip address 4.0.0.2 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 4::2/64

ipv6 ospf 10 area 1

interface Vlan1

no ip address

shutdown

router ospf 1

log-adjacency-changes

network 4.0.0.0 0.0.0.255 area 1

ipv6 router ospf 10

router-id 5.5.5.5

log-adjacency-changes

ip classless

ip flow-export version 9

line con 0

line aux 0

line vty 0 4

login

end

R5#show ipv6 route

IPv6 Routing Table - 12 entries

Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP

U - Per-user Static route, M - MIPv6

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

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

D - EIGRP, EX - EIGRP external

OI 1::/64 [110/256]

via FE80::1, Serial0/1/1

OI 2::/64 [110/192]

via FE80::1, Serial0/1/1

C 4::/64 [0/0]

via Serial0/1/1, directly connected

L 4::2/128 [0/0]

via Serial0/1/1, receive

OI 11::/64 [110/257]

via FE80::1, Serial0/1/1

OI 12::/64 [110/193]

via FE80::1, Serial0/1/1

OI 13::/64 [110/129]

via FE80::1, Serial0/1/1

O 21::/64 [110/65]

via FE80::1, Serial0/1/1

C 22::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 22::1/128 [0/0]

via GigabitEthernet0/0/0, receive

O 30::/64 [110/128]

via FE80::1, Serial0/1/1

L FF00::/8 [0/0]

via Null0, receive

R5#show ipv6 ospf

Routing Process "ospfv3 10" with ID 5.5.5.5

SPF schedule delay 5 secs, Hold time between two SPFs 10 secs

Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

Number of external LSA 0. Checksum Sum 0x000000

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

Reference bandwidth unit is 100 mbps

Area 1

Number of interfaces in this area is 2

SPF algorithm executed 83 times

Number of LSA 11. Checksum Sum 0x062fff

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

R5#show ipv6 ospf neighbor

Neighbor ID Pri State Dead Time Interface ID Interface

4.4.4.4 0 FULL/ - 00:00:35 3 Serial0/1/1

R5#show ipv6 ospf interface

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

Link Local Address FE80::1, Interface ID 1

Area 1, Process ID 10, 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::1

No backup designated router on this network

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

Hello due in 00:00:08

Index 1/1, flood queue length 0

Next 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 0, Adjacent neighbor count is 0

Suppress hello for 0 neighbor(s)

Serial0/1/1 is up, line protocol is up

Link Local Address FE80::1, Interface ID 4

Area 1, Process ID 10, Instance ID 0, Router ID 5.5.5.5

Network Type POINT-TO-POINT, Cost: 64

Transmit Delay is 1 sec, State POINT-TO-POINT,

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

Hello due in 00:00:09

Index 2/2, flood queue length 0

Next 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

Suppress hello for 0 neighbor(s)

***Problems***

The problems I encountered while configuring this lab were minor, but the one major issue I had to seek help with was with the 30:: serial connection between routers three and four in the diagram, as it needed to be a network that wouldn’t be used by any others. Other than that, I had originally configured the interfaces between routers three and four in different areas, creating a mismatch. This was easily fixed with the help of a few classmates, however. The only other problems I faced were the minor things I mentioned earlier, such as forgetting to set default gateways, forgetting IP unicast routing, or realizing I had not set a hostname on a router, all easily diagnosed and dealt with.

***Conclusion***

In conclusion, for this lab, I set up OSPF on each router and had to re-assign their IPs because of the routing issue. In the process, I learned a lot about OSPF through researching how it functions and by setting it up, and how to repair an IP scheme. This lab taught me a lot about how networking can be optimized, and to understand the optimization itself.