Basic OSPFv3 for IPv6 v1.1

Introduction

OSPFv3 is a routing protocol for IPv4 and IPv6. It is a link-state protocol, as opposed to a distance-vector protocol. Think of a link as being an interface on a networking device. Much of OSPF version 3 is the same as in OSPF version 2. OSPFv3, which is described in RFC 5340, expands on OSPF version 2 to provide support for IPv6 routing prefixes and the larger size of IPv6 addresses.

Objective(s)

In this lab the student will:

- Build the Network and Configure Basic Device Settings
- Configure OSPFv3 for IPv6 Routing
- Verify IPv6 OSPFv3 Routing
- Configure and Verify Passive Interfaces.

Equipment/Supplies Needed

If working in a physical environment:

- 3 Routers (Cisco 1941 with Cisco IOS Release 15.2(4) M3 universal image or comparable)
- 3 Cisco 2960 Switches (Software (C2960-LANBASE-M), Version 12.2)
- 3 PCs (Windows 7, Vista, or XP with terminal emulation program, such as TeraTerm)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet and serial cables as shown in the topology

If working online:

- Your Computer workstation
- Cisco Packet Tracer (online)
- Basic OSPFv3 for IPv6.pka file

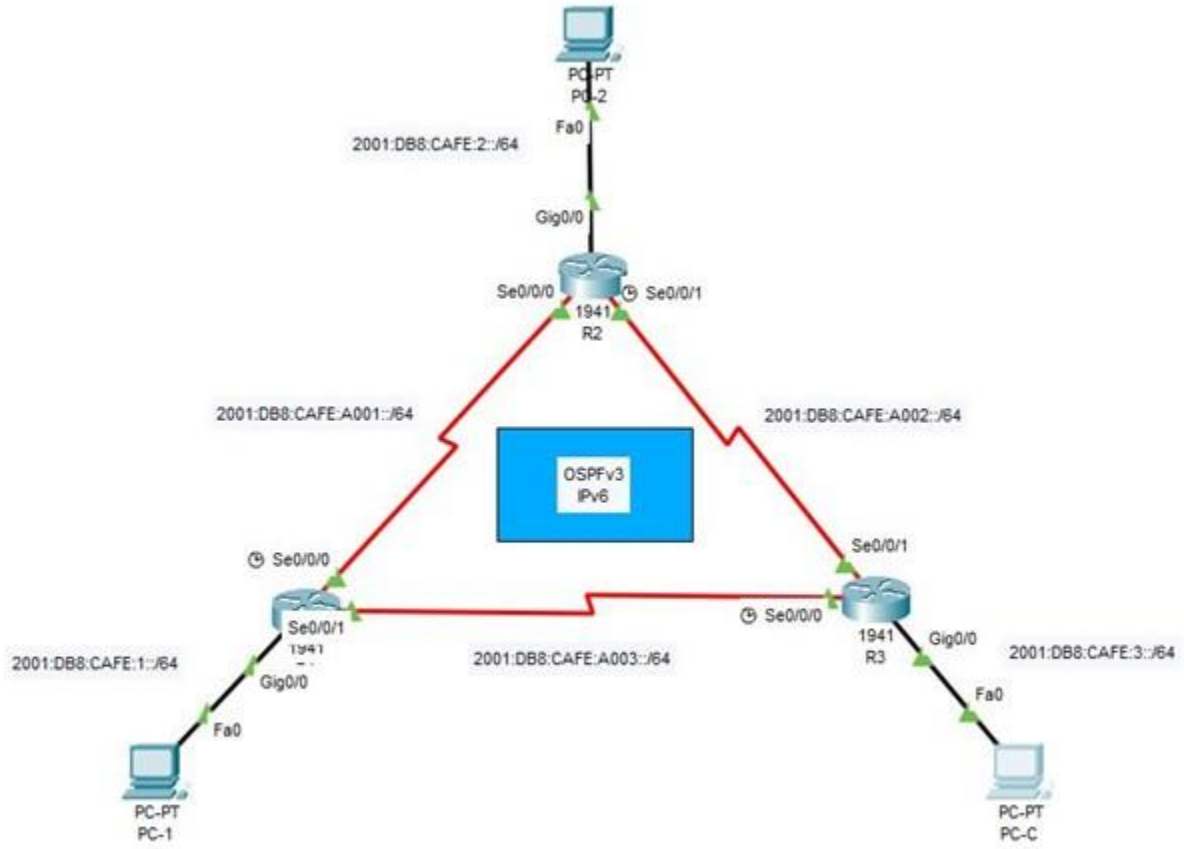
Note: The routers used are Cisco 1941 Integrated Services Routers (ISRs) with Cisco IOS Release 15.2(4)M3 (universalk9 image). Other routers and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of this lab for the correct interface identifiers.

Addressing Table

Device	Interface	IPv6 Address	Default Gateway
R1	G0/0	2001:DB8:CAFE:1::1/64	N/A
	S0/0/0	2001:DB8:CAFE:A001::1/64	N/A
	S0/0/1	2001:DB8:CAFE:A003::1/64	N/A
	Link-local (All Interfaces)	FE80::1	N/A
R2	G0/0	2001:DB8:CAFE:2::1/64	N/A
	S0/0/0	2001:DB8:CAFE:A001::2/64	N/A
	S0/0/1 (All Interfaces)	2001:DB8:CAFE:A002::1/64	N/A
	Link-local	FE80::2	N/A
R3	G0/0	2001:DB8:CAFE:3::1/64	N/A
	S0/0/0	2001:DB8:CAFE:A003::2/64	N/A
	S0/0/1	2001:DB8:CAFE:A002::2/64	N/A
	Link-local (All Interfaces)	FE80::3	N/A
PC-1	NIC	2001:DB8:CAFE:1::3/64	FE80::1

PC-2	NIC	2001:DB8:CAFE:2::3/64	FE80::2
PC-C	NIC	2001:DB8:CAFE:3::3/64	FE80::3

Topology



Procedure

Perform the steps in this lab in the order they are presented to you. Answer all questions and record the requested information in a file.

In this lab, you will configure the network topology with OSPFv3 routing, assign router IDs, configure passive interfaces, and use a number of CLI commands to display and verify OSPFv3 routing information.

Part 1: Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic settings on the PC hosts and routers.

Step 1: Configure basic settings for each router.

a. Disable DNS lookup.

b. Configure device name as shown in the topology.

c. Assign **cyber** as the privileged EXEC password.

d. Assign **security** as the vty password.

e. Configure a MOTD banner. "**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 AddressingTable for all interfaces.

i. Enable IPv6 unicast routing on each router.

j. Copy the running configuration to the startup configuration.

Step 2: Configure PC hosts

Step 3: Test connectivity.

Part 2: Configure OSPFv3 Routing

In Part 2, you will configure OSPFv3 routing on all routers in the network and then verify that routing tables are updated correctly.

Step 1: Assign router IDs.

OSPFv3 continues to use a 32 bit address for the router ID. Because there are no IPv4 addresses configured on the routers, you will manually assign the router ID using the **router-id** command.

a. Issue the **ipv6 router ospf** command to start an OSPFv3 process to the router.

R1(config)# **ipv6 router ospf 1**

Note: you might get a short output after this command (shown below):

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

This output is showing because there are no IPv4 addresses configured on the interfaces and you are about to do what it's asking in the next step.

b. Assign the OSPFv3 router ID 1.1.1.1 to the R1.

R1(config-rtr)# **router-id 1.1.1.1**

Note: The OSPF process ID is kept locally and has no meaning to other routers on the network.

c. Start the OSPFv3 routing process and assign a router ID of 2.2.2.2 to R2 and arouter ID of 3.3.3.3 to R3.

d. Issue the **show ipv6 ospf** command to verify the router IDs on all routers.

R2# **show ipv6 ospf**

Routing Process "ospfv3 1" with ID 2.2.2.2

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

Router is not originating router-LSAs with maximum metric

<output omitted>

Step 2: Configure OSPFv6 on R1.

With IPv6, it is common to have multiple IPv6 addresses configured on an interface. The network statement has been eliminated in OSPFv3. OSPFv3 routing is enabled at the interface level instead.

a. Issue the **ipv6 ospf 1 area 0** command for each interface on R1 that is to participate in OSPFv3 routing.

R1(config)# **interface g0/0**

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

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

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

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

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

Note: The process ID must match the process ID you used in Step1a.

b. Assign the interfaces on R2 and R3 to OSPFv3 area 0. You should see neighboradjacency messages display when adding the interfaces to area 0.

R1#

*Mar 19 22:14:43.251: %OSPFv3-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial0/0/0 from LOADING to FULL, Loading Done

R1#

*Mar 19 22:14:46.763: %OSPFv3-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial0/0/1 from LOADING to FULL, Loading Done

Part 3: Verify OSPFv3 neighbors

Step 1: Verify Neighbor Adjacencies

Issue the **show ipv6 ospf neighbor** command to verify that the router has formed an adjacency with its neighboring routers. If the router ID of the neighboring router is not displayed, or if its state does not show as FULL, the two routers have not formed an OSPF adjacency.

```
R1# show ipv6 ospf neighbor

OSPFv3 Router with ID (1.1.1.1) (Process ID 1)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
2.2.2.2           0   FULL/ -         00:00:39    3               Serial0/0/0
3.3.3.3           0   FULL/ -         00:00:36    3               Serial0/0/1
```

Step 2: Verify OSPFv3 protocol settings.

The **show ipv6 protocols** command is a quick way to verify vital OSPFv3 configuration information, including the OSPF process ID, the router ID, and the interfaces enabled for OSPFv3.

```
R1# show ipv6 protocols

IPv6 Routing Protocol is "connected"

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):

Serial0/0/1

Serial0/0/0

GigabitEthernet0/0

Redistribution:

None
```

Step 3: Verify OSPFv3 interfaces.

a. Issue the **show ipv6 ospf interface** command to display a detailed list for every OSPF-enabled interface.

R1# **show ipv6 ospf interface**

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

Link Local Address FE80::1, Interface ID 7

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 00:00:05

Graceful restart helper support enabled

Index 1/3/3, flood queue length 0

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

Last flood scan length is 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)

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

Link Local Address FE80::1, Interface ID 6

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

Step 4: Verify the IPv6 routing table.

Issue the **show ipv6 route** command to verify that all networks are appearing in the routing table.

R2# **show ipv6 route**

```
IPv6 Routing Table - 10 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:CAFE:1::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L 2001:DB8:CAFE:1::1/128 [0/0]
     via GigabitEthernet0/0, receive
O 2001:DB8:CAFE:2::/64 [110/65]
     via FE80::2, Serial0/0/0
O 2001:DB8:CAFE:3::/64 [110/65]
     via FE80::3, Serial0/0/1
C 2001:DB8:CAFE:A001::/64 [0/0]
     via Serial0/0/0, directly connected
L 2001:DB8:CAFE:A001::1/128 [0/0]
     via Serial0/0/0, receive
O 2001:DB8:CAFE:A002::/64 [110/128]
     via FE80::2, Serial0/0/0
```

via FE80::3, Serial0/0/1

C 2001:DB8:CAFE:A003::/64 [0/0]

via Serial0/0/1, directly connected

L 2001:DB8:CAFE:A003::1/128 [0/0]

via Serial0/0/1, receive

L FF00::/8 [0/0]

via Null0, receive

What command would you use to only see the OSPF routes in the routing table?

show ipv6 route ospf

Step 5: Verify end-to-end connectivity.

Part 4: Configure OSPFv3 Passive Interfaces

Note: 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)

Issue the **passive-interface** command to change the G0/0 interface on R1 to passive.

R1(config)# **ipv6 router ospf 1**

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

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)

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**

Note: Before the introduction of the Default Passive Interfaces feature, you could configure the routing protocol on all interfaces and manually set the passive-interface router configuration command on interfaces where adjacencies were not desired. But in some networks, this solution meant configuring 200 or more passive interfaces. The Default Passive Interfaces feature solved this problem by allowing all interfaces to be set as passive by default. You can set all interfaces as passive by default by using the

passive-interface default command and then configure individual interfaces where adjacencies are desired using the **no passive-interface command**.

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 - (Compare to your output)**

```
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 beingadvertised. If this is the case, then R1 and R3 should no longer have a route to the 2001:DB8:CAFE:2::/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:CAFE:2::/64 network

g. On R2, issue the **no passive-interface S0/0/0** command to allow OSPFv3 routing updates to be advertised on that interface.

h. Verify that R1 and R2 are now OSPFv3 neighbors

Reflection

1. If the OSPFv3 configuration for R1 had a process ID of 1, and the OSPFv3 configuration for R2 had a process ID of 2, can routing information be exchanged between the two routers? Why? Yes Because they are in the same area , area 0

Submit Your Work:

Submit all text files, screenshots, or answers to questions to your instructor Using the most appropriate method below.

Packet Tracer:

Submit Packet Tracer file as well as your text file with your findings and notes.

Rubric

Checklist/Single Point Mastery

Concerns Working Towards Proficiency	Criteria Standards for This Competency	Accomplished Evidence of Mastering Competency
	Criteria #1:Configure IP addresses on Router interfaces and PCs.. (30 pts)	Configure IPv6 address on router interfaces and PCs. Test point to point connectivity between devices. (30 pts) 3 IPs for each router - each router (15 pts) 3 PCs IP address and default gateway. (15 pts)
	Criteria #2: Configure OSPF protocol needed on all 3	Configure EIGRP protocol needed on all 3 routers for connectivity between networks. (30 pts)
	routers for connectivity between networks (30 pts)	Each router should have 2 adjacencies. (10pts)
	Criteria #3: Configure Passive interfaces. (10 pts)	Configure Passive interfaces on all LAN interfaces on each router. (10 pts) 3 passive interfaces (3.3 pts)

	Criteria #4: Test connectivity between all remote networks using ping. (10 pts)	Test connectivity between all remote networks using ping. (10 pts) 3 remote networks (3.3 pts)
	Criteria #5: Submit instructions document with lab questions completed. (10 pts)	Criteria #5: Submit instructions document with lab questions completed. (10 pts)