NetSim®
NETWORK SIMULATOR®

Lab ID: 9.9K1114A091.SQI1.1

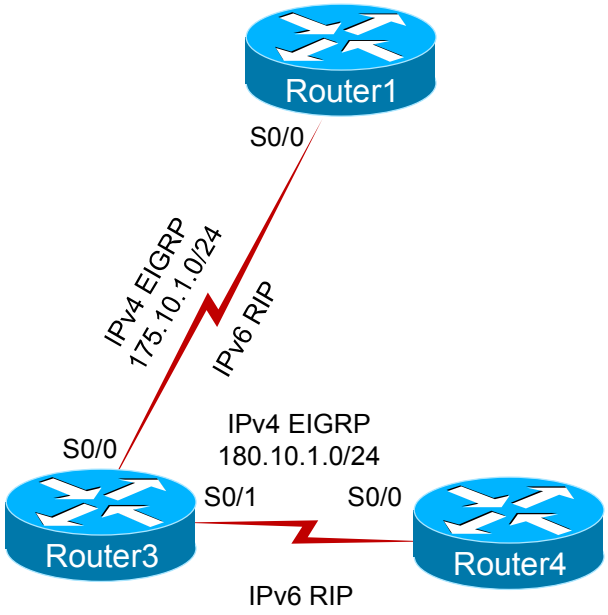
Sequential Lab: Implementing IPv6

Objective

Configure a simulated network with Internet Protocol version 6 (IPv6) addresses on physical interfaces and loopback interfaces. Your implementation should enable router interfaces to ping IPv6 addresses across routers and across IPv6 subnets. All passwords configured for the devices in this lab have been configured as **cisco**. You will configure IPv6 addressing and Routing Information Protocol (RIP) for IPv6 on Router1, Router3, and Router4.

Lab Topology

The topology diagram below represents the portion of the network you will configure in this lab.



Command Summary

Command	Description
configure terminal	enters global configuration mode from privileged EXEC mode
copy running-config startup-config	saves the configuration file
enable	enters privileged EXEC mode
end	ends and exits configuration mode
exit	exits one level in the menu structure
interface *type number*	changes from global configuration mode to interface configuration mode
ipv6 address *ipv6-address/prefix-length*	configures an IPv6 address for an interface
ipv6 rip *process-name* **enable**	configures an interface for RIP next generation (RIPng) and enters IPv6 RIP router configuration mode

Command	Description
ipv6 router rip *process-name*	configures a router for RIPng and enters IPv6 RIP router configuration mode
ipv6 unicast-routing	enables IPv6 routing
ping *ip-address*	sends an Internet Control Message Protocol (ICMP) echo request to the specified address
ping ipv6 *ip-address*	sends an ICMP echo request to the specified IPv6 address
show ipv6 interface	displays IPv6 interface information
show ipv6 interface brief	displays a brief summary of each IPv6 interface's configuration and status
show ipv6 rip	displays statistics and configuration information about the IPv6 RIP routing process
show ipv6 route	displays the IPv6 routing table

The IP addresses and subnet masks used in this lab are shown in the table below:

IPv6 Addresses

Device	Interface	IPv6 Address
Router1	Serial 0/0	2001:0001:0003:0004::0002/64
	Loopback 6	2001:0001:0003:0005::0001/64
Router3	Serial 0/0	2001:0001:0003:0004::0001/64
	Serial 0/1	2001:0001:0003:0001::0001/64
	Loopback 6	2001:0001:0003:0002::0001/64
Router4	Serial 0/0	2001:0001:0003:0001::0002/64
	Loopback 6	2001:0001:0003:0003::0001/64

Lab Tasks

Task 1: Configure IPv6 Addresses

All passwords in this lab have been set to **cisco**.

1. Verify IPv4 connectivity between Router3 and Router4 by issuing the **ping 180.10.1.2** command on Router3 and the **ping 180.10.1.1** command on Router4. The pings should be successful.

2. Enable IPv6 routing on Router3 and Router4.

3. On Router3, configure the IPv6 address for the Serial 0/1 interface; refer to the IPv6 Addresses table.

4. On Router4, configure the IPv6 address for the Serial 0/0 interface; refer to the IPv6 Addresses table.

5. On Router3, issue the **show ipv6 interface** command. What IPv6 addresses have been assigned to Router3's Serial 0/1 interface? _____

6. Are loopback interfaces logical or physical? What benefit does this have? _____
_____

7. Create the Loopback 6 interface on Router3, and configure the appropriate IPv6 address; refer to the IPv6 Addresses table.

8. Create the Loopback 6 interface on Router4, and configure the appropriate IPv6 address; refer to the IPv6 Addresses table.

9. On Router3, issue the **show ipv6 interface brief** command. What interfaces have IPv6 addresses?

_____

10. From Router4, try to ping Router3's global unicast Serial 0/1 IPv6 address (2001:1:3:1::1) and Router3's global unicast Loopback 6 IPv6 address (2001:1:3:2::1) assigned. Which pings fail? Why?

_____

Task 2: Enable IPv6 RIP Routing

1. On Router3 and Router4, globally enable RIP for IPv6. Name the process **boson**.

2. Issue the **show ipv6 route** command on Router3. What RIP routes are being advertised? Why?
_____
_____

3. On Router4, try to ping the global unicast IPv6 address assigned to Router3's Loopback 6 interface (2001:1:3:2::1) . Does the ping succeed? Why or why not? _____
_____

4. On Router3, enable RIP for IPv6 on the Serial 0/1 interface and the Loopback 6 interface.

5. On Router4, enable RIP for IPv6 on the Serial 0/0 interface and the Loopback 6 interface.

6. Allow time for the network to converge, and then issue the **show ipv6 route** command on Router3. Do you see a route from Router3 to Router4's Loopback 6 interface? _____

7. On Router4, attempt to ping Router3's Loopback interface (2001:1:3:2::1). The ping should succeed.

8. On Router3, issue the **show ipv6 protocols** command. You should note that Router3 is sending and receiving updates on the Serial 0/1 interface by using the “rip boson” process.

Task 3: Configure IPv6 between Router1 and Router3

In this task, you will use the commands you learned in previous tasks to implement IPv6 on the link between Router1 and Router3. Use the IPv6 addresses in the table below:

IPv6 Addresses

Device	Interface	IPv6 Address
Router1	Serial 0/0	2001:0001:0003:0004::0002/64
	Loopback 6	2001:0001:0003:0005::0001/64
Router3	Serial 0/0	2001:0001:0003:0004::0001/64

1. On Router3, configure the Serial 0/0 interface with the appropriate IPv6 address.

2. On Router3, enable RIP routing for the Serial 0/0 interface. Use the process name **boson**.

3. On Router1, enable IPv6 routing.

4. On Router1, configure the Serial 0/0 interface with the appropriate IPv6 address.

5. On Router1, create a Loopback 6 interface and configure it with the appropriate IPv6 address.

6. On Router1, globally enable RIP routing for IPv6. Use the process name **boson**.

7. On Router1, enable RIP routing for the Serial 0/0 interface and for the Loopback 6 interface. Use the process name **boson**.

8. On Router3, verify that you can ping Router1’s Serial 0/0 IPv6 address (2001:1:3:4::2).

9. On Router3, verify that you can ping Router1’s Loopback 6 IPv6 address (2001:1:3:5::1).

10. On Router1, verify that you can see IPv6 routes from other routers.

Lab Solutions

Task 1: Configure IPv6 Addresses

All passwords in this lab have been set to **cisco**.

1. Pings between Router3 (180.10.1.1) and Router4 (180.10.1.2) should be successful.

```
Router3>enable
Password:cisco
Router3#ping 180.10.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 180.10.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms


Router4>enable
Password:cisco
Router4#ping 180.10.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 180.10.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

2. Issue the following commands to enable IPv6 routing on Router3 and Router4:

```
Router3#configure terminal
Router3(config)#ipv6 unicast-routing

Router4#configure terminal
Router4(config)#ipv6 unicast-routing
```

3. On Router3, issue the following commands to configure an IPv6 address on the Serial 0/1 interface; note that you can omit leading zeroes from IPv6 octets:

```
Router3(config)#interface serial 0/1
Router3(config-if)#ipv6 address 2001:1:3:1::1/64
```

4. On Router4, issue the following commands to configure an IPv6 address on the Serial 0/0 interface:

```
Router4(config)#interface serial 0/0
Router4(config-if)#ipv6 address 2001:1:3:1::2/64
```

5. Output from the show ipv6 interface command issued on Router3 should show that the Serial 0/1 interface has been assigned the global unicast IPv6 address 2001:0001:0003:0001::0001/64 and the link-local IPv6 address FE80::020C:26FF:FE50:8795. The link-local IPv6 address is automatically generated when you assign a global unicast IPv6 address to an interface. Sample output is shown below:

```
Router3(config-if)#end
Router3#show ipv6 interface
Serial0/1 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::020C:31FF:FE68:8461
  Global unicast address(es):
  2001:1:3:1::1, subnet is 2001:1:3:1::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF00:1
    FF02::1:FF68:8461
  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
  Hosts use stateless autoconfig for addresses.
```

6. Loopback interfaces are logical, not physical; therefore, a Loopback interface can never fail. If you cannot ping the loopback interface on the router, you most likely cannot connect to any interface on the router.

7. On Router3, issue the following commands to configure an IPv6 address for the Loopback 6 interface:

```
Router3#configure terminal
Router3(config)#interface loopback 6
Router3(config-if)#ipv6 address 2001:1:3:2::1/64
```

8. On Router4, issue the following commands to configure an IPv6 address for the Loopback 6 interface:

```
Router4(config-if)#interface loopback 6
Router4(config-if)#ipv6 address 2001:1:3:3::1/64
```

9. Output from the **show ipv6 interface brief** command issued on Router3 shows that the Serial 0/1 interface has a global unicast IPv6 address and a link-local IPv6 address. Additionally, the Loopback 6 interface has a global unicast IPv6 address and a link-local IPv6 address. Sample output is shown below:

```
Router3(config-if)#end
Router3#show ipv6 interface brief
Serial0/0                  [up/up]
    unassigned
Serial0/1                  [up/up]
    FE80::020C:31FF:FE68:8461
    2001:1:3:1::1
FastEthernet0/0            [administratively down/down]
    unassigned
FastEthernet0/1            [up/up]
    unassigned
FastEthernet0/1.1          [up/up]
    unassigned
FastEthernet0/1.2          [up/up]
    unassigned
FastEthernet0/1.4          [up/up]
    unassigned
Loopback6                  [up/up]
    FE80::020C:31FF:FE68:8461
    2001:1:3:2::1
```

10. A ping from Router4 to Router3's Loopback 6 interface (2001:1:3:2::1) fails; the IPv6 addresses that are assigned to the Loopback 6 interfaces are not directly connected and reside on different subnets. A ping from Router4 to Router3's Serial 0/1 interface (2001:1:3:1::1) should succeed because the Serial interfaces are directly connected between the two routers and reside on the same subnet.

```
Router4(config-if)#end
Router4#ping ipv6 2001:1:3:2::1
Router4#ping ipv6 2001:1:3:1::1
```

Task 2: Enable IPv6 RIP Routing

1. IPv6 routing processes are similar to IPv4 routing processes in that they are enabled globally. IPv6 routing processes typically use the IPv6 address assigned to the interface when sending advertisements to neighboring routers. On Router3 and Router4, you should issue the following commands to globally enable RIP for IPv6, using the process **boson**:

```
Router3#configure terminal
Router3(config)#ipv6 router rip boson

Router4#configure terminal
Router4(config)#ipv6 router rip boson
```

2. On Router3, you should issue the **show ipv6 route** command. Even though RIP for IPv6 has been globally enabled, no RIP for IPv6 routes are being advertised because no IPv6 interfaces have been configured with RIP for IPv6. Sample output is shown below:

```
Router3#(config)#end
Router3#show ipv6 route
IPv6 Routing Table
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
C   2001:1:3:1::/64 [0/0]
     via Serial0/1, directly connected
L   2001:1:3:1::1/128 [0/0]
     via Serial0/1, receive
C   2001:1:3:2::/64 [0/0]
     via Loopback6, directly connected
L   2001:1:3:3::1/128 [0/0]
     via ::, Loopback6
L   FF00::/8 [0/0]
     via Null0, receive
```

3. A ping from Router4 to Router3's Loopback 6 interface (2001:1:3:2::1) fails, because Router3 is not advertising a route to the IPv6 addresses on the Loopback 6 interface.

4. The IPv6 RIP routing process, which was enabled in step 1 with the **ipv6 router rip boson** command, will not advertise any networks to neighboring routers unless interfaces with IPv6 addresses configured on the router are added to the routing process using the process name. On Router3, issue the following commands to enable RIP for IPv6 for the Serial 0/1 interface and the Loopback 6 interface:

```
Router3#configure terminal
Router3(config)#interface serial 0/1
Router3(config-if)#ipv6 rip boson enable
Router3(config-if)#interface loopback 6
Router3(config-if)#ipv6 rip boson enable
```

5. On Router4, issue the following commands to enable RIP for IPv6 on the Serial 0/0 interface and Loopback 6 interface:

```
Router4#configure terminal
Router4(config)#interface serial 0/0
Router4(config-if)#ipv6 rip boson enable
Router4(config-if)#interface loopback 6
Router4(config-if)#ipv6 rip boson enable
```

5. Router3 now displays a route to the 2001:1:3:3::1 IPv6 address that is assigned to the Loopback 6 interface on Router4. The following is sample output from the **show ipv6 route** command issued Router3:

```
Router3(config-if)#end
Router3#show ipv6 route
IPv6 Routing Table - 8 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
C   2001:1:3:1::/64 [0/0]
     via Serial0/1, directly connected
L   2001:1:3:1::1/128 [0/0]
     via Serial0/1, receive
C   2001:1:3:2::/64 [0/0]
     via Loopback6, directly connected
L   2001:1:3:2::1/128 [0/0]
     via Loopback6, receive
R   2001:1:3:3::/64 [120/1]
L   FF00::/8 [0/0]
     via Null0, receive
```

6. A ping from Router4 to Router3's Loopback interface (2001:1:3:2::1) should succeed.

7. On Router3, issue the show ipv6 protocols command. You should note that Router3 is sending and receiving updates on the Serial 0/1 interface by using the "rip boson" process. Sample output is shown below:

```
Router3#show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "static"
IPv6 Routing Protocol is "rip boson"
    Serial0/1
Redistribution:
    None
```

Task 3: Configure IPv6 between Router1 and Router3

1. On Router3, issue the following commands to configure the Serial 0/0 interface with the appropriate IPv6 address:

```
Router3#configure terminal
Router3(config)#interface serial 0/0
Router3(config-if)#ipv6 address 2001:1:3:4::1/64
```

2. On Router3, issue the following commands to enable RIP routing for the Serial 0/0 interface:

```
Router3(config-if)#ipv6 rip boson enable
```

3. On Router1, issue the following commands to enable IPv6 routing:

```
Password:cisco
Router1>enable
Password:cisco
Router1#configure terminal
Router1(config)#ipv6 unicast-routing
```

4. On Router1, issue the following commands to configure the Serial 0/0 interface with the appropriate IPv6 address:

```
Router1(config)#interface serial 0/0
Router1(config-if)#ipv6 address 2001:1:3:4::2/64
```

5. On Router1, issue the following commands to create a Loopback 6 interface and configure it with the appropriate IPv6 address:

```
Router1(config)#interface loopback 6
Router1(config-if)#ipv6 address 2001:1:3:5::1/64
```

6. On Router1, issue the following command to globally enable RIP routing for IPv6:

```
Router1(config-if)#exit
Router1(config)#ipv6 router rip boson
```

7. On Router1, issue the following commands to enable RIP routing for the Serial 0/0 interface and for the Loopback 6 interface:

```
Router1(config)#interface serial 0/0
Router1(config-if)#ipv6 rip boson enable
Router1(config-if)#interface loopback 6
Router1(config-if)#ipv6 rip boson enable
```

8. A ping from Router3 to Router1's Serial 0/0 IPv6 address (2001:1:3:4::2) should be successful:

```
Router3(config-if)#end
Router3#ping 2001:1:3:4::2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:1:3:4::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

9. A ping from Router3 to Router1's Loopback 6 interface (2001:1:3:5::1) should be successful:

```
Router3#ping 2001:1:3:5::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:1:3:5::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

10. On Router1, issue the **show ipv6 route** command to verify that you can see IPv6 routes from other routers. Sample output is shown below:

```
Router1(config-if)#end
Router1#show ipv6 route
IPv6 Routing Table - 8 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
C   2001:1:3:5::/64 [0/0]
     via Serial0/0, directly connected
L   2001:1:3:4::2/128 [0/0]
     via Serial0/0, receive
C   2001:1:3:5::/64 [0/0]
     via Loopback6, directly connected
L   2001:1:3:5::1/128 [0/0]
     via Loopback6, receive
R   2001:1:3:1::/64 [120/2]
R   2001:1:3:2::/64 [120/2]
R   2001:1:3:3::/64 [120/2]
L   FF00::/8 [0/0]
     via Null0, receive
```

Sample Configuration Script

Router3

```
Router3#show running-config
Current configuration : 1562 bytes
!
Version 12.3
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router3
enable secret 5 $sdf$6978yhg$jnb76sd
!
ip subnet-zero
!
ip cef
no ip domain-lookup
!
ipv6 unicast-routing
!
interface Loopback6
 no ip address
 ipv6 address 2001:1:3:2::1/64
 ipv6 rip boson enable
 no ip directed broadcast
!
interface Serial0/0
 ip address 175.10.1.2 255.255.255.0
 no ip directed-broadcast
ipv6 rip boson enable
ipv6 address 2001:1:3:4::1/64
!
interface Serial0/1
 ip address 180.10.1.1 255.255.255.0
no ip directed-broadcast
 clock rate 64000
 ipv6 rip boson enable
 ipv6 address 2001:1:3:1::1/64
!
interface FastEthernet0/0
 no ip address
 no ip directed-broadcast
 shutdown
!
```

Router3 (continued)

```
interface FastEthernet0/1
 no ip address
 no ip directed-broadcast
!
interface FastEthernet0/1.1
 encapsulation dot1q 1
 ip address 197.10.1.1 255.255.255.0
!
interface FastEthernet0/1.2
 encapsulation dot1q 2
 ip address 197.10.2.1 255.255.255.0
!
interface FastEthernet0/1.4
 encapsulation dot1q 4
 ip address 197.10.4.1 255.255.255.0
!
 ipv6 router rip boson
!
router eigrp 100
 network 175.10.0.0
 network 180.10.0.0
 network 197.10.1.0
 network 197.10.2.0
 network 197.10.4.0
 auto-summary
!
ip classless
no ip http server
!
line con 0
line aux 0
line vty 0 4
 login
 password cisco
!
no scheduler allocate
end
```