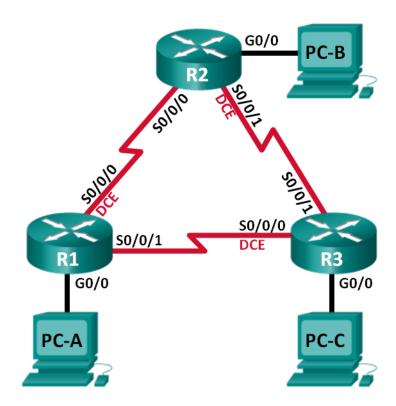# Lab - Configuring Basic Single-Area OSPFv3

Topology

Addressing Table

Device	Interface	IPv6 Address	Default Gateway
R1	G0/0	2001:DB8:ACAD:A::1/64 FE80::1 link-local	N/A
	S0/0/0 (DCE)	2001:DB8:ACAD:12::1/64 FE80::1 link-local	N/A
	S0/0/1	2001:DB8:ACAD:13::1/64 FE80::1 link-local	N/A
R2	G0/0	2001:DB8:ACAD:B::2/64 FE80::2 link-local	N/A
	S0/0/0	2001:DB8:ACAD:12::2/64 FE80::2 link-local	N/A
	S0/0/1 (DCE)	2001:DB8:ACAD:23::2/64 FE80::2 link-local	N/A
R3	G0/0	2001:DB8:ACAD:C::3/64 FE80::3 link-local	N/A
	S0/0/0 (DCE)	2001:DB8:ACAD:13::3/64 FE80::3 link-local	N/A
	S0/0/1	2001:DB8:ACAD:23::3/64 FE80::3 link-local	N/A
PC-A	NIC	2001:DB8:ACAD:A::A/64	FE80::1
PC-B	NIC	2001:DB8:ACAD:B::B/64	FE80::2
PC-C	NIC	2001:DB8:ACAD:C::C/64	FE80::3

Objectives

Part 1: Build the Network and Configure Basic Device Settings

Part 2: Configure and Verify OSPFv3 Routing

Part 3: Configure OSPFv3 Passive Interfaces

Background / Scenario

Open Shortest Path First (OSPF) is a link-state routing protocol for IP networks. OSPFv2 is defined for IPv4 networks, and OSPFv3 is defined for IPv6 networks.

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.

Note: The routers used with CCNA hands-on labs 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.

Note: Make sure that the routers have been erased and have no startup configurations. If you are unsure, contact your instructor.

Required Resources

- 3 Routers (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
- 3 PCs (Windows 7, Vista, or XP with terminal emulation program, such as Tera Term)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet and serial cables as shown in the topology

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: 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 4: Configure PC hosts.

Step 5: Test connectivity.

The routers should be able to ping one another, and each PC should be able to ping its default gateway. The PCs are unable to ping other PCs until OSPFv3 routing is configured. Verify and troubleshoot if necessary.

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

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

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

c. Start the OSPFv3 routing process and assign a router ID of **2.2.2.2** to R2 and a router 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 neighbor adjacency 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
    ```

Step 3:   Verify OSPFv3 neighbors.

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
3.3.3.3           0   FULL/  -        00:00:39    6               Serial0/0/1
2.2.2.2           0   FULL/  -        00:00:36    6               Serial0/0/0
```

Step 4: 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 5: 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
    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 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 2.2.2.2
   Suppress hello for 0 neighbor(s)
 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 00:00:03
   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)
```

b. To display a summary of OSPFv3-enabled interfaces, issue the **show ipv6 ospf interface brief** command.

```
R1# show ipv6 ospf interface brief
Interface   PID   Area          Intf ID   Cost   State   Nbrs F/C
Se0/0/1     1     0             7         64     P2P     1/1
Se0/0/0     1     0             6         64     P2P     1/1
Gi0/0       1     0             3         1      DR      0/0
```

Step 6: 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 - 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
C   2001:DB8:ACAD:B::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L   2001:DB8:ACAD:B::2/128 [0/0]
     via GigabitEthernet0/0, receive
O   2001:DB8:ACAD:C::/64 [110/65]
     via FE80::3, Serial0/0/1
C   2001:DB8:ACAD:12::/64 [0/0]
     via Serial0/0/0, directly connected
L   2001:DB8:ACAD:12::2/128 [0/0]
     via Serial0/0/0, receive
```

```
O   2001:DB8:ACAD:13::/64 [110/128]
     via FE80::3, Serial0/0/1
     via FE80::1, Serial0/0/0
C   2001:DB8:ACAD:23::/64 [0/0]
     via Serial0/0/1, directly connected
L   2001:DB8:ACAD:23::2/128 [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 7: Verify end-to-end connectivity.

Each PC should be able to ping the other PCs in the topology. Verify and troubleshoot if necessary.

Note: It may be necessary to disable the PC firewall to ping between PCs.

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)
```

b. 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
```

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.

What interface is R1 using to route to the 2001:DB8:ACAD:B::/64 network? S0/0/1

What is the accumulated cost metric for the 2001:DB8:ACAD:B::/64 network on R1? 129

Does R2 show up as an OSPFv3 neighbor on R1? no

Does R2 show up as an OSPFv3 neighbor on R3? yes

What does this information tell you?

interface and cost metric to reach 2001:DB8:ACAD:B::/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.

yes

Reflection

1. If the OSPFv6 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 process ID is local and can be different to each router. as long as it have the same area number it should be able to exchange information

2. What may have been the reasoning for removing the **network** command in OSPFv3?

    to make the configuration process more simple

Router Interface Summary Table

Router Interface Summary				
Router Model	**Ethernet Interface #1**	**Ethernet Interface #2**	**Serial Interface #1**	**Serial Interface #2**
1800	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
1900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2801	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
2811	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)

Note: To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.