**Configuring Basic Single-Area OSPFv3**

Open Shortest Path First (OSPF) is a link-state routing protocol that was developed as a replacement for the distance vector routing protocol, RIP. RIP was an acceptable routing protocol in the early days of networking and the Internet. However, RIP's reliance on hop count as the only metric for determining best route quickly became problematic. Using hop count does not scale well in larger networks with multiple paths of varying speeds. OSPF has significant advantages over RIP in that it offers faster convergence and scales to much larger network implementations.

OSPF is a classless routing protocol that uses the concept of areas for scalability. This chapter covers basic, single-area OSPF implementations and configurations.

Step 1: Cable the network as shown in the topology.

Step 2: Initialize and reload the routers as necessary.

Step 3: Configure basic settings for each router.

a. Disable DNS lookup.

b. Configure device name as shown in the topology.

c. Assign class as the privileged EXEC password.

d. Assign cisco as the vty password.

e. Configure a MOTD banner to warn users that unauthorized access is prohibited.

f. Configure logging synchronous for the console line.

g. Encrypt plain text passwords.

h. Configure the IPv6 unicast and link-local addresses listed in the Addressing Table for all interfaces.

i. Enable IPv6 unicast routing on each router.

j. Copy the running configuration to the startup configuration.

 Step 3 instructions below:

In this we also assign router IDs and configure OSPFv6 on R1

**Router R1 Configuration:**

Router > enable

Router# config terminal

Router(config)# no ip domain-lookup

R1(config)#service password-encryption

hostname R1

R1(config)#enable secret class

R1(config)# line console 0

R1(config-line)# password cisco

R1(config-line)# login

R1(config-line)# exit

R1(config)# line vty 0 15

R1(config-line)# password cisco

R1(config-line)# login

R1(config-line)# exit

R1(config)# banner motd #Unauthorized Access is Prohibited#

R1(config-line)# logging synchronous

R1(config-line)# ipv6 unicast-routing

R1(config)# ipv6 router ospf 1

R1(config-rtr)# router-id 1.1.1.1

R1(config-rtr)# passive-interface g0/0

R1(config-rtr)# interface g0/0

R1(config-if)# ip address 192.168.1.1 255.255.255.0

R1(config-if)# ipv6 address 2001:db8:acad:a::1/64

R1(config-if)# ipv6 address fe80::1 link-local

R1(config-if)# interface s0/0/0

R1(config-if)# clock rate 128000

R1(config-if)# ip address 192.168.12.1 255.255.255.0

R1(config-if)# ipv6 address 2001:db8:acad:12::1/64

R1(config-if)# ipv6 address fe80::1 link-local

R1(config-if)# ipv6 ospf 1 area 0

R1(config-if)# no shutdown

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down

R1(config-if)# interface s0/0/1

R1(config-if)# ip address 192.168.13.1 255.255.255.0

R1(config-if)# ipv6 address 2001:db8:acad:13::1/64

R1(config-if)# ipv6 address fe80::1 link-local

R1(config-if)# ipv6 ospf 1 area 0

R1(config-if)# no shutdown

%LINK-5-CHANGED: Interface Serial0/0/1, changed state to down

R1(config-if)# router ospf 1

R1(config-router)# network 192.168.1.0 0.0.0.255 area 0

R1(config-router)# network 129.168.12.0 0.0.0.3 area 0

R1(config-router)# network 192.168.13.0 0.0.0.3 area 0

R1(config-router)# passive-interface g0/0

R1(config-router)# end

R1#

**Router R2 Configuration:**

Router>enable

Router#config terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#no ip domain lookup

Router(config)#hostname R2

R2(config)#enable secret class

R2(config)#line console 0

R2(config-line)#logging synchronous

R2(config-line)#password cisco

R2(config-line)#login

R2(config-line)#exit

R2(config)#banner motd @UNAUTHORIZED ACCESS IS PROHIBITED!@

R2(config)#ipv6 unicast-routing

R2(config)#ipv6 router ospf 1

%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id,please configure manually

R2(config-rtr)#router-id 2.2.2.2

R2(config-rtr)#interface g0/0

R2(config-if)#ip address 192.168.2.1 255.255.255.0

R2(config-if)#ipv6 address 2001:db8:acad:B::2/64

R2(config-if)#ipv6 address fe80::1 link-local

R2(config-if)#no shutdown

R2(config-if)#

%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

R2(config-if)#interface s0/0/0

R2(config-if)#ip address 192.168.12.2 255.255.255.252

R2(config-if)#ipv6 address 2001:db8:acad:12::2/64

R2(config-if)#ipv6 address fe80::1 link-local

R2(config-if)#no shutdown

R2(config-if)#

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

R2(config-if)#interface s0/0/0

R2(config-if)#i

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

R2(config-if)#ip address 192.168.12.2 255.255.255.252

R2(config-if)#ipv6 address 2001:db8:acad:12::2/64

R2(config-if)#ipv6 address fe80::2 link-local

R2(config-if)#ipv6 ospf 1 area 0

R2(config-if)#

00:08:50: %OSPFv3-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/0/0 from LOADING to FULL, Loading Done

R2(config-if)#no shutdown

R2(config-if)#clock rate 128000

This command applies only to DCE interfaces

R2(config-if)#ipv6 address fe80::2 link-local

R2(config-if)#no shutdown

R2(config-if)#router ospf 1

R2(config-router)#network 192.168.2.0 0.0.0.255 area 0

R2(config-router)#network 192.168.12.0 0.0.0.3 area 0

R2(config-router)#network 192.168.23.0 0.0.0.3 area 0

R2(config-router)#end

R2#

%SYS-5-CONFIG\_I: Configured from console by console

**Router R3 Configuration:**

Router>enable

Router#config terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#no ip domain lookup

Router(config)#enable secret class

Router(config)#hostname R3

R3(config)#line con 0

R3(config-line)#logging synchronous

R3(config-line)#password cisco

R3(config-line)#login

R3(config-line)#exit

R3(config)#line vty 0

R3(config-line)#password cisco

R3(config-line)#login

R3(config-line)#exit

R3(config)#banner motd @UNAUTHORIZED ACCESS IS PROHIBITED!@

R3(config)#ipv6 unicast-routing

R3(config)#interface g0/0

R3(config-if)#ipv6 address 2001:db8:acad:c::3/64

R3(config-if)#ipv6 address fe80::3 link-local

R3(config)#ipv6 ospf 1 area 0

R3(config-if)#interface s0/0/0

R3(config-if)#clock rate 128000

R3(config-if)#ip address 192.168.13.1 255.255.255.252

R3(config-if)#ipv6 address 2001:db8:acad:13::3/64

R3(config-if)#ipv6 address fe80::3 link-local

R3(config)#ipv6 ospf 1 area 0

R3(config-if)#no shutdown

R3(config-if)#

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

R3(config-if)#interface s0/0/1

R3(config-if)#ip address 192.168.23.2 255.255.255.252

R3(config-if)#ipv6 address 2001:db8:acad:23::3/64

R3(config-if)#ipv6 address fe80::3 link-local

R3(config)#ipv6 ospf 1 area 0

R3(config-if)#ipv6 router ospf 1

R3(config-router)#router-id 3.3.3.3

R3(config-router)#network 192.168.3.0 0.0.0.255 area 0

R3(config-router)#passive-interface g0/0

R3(config-router)#end

R3#

%SYS-5-CONFIG\_I: Configured from console by console

R3#

**Step 4: Configure PC hosts.**

PC-A🡪 IP address: 192.168.1.3

 Subnet Mask: 255.255.255.0

 Default Gateway: 192.168.1.1

IPV6 Address: 2001:DB8:ACAD:A::A/64

Default Gateway: FE80::1

PC-B🡪IP address: 192.168.2.3

 Subnet Mask: 255.255.255.0

 Default Gateway: 192.168.2.1

IPV6 Address: 2001:DB8:ACAD:B::B/64

Default Gateway: FE80::2

PC-C🡪IP address: 192.168.3.3

 Subnet Mask: 255.255.255.0

 Default Gateway: 192.168.3.1

IPV6 Address: 2001:DB8:ACAD:C::C/64

Default Gateway: FE80::3

**Step 3: Verify OSPFv3 neighbors**

***R1#show ipv6 ospf neighbor***

Neighbor ID Pri State Dead Time Interface ID Interface

2.2.2.2 0 FULL/ - 00:00:39 3 Serial0/0/0

3.3.3.3 0 FULL/ - 00:00:35 3 Serial0/0/1

R1#

**Step 4: Verify OSPFv3 protocol settings**

***R1>show ipv6 ospf neighbor***

Neighbor ID Pri State Dead Time Interface ID Interface

2.2.2.2 0 FULL/ - 00:00:30 3 Serial0/0/0

R1>show ipv6 protocols

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "ND"

IPv6 Routing Protocol is "ospf 1"

 Interfaces (Area 0)

 Serial0/0/0

 Serial0/0/1

 Redistribution:

 None

**Step 5: verify OSPFv3 interfaces**

***R1>show ipv6 ospf interface***

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

 Link Local Address FE80::1, Interface ID 3

 Area 0, Process ID 1, 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 00:00:09

 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 1 , Adjacent neighbor count is 1

 Adjacent with neighbor 2.2.2.2

 Suppress hello for 0 neighbor(s)

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

 Link Local Address FE80::290:21FF:FE2E:4B01, Interface ID 4

 Area 0, Process ID 1, 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 00:00:09

 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

Suppress hello for 0 neighbor(s)

**Step 6: Verify the IPv6 routing table.**

***R1>show ipv6 route***

IPv6 Routing Table - 5 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 2001:DB8:ACAD:12::/64 [0/0]

 via Serial0/0/0, directly connected

L 2001:DB8:ACAD:12::1/128 [0/0]

 via Serial0/0/0, receive

C 2001:DB8:ACAD:13::/64 [0/0]

 via Serial0/0/1, directly connected

L 2001:DB8:ACAD:13::1/128 [0/0]

 via Serial0/0/1, receive

L FF00::/8 [0/0]

 via Null0, receive

**Part 3: Configure OSPFv3 Passive Interfaces**

The **passive-interface** command prevents routing updates from being sent through the specified router interface. This is commonly done to reduce traffic on the LANs as they do not need to receive dynamic routing protocol communication. In Part 3, you will use the **passive-interface** command to configure a single interface as passive. You will also configure OSPFv3 so that all interfaces on the router are passive by default, and then enable OSPF routing advertisements on selected interfaces.

**Step 1: Configure a passive interface.**

a. Issue the ***show ipv6 ospf interface g0/0*** command on R1. Notice the timer indicating when the next Hello packet is expected. Hello packets are sent every 10 seconds and are used between OSPF routers to verify that their neighbors are up.

***R1# show ipv6 ospf interface g0/0***

GigabitEthernet0/0 is up, line protocol is up

Link Local Address FE80::1, Interface ID 3

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 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 00:00:05

Graceful restart helper support enabled

Index 1/1/1, flood queue length 0

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

Last flood scan length is 0, maximum is 0

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

Neighbor Count is 0, Adjacent neighbor count is 0

Suppress hello for 0 neighbor(s)

c. Re-issue the **show ipv6 ospf interface g0/0** command to verify that G0/0 is now passive.

R1# **show ipv6 ospf interface g0/0**

GigabitEthernet0/0 is up, line protocol is up

Link Local Address FE80::1, Interface ID 3

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 WAITING, Priority 1

No designated router on this network

No backup designated router on this network

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

No Hellos (Passive interface)

Wait time before Designated router selection 00:00:34

Graceful restart helper support enabled

Index 1/1/1, flood queue length 0

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

Last flood scan length is 0, maximum is 0

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

Neighbor Count is 0, Adjacent neighbor count is 0

Suppress hello for 0 neighbor(s)

d. Issue the **show ipv6 route ospf** command on R2 and R3 to verify that a route to the 2001:DB8:ACAD:A::/64 network is still available.

**R2# show ipv6 route ospf**

IPv6 Routing Table - default - 10 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

O 2001:DB8:ACAD:A::/64 [110/65]

via FE80::1, Serial0/0/0

O 2001:DB8:ACAD:C::/64 [110/65]

via FE80::3, Serial0/0/1

O 2001:DB8:ACAD:13::/64 [110/128]

via FE80::3, Serial0/0/1

via FE80::1, Serial0/0/0

**Step 2: Set passive interface as the default on the router.**

a. Issue the **passive-interface default** command on R2 to set the default for all OSPFv3 interfaces as passive.

R2(config)# **ipv6 router ospf 1**

R2(config-rtr)# **passive-interface default**

b. Issue the **show ipv6 ospf neighbor** command on R1. After the dead timer expires, R2 is no longer listed as an OSPF neighbor.

**R1# show ipv6 ospf neighbor**

OSPFv3 Router with ID (1.1.1.1) (Process ID 1)

Neighbor ID Pri State Dead Time Interface ID Interface

3.3.3.3 0 FULL/ - 00:00:37 6 Serial0/0/1

c. On R2, issue the **show ipv6 ospf interface s0/0/0** command to view the OSPF status of interface S0/0/0.

**R2# show ipv6 ospf interface s0/0/0**

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

Link Local Address FE80::2, Interface ID 6

Area 0, Process ID 1, 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

No Hellos (Passive interface)

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 3

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)

d. If all OSPFv3 interfaces on R2 are passive, then no routing information is being advertised. If this is the case, then R1 and R3 should no longer have a route to the 2001:DB8:ACAD:B::/64 network. You can verify this by using the **show ipv6 route** command.

e. ***Change S0/0/1 on R2 by issuing the no passive-interface command, so that it sends and receives OSPFv3 routing updates. After entering this command, an informational message displays stating that a neighbor adjacency has been established with R3.***

R2(config)# **ipv6 router ospf 1**

R2(config-rtr)# **no passive-interface s0/0/1**

\*Apr 8 19:21:57.939: %OSPFv3-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial0/0/1 from LOADING to FULL, Loading Done

**f. Re-issue the show ipv6 route and show ipv6 ospf neighbor commands on R1 and R3, and look for a route to the 2001:DB8:ACAD:B::/64 network.**