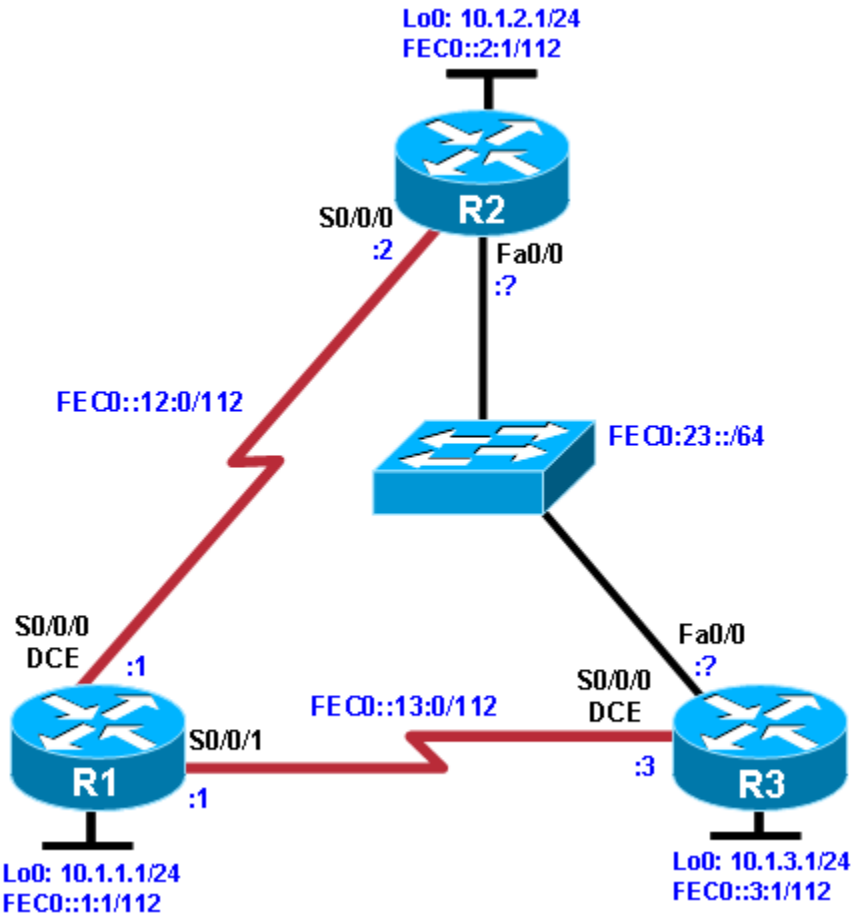
Chapter 8 Lab 8-1, Configuring OSPF for IPv6

Topology



Objectives

- Configure a static IPv6 address on an interface.
- Change the default link-local address on an interface.
- Configure an EUI-64 IPv6 address on an interface.
- Enable IPv6 routing and CEF.
- Configure and verify single-area OSPFv3 operation.

Background

In this lab, you configure static IPv6 addresses and EUI-64 IPv6 addresses on interfaces. You then configure OSPFv3 to route between the IPv6 networks.

Note: This lab uses Cisco 1841 routers with Cisco IOS Release 12.4(24)T1 and the Advanced IP Services Image c1841-advipservicesk9-mz.124-24.T1.bin. The switch is a Cisco WS-C2960-24TT-L with the Cisco IOS

image c2960-lanbasek9-mz.122-46.SE.bin. You can use other routers (such as a 2801 or 2811), switches (such as 2950), and Cisco IOS Software versions if they have comparable capabilities and features. Depending on the router or switch model and Cisco IOS Software version, the commands available and output produced might vary from what is shown in this lab.

Required Resources

- 3 routers (Cisco 1841 with Cisco IOS Release 12.4(24)T1 Advanced IP Services or comparable)
- 1 switch (Cisco 2960 with the Cisco IOS Release 12.2(46)SE C2960-LANBASEK9-M image or comparable)
- Serial and Ethernet cables

Step 1: Prepare the routers for the lab.

Cable the network as shown in the topology diagram. Erase the startup configuration, and reload each router to clear the previous configurations.

Step 2: Configuring the hostname and loopback interfaces.

Configure the loopback interface on each router with both the IPv4 address and IPv6 address shown in the diagram. The IPv4 address is configured using the **ip address** *address mask* command. The IPv6 address configuration is similar, using the **ipv6 address** *address/mask* command. With IPv6 addresses, you can enter the mask length in bits with a decimal /mask, rather than entering the whole mask out in hexadecimal.

IPv6 addresses consist of eight groups of 16 bits (four hexadecimal characters) separated by colons. You can also enter the IPv6 address in an abbreviated form. For example, you can abbreviate any continuous group of zeros with two colons "::". However, you can only use this abbreviation once per address. Also, leading zeros in each group can be omitted. For example, FEC0:0:0:0:0:0:12:1 /112 can be shortened to FEC0::12:1 /112.

```
Router(config)# hostname R1
R1(config)# interface loopback0
R1(config-if)# ip address 10.1.1.1 255.255.255.0
R1(config-if)# ipv6 address FEC0::1:1/112

Router(config)# hostname R2
R2(config)# interface loopback0
R2(config-if)# ip address 10.1.2.1 255.255.255.0
R2(config-if)# ipv6 address FEC0::2:1/112

Router(config)# hostname R3
R3(config)# interface loopback0
R3(config-if)# ip address 10.1.3.1 255.255.255.0
R3(config-if)# ipv6 address FEC0::3:1/112
```

If you accidentally enter the wrong IPv6 address on an interface, make sure you remove it with the **no** version of the command that you entered. Unlike IPv4 addresses, where the **ip address** command overwrites the existing address, multiple IPv6 addresses can exist on an interface. Issuing the **ipv6 address** command multiple times adds more addresses rather than replacing them.

Notice that both an IPv4 and an IPv6 address are on the same interface, and they do not conflict with each other. This is because they are different Layer 3 protocols, and they run independently.

Step 3: Configure static IPv6 addresses.

a. Configure the two serial links with IPv6 addresses. Use the **ipv6 address** *address/mask* command to configure the interfaces with the addresses shown in the diagram. Set the clock rates where appropriate, and bring up the interfaces.

```
R1(config)# interface serial0/0/0
R1(config-if)# ipv6 address FEC0::12:1/112
R1(config-if)# clockrate 64000
R1(config-if)# bandwidth 64
R1(config-if)# no shutdown

R1(config-if)# interface serial0/0/1
R1(config-if)# ipv6 address FEC0::13:1/112
R1(config-if)# bandwidth 64
R1(config-if)# no shutdown

R2(config)# interface serial0/0/0
R2(config-if)# ipv6 address FEC0::12:2/112
R2(config-if)# bandwidth 64
R2(config-if)# no shutdown

R3(config)# interface serial0/0/0
R3(config-if)# ipv6 address FEC0::13:3/112
R3(config-if)# clockrate 64000
R3(config-if)# bandwidth 64
R3(config-if)# no shutdown
```

b. Use **ping** to verify local subnet connectivity.

```
R1# ping FEC0::12:2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::12:2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms

R1# ping FEC0::13:3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::13:3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms

R2# ping FEC0::12:1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::12:1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms

R3# ping FEC0::13:1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::13:1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms
```

Step 4: Change the link-local address on an interface.

a. Use the **show ipv6 interface** command to look at IPv6-related properties of the router interfaces. You can also specify a type/number of an interface to see the output of that interface only.

```
R1# show ipv6 interface serial 0/0/0
Serial0/0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::219:6FF:FE23:4380
  No Virtual link-local address(es):
  Global unicast address(es):
    FEC0::12:1, subnet is FEC0::12:0/112
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF12:1
    FF02::1:FF23:4380
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds

R2# show ipv6 interface serial 0/0/0
Serial0/0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::218:B9FF:FE92:28D8
  Global unicast address(es):
    FEC0::12:2, subnet is FEC0::12:0/112
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF12:2
    FF02::1:FF92:28D8
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds
```

Notice that in addition to the address that you already configured, there is a link-local address starting with FE80 (your actual address will vary). You can change the addresses on the link between R1 and R2 by putting the link-local address FE80::1 on R1 and FE80::2 on R2. Link-local addresses do not have a subnet mask because they are not routed, hence the term “link-local.”

b. To change the link-local address, use the **ipv6 address** *address* **link-local** command.

```
R1(config)# interface serial0/0/0
R1(config-if)# ipv6 address FE80::1 link-local

R2(config)# interface serial0/0/0
R2(config-if)# ipv6 address FE80::2 link-local
```

c. Verify that you can ping the link-local address on the other side. When pinging link-local addresses, you must specify an outgoing interface because the addresses are not routed and not in the routing table.

Note: When prompted for the output interface with this command, you must use the full interface name without spaces (for example, use serial0/0/0, not s0/0/0).

```
R1# ping FE80::2
Output Interface: Serial0/0/0
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FE80::2, timeout is 2 seconds:
Packet sent with a source address of FE80::1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms

R2# ping FE80::1
Output Interface: Serial0/0/0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FE80::1, timeout is 2 seconds:
Packet sent with a source address of FE80::2
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms
```

d. Verify the link-local addresses with the **show ipv6 interface** command.

```
R1# show ipv6 interface serial 0/0/0
Serial0/0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::1
  No Virtual link-local address(es):
  Global unicast address(es):
    FEC0::12:1, subnet is FEC0::12:0/112
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF00:1
    FF02::1:FF12:1
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds

R2# show ipv6 interface serial 0/0/0
Serial0/0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::2
  Global unicast address(es):
    FEC0::12:2, subnet is FEC0::12:0/112
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF00:2
    FF02::1:FF12:2
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds
```

Note: Manually modifying a link-local address is seldom needed. It is demonstrated here for the purpose of this lab.

Step 5: Configure EUI-64 addresses.

EUI-64 IPv6 addresses are addresses where the first 64 bits are the network portion of the address and are specified. The second 64 bits are the host portion of the address and are automatically generated by the device. RFC 4921 splits the 48-bit MAC address into two 24-bit segments: the Organizational Unique Identifier (OUI) and the NIC-specific component. The seventh bit of the OUI (bit 7 from the left) is inverted

(changed from zero to one or vice versa). The 16-bit hex value 0xFFFE is then inserted between the modified OUI and the NIC-specific component to create the modified EUI-64 address. This can be seen in the highlighted EUI-64 address in Step 5b.

a. Configure IPv6 EUI-64 addresses on an interface using the **ipv6 address** *address/mask* **eui-64** command. Configure the R2 and R3 Fast Ethernet interfaces with the subnet shown in the diagram, and enable the interfaces.

```
R2(config)# interface fastEthernet 0/0
R2(config-if)# ipv6 address FEC0:23::/64 eui-64
R2(config-if)# no shutdown

R3(config)# interface fastEthernet 0/0
R3(config-if)# ipv6 address FEC0:23::/64 eui-64
R3(config-if)# no shutdown
```

b. Get the IPv6 addresses of the interfaces with the **show ipv6 interface** or **show ipv6 interface brief** command, and then ping the other side of the link.

```
R2# show ipv6 interface fastEthernet 0/0
FastEthernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::218:B9FF:FE92:28D8
  No Virtual link-local address(es):
  Global unicast address(es):
    FEC0:23::218:B9FF:FE92:28D8, subnet is FEC0:23::/64 [EUI]
  Joined group address(es):
    FF02::1
    FF02::1:FF92:28D8
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 17162)

R2# show ipv6 interface brief
FastEthernet0/0            [up/up]
    FE80::218:B9FF:FE92:28D8
    FEC0:23::218:B9FF:FE92:28D8
FastEthernet0/1            [administratively down/down]
Serial0/0/0                [up/up]
    FE80::2
    FEC0::12:2
Serial0/0/1                [administratively down/down]
Serial0/1/0                [administratively down/down]
Serial0/1/1                [administratively down/down]
Loopback0                  [up/up]
    FE80::218:B9FF:FE92:28D8
    FEC0::2:1

R3# show ipv6 interface brief
FastEthernet0/0            [up/up]
    FE80::218:B9FF:FECD:BEF0
    FEC0:23::218:B9FF:FECD:BEF0
FastEthernet0/1            [administratively down/down]
Serial0/0/0                [up/up]
    FE80::218:B9FF:FECD:BEF0
    FEC0::13:3
Serial0/0/1                [administratively down/down]
```

```
Serial0/1/0               [administratively down/down]
Serial0/1/1               [administratively down/down]
Loopback0                 [up/up]
    FE80::218:B9FF:FECD:BEF0
    FEC0::3:1

R2# ping FEC0:23::218:B9FF:FECD:BEF0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0:23::218:B9FF:FECD:BEF0, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/4 ms

R3# ping FEC0:23::218:B9FF:FE92:28D8

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0:23::218:B9FF:FE92:28D8, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms
```

Note: Your addresses will be different from the addresses displayed in the example because EUI-64 addresses include the MAC address of the interface, which is unique per interface.

At this point, you should have local subnet connectivity.

Note: Although not configured in this lab, the **ipv6 general-prefix** command can simplify the configuration of IPv6 addresses, including the EUI-64. You can use this command to assign a name to an often-used IPv6 prefix and then use the name to configure interfaces.

Step 6: Enable IPv6 routing and CEF.

The Cisco IOS version used with the routers in this lab has IPv6 routing and IPv6 CEF disabled by default. To enable IPv6 routing, use the **ipv6 unicast-routing** command in global configuration mode. To enable IPv6 CEF, use the **ipv6 cef** command. Enter these commands on all three routers.

```
R1(config)# ipv6 unicast-routing
R1(config)# ipv6 cef

R2(config)# ipv6 unicast-routing
R2(config)# ipv6 cef

R3(config)# ipv6 unicast-routing
R3(config)# ipv6 cef
```

Step 7: Configure OSPFv3.

Unlike IPv4 OSPF, where networks are added to the OSPF process using **network** statements under the routing protocol configuration prompt, IPv6 OSPF uses the interface-level command **ipv6 ospf** *process* **area** *area-id* to add an interface to an area.

a. Add all interfaces shown in the diagram into OSPF process 1, area 0. After you add the interfaces to the OSPF process, the OSPF process starts automatically. If the adjacencies do not come up after a reasonable period of time, troubleshoot using the **debug ipv6 ospf adjacency** and **debug ipv6 packet** commands. Make sure that the packets are being sent to their destination and that adjacencies are forming correctly.

```
R1(config)# interface loopback0
```



```
R1(config-if)# ipv6 ospf 1 area 0
R1(config-if)# interface serial0/0/0
R1(config-if)# ipv6 ospf 1 area 0
R1(config-if)# interface serial0/0/1
R1(config-if)# ipv6 ospf 1 area 0

R2(config)# interface loopback0
R2(config-if)# ipv6 ospf 1 area 0
R2(config-if)# interface serial0/0/0
R2(config-if)# ipv6 ospf 1 area 0
R2(config-if)# interface fastEthernet 0/0
R2(config-if)# ipv6 ospf 1 area 0

R3(config)# interface loopback0
R3(config-if)# ipv6 ospf 1 area 0
R3(config-if)# interface serial0/0/0
R3(config-if)# ipv6 ospf 1 area 0
R3(config-if)# interface fastEthernet 0/0
R3(config-if)# ipv6 ospf 1 area 0
```

b. Verify that you have OSPFv3 neighbors with the **show ipv6 ospf neighbor** command.

```
R1# show ipv6 ospf neighbor

Neighbor ID     Pri   State           Dead Time   Interface ID   Interface
10.1.3.1          1   FULL/  -        00:00:39    6              Serial0/0/1
10.1.2.1          1   FULL/  -        00:00:34    6              Serial0/0/0

R2# show ipv6 ospf neighbor

Neighbor ID     Pri   State           Dead Time   Interface ID   Interface
10.1.3.1          1   FULL/DR         00:00:39    4              FastEthernet0/0
10.1.1.1          1   FULL/  -        00:00:32    6              Serial0/0/0

R3# show ipv6 ospf neighbor

Neighbor ID     Pri   State           Dead Time   Interface ID   Interface
10.1.2.1          1   FULL/BDR        00:00:39    4              FastEthernet0/0
10.1.1.1          1   FULL/  -        00:00:39    7              Serial0/0/0
```

The router IDs for each router are created the same way that they are in OSPFv2 or BGP. Without any IPv4 addresses on the router, the OSPFv3 process will not start unless you manually set the router IDs. This is why the loopback interfaces have been configured with both IPv4 and IPv6 addresses.

c. View the routing table on all three routers with the **show ipv6 route** command.

```
R1# show ipv6 route
IPv6 Routing Table - 11 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       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
L   FE80::/10 [0/0]
     via ::, Null0
C   FEC0::1:0/112 [0/0]
     via ::, Loopback0
L   FEC0::1:1/128 [0/0]
     via ::, Loopback0
```

```
O   FEC0::2:1/128 [110/1562]
     via FE80::2, Serial0/0/0
O   FEC0::3:1/128 [110/1562]
     via FE80::218:B9FF:FECD:BEF0, Serial0/0/1
C   FEC0::12:0/112 [0/0]
     via ::, Serial0/0/0
L   FEC0::12:1/128 [0/0]
     via ::, Serial0/0/0
C   FEC0::13:0/112 [0/0]
     via ::, Serial0/0/1
L   FEC0::13:1/128 [0/0]
     via ::, Serial0/0/1
O   FEC0:23::/64 [110/1563]
     via FE80::2, Serial0/0/0
     via FE80::218:B9FF:FECD:BEF0, Serial0/0/1
L   FF00::/8 [0/0]
     via ::, Null0

R2# show ipv6 route
IPv6 Routing Table - 11 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       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
L   FE80::/10 [0/0]
     via ::, Null0
O   FEC0::1:1/128 [110/1562]
     via FE80::1, Serial0/0/0
C   FEC0::2:0/112 [0/0]
     via ::, Loopback0
L   FEC0::2:1/128 [0/0]
     via ::, Loopback0
O   FEC0::3:1/128 [110/1]
     via FE80::218:B9FF:FECD:BEF0, FastEthernet0/0
C   FEC0::12:0/112 [0/0]
     via ::, Serial0/0/0
L   FEC0::12:2/128 [0/0]
     via ::, Serial0/0/0
O   FEC0::13:0/112 [110/1563]
     via FE80::218:B9FF:FECD:BEF0, FastEthernet0/0
C   FEC0:23::/64 [0/0]
     via ::, FastEthernet0/0
L   FEC0:23::218:B9FF:FE92:28D8/128 [0/0]
     via ::, FastEthernet0/0
L   FF00::/8 [0/0]
     via ::, Null0

R3# show ipv6 route
IPv6 Routing Table - 11 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       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
L   FE80::/10 [0/0]
     via ::, Null0
O   FEC0::1:1/128 [110/1562]
```



```
     via FE80::219:6FF:FE23:4380, Serial0/0/0
O    FEC0::2:1/128 [110/1]
     via FE80::218:B9FF:FE92:28D8, FastEthernet0/0
C    FEC0::3:0/112 [0/0]
     via ::, Loopback0
L    FEC0::3:1/128 [0/0]
     via ::, Loopback0
O    FEC0::12:0/112 [110/1563]
     via FE80::218:B9FF:FE92:28D8, FastEthernet0/0
C    FEC0::13:0/112 [0/0]
     via ::, Serial0/0/0
L    FEC0::13:3/128 [0/0]
     via ::, Serial0/0/0
C    FEC0:23::/64 [0/0]
     via ::, FastEthernet0/0
L    FEC0:23::218:B9FF:FECD:BEF0/128 [0/0]
     via ::, FastEthernet0/0
L    FF00::/8 [0/0]
     via ::, Null0
```

d. You can also look at per-interface OSPF behavior with the **show ipv6 ospf interface** command.

```
R1# show ipv6 ospf interface
Serial0/0/1 is up, line protocol is up
  Link Local Address FE80::219:6FF:FE23:4380, Interface ID 7
  Area 0, Process ID 1, Instance ID 0, Router ID 10.1.1.1
  Network Type POINT_TO_POINT, Cost: 1562
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:06
  Index 1/3/3, 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 10.1.3.1
  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 10.1.1.1
  Network Type POINT_TO_POINT, Cost: 1562
  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 1/2/2, 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 10.1.2.1
  Suppress hello for 0 neighbor(s)
Loopback0 is up, line protocol is up
  Link Local Address FE80::219:6FF:FE23:4380, Interface ID 20
  Area 0, Process ID 1, Instance ID 0, Router ID 10.1.1.1
  Network Type LOOPBACK, Cost: 1
  Loopback interface is treated as a stub Host

R2# show ipv6 ospf interface
FastEthernet0/0 is up, line protocol is up
```



```
  Link Local Address FE80::218:B9FF:FE92:28D8, Interface ID 4
  Area 0, Process ID 1, Instance ID 0, Router ID 10.1.2.1
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 10.1.3.1, local address FE80::218:B9FF:FECD:BEF0
  Backup Designated router (ID) 10.1.2.1, local address
FE80::218:B9FF:FE92:28D8
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:04
  Index 1/3/3, 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 10.1.3.1  (Designated Router)
  Suppress hello for 0 neighbor(s)
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 10.1.2.1
  Network Type POINT_TO_POINT, Cost: 1562
  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 1/2/2, 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 10.1.1.1
  Suppress hello for 0 neighbor(s)
Loopback0 is up, line protocol is up
  Link Local Address FE80::218:B9FF:FE92:28D8, Interface ID 17
  Area 0, Process ID 1, Instance ID 0, Router ID 10.1.2.1
  Network Type LOOPBACK, Cost: 1
  Loopback interface is treated as a stub Host

R3# show ipv6 ospf interface
FastEthernet0/0 is up, line protocol is up
  Link Local Address FE80::218:B9FF:FECD:BEF0, Interface ID 4
  Area 0, Process ID 1, Instance ID 0, Router ID 10.1.3.1
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 10.1.3.1, local address FE80::218:B9FF:FECD:BEF0
  Backup Designated router (ID) 10.1.2.1, local address
FE80::218:B9FF:FE92:28D8
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:09
  Index 1/3/3, 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 10.1.2.1  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
Serial0/0/0 is up, line protocol is up
  Link Local Address FE80::218:B9FF:FECD:BEF0, Interface ID 6
  Area 0, Process ID 1, Instance ID 0, Router ID 10.1.3.1
  Network Type POINT_TO_POINT, Cost: 1562
```



```
  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 1/2/2, 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 10.1.1.1
  Suppress hello for 0 neighbor(s)
Loopback0 is up, line protocol is up
  Link Local Address FE80::218:B9FF:FECD:BEF0, Interface ID 17
  Area 0, Process ID 1, Instance ID 0, Router ID 10.1.3.1
  Network Type LOOPBACK, Cost: 1
  Loopback interface is treated as a stub Host
```

e. Run the following Tcl script on all routers to verify full connectivity. If these pings are not successful, troubleshoot. Modify the script to include the correct EUI addresses on the FEC0:23:: /64 subnet. The addresses for the router interfaces used in this lab are shown below.

```
tclsh

foreach address {
FEC0::1:1
FEC0::2:1
FEC0::3:1
FEC0::12:1
FEC0::12:2
FEC0::13:1
FEC0::13:3
FEC0:23::
FEC0:23::
} {
ping $address }
```

```
R1#tclsh
R1(tcl)#
R1(tcl)#foreach address {
+>(tcl)#FEC0::1:1
+>(tcl)#FEC0::2:1
+>(tcl)#FEC0::3:1
+>(tcl)#FEC0::12:1
+>(tcl)#FEC0::12:2
+>(tcl)#FEC0::13:1
+>(tcl)#FEC0::13:3
+>(tcl)#FEC0:23::218:B9FF:FE92:28D8
+>(tcl)#FEC0:23::218:B9FF:FECD:BEF0
+>(tcl)#} {
+>(tcl)#ping $address }
```

Challenge: Summarize OSPFv3 Areas

The commands available for OSPFv3 are similar to the commands available for OSPFv2. On R2, add in two loopback interfaces, with the addresses FEC0:500::100:1 /112 and FEC0:500::200:1 /112. Add both of these interfaces to the OSPF process in area 500. Summarize area 500 to FEC0:500:: /64. To enter the OSPF configuration prompt, use the **ipv6 router ospf** *process-id* command. Unlike the IPv4 (config-router) prompt, the IPv6 router prompt is (config-rtr). When in the IPv6 router prompt, use the **area range** command to summarize the address. Use the question mark (?) if you need help.

Router Interface Summary Table

Router Interface Summary				
Router Model	Ethernet Interface #1	Ethernet Interface #2	Serial Interface #1	Serial Interface #2
1700	Fast Ethernet 0 (FA0)	Fast Ethernet 1 (FA1)	Serial 0 (S0)	Serial 1 (S1)
1800	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2600	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0 (S0/0)	Serial 0/1 (S0/1)
2800	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	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. Rather than list all 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 might contain one. For example, for an ISDN BRI interface, the string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.				