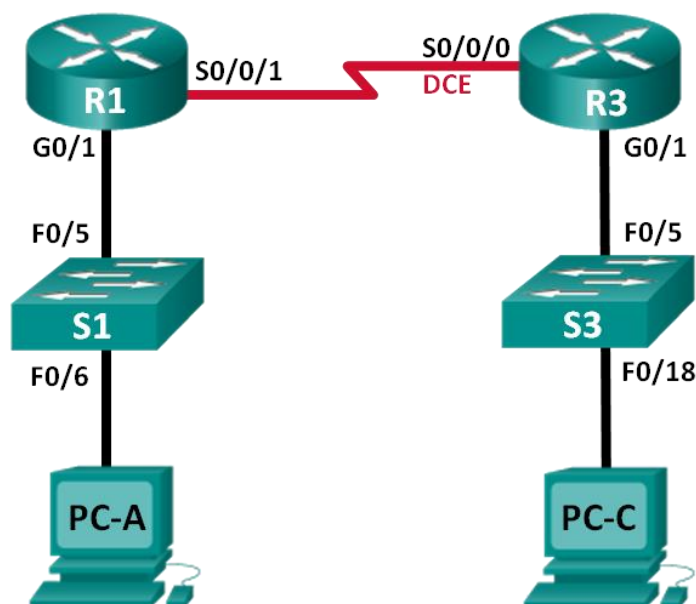


## Lab – Configuring IPv6 Static and Default Routes

### Topology



### Addressing Table

Device	Interface	IPv6 Address / Prefix Length	Default Gateway
R1	G0/1	2001:DB8:ACAD:A::/64 eui-64	N/A
	S0/0/1	FC00::1/64	N/A
R3	G0/1	2001:DB8:ACAD:B::/64 eui-64	N/A
	S0/0/0	FC00::2/64	N/A
PC-A	NIC	SLAAC	SLAAC
PC-C	NIC	SLAAC	SLAAC

### Objectives

#### Part 1: Build the Network and Configure Basic Device Settings

- Enable IPv6 unicast routing and configure IPv6 addressing on the routers.
- Disable IPv4 addressing and enable IPv6 SLAAC for the PC network interfaces.
- Use **ipconfig** and **ping** to verify LAN connectivity.
- Use **show** commands to verify IPv6 settings.

#### Part 2: Configure IPv6 Static and Default Routes

- Configure a directly attached IPv6 static route.
- Configure a recursive IPv6 static route.
- Configure a default IPv6 static route.

### Background / Scenario

In this lab, you will configure the entire network to communicate using only IPv6 addressing, including configuring the routers and PCs. You will use stateless address auto-configuration (SLAAC) for configuring the IPv6 addresses for the hosts. You will also configure IPv6 static and default routes on the routers to enable communication to remote networks that are not directly connected.

**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). The switches used are Cisco Catalyst 2960s with Cisco IOS Release 15.0(2) (lanbasek9 image). Other routers, switches, 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 and switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

### Required Resources

- 2 Routers (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
- 2 Switches (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
- 2 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 cable and configure the network to communicate using IPv6 addressing.

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

**Step 2: Initialize and reload the routers and switches.**

**Step 3: Enable IPv6 unicast routing and configure IPv6 addressing on the routers.**

- Using Tera Term, console into the router labeled R1 in the topology diagram and assign the router the name R1.
- Within global configuration mode, enable IPv6 routing on R1.

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

- Configure the network interfaces on R1 with IPv6 addresses. Notice that IPv6 is enabled on each interface. The G0/1 interface has a globally routable unicast address and EUI-64 is used to create the interface identifier portion of the address. The S0/0/1 interface has a privately routable, unique-local address, which is recommended for point-to-point serial connections.

```
R1(config)# interface g0/1
```

```
R1(config-if)# ipv6 address 2001:DB8:ACAD:A::/64 eui-64
```

```
R1(config-if)# no shutdown
```

```
R1(config-if)# interface serial 0/0/1
```

```
R1(config-if)# ipv6 address FC00::1/64
```

```
R1(config-if)# no shutdown
```

```
R1(config-if)# exit
```

- Assign a device name to router R3.

- e. Within global configuration mode, enable IPv6 routing on R3.

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

- f. Configure the network interfaces on R3 with IPv6 addresses. Notice that IPv6 is enabled on each interface. The G0/1 interface has a globally routable unicast address and EUI-64 is used to create the interface identifier portion of the address. The S0/0/0 interface has a privately routable, unique-local address, which is recommended for point-to-point serial connections. The clock rate is set because it is the DCE end of the serial cable.

```
R3(config)# interface gigabit 0/1
```

```
R3(config-if)# ipv6 address 2001:DB8:ACAD:B::/64 eui-64
```

```
R3(config-if)# no shutdown
```

```
R3(config-if)# interface serial 0/0/0
```

```
R3(config-if)# ipv6 address FC00::2/64
```

```
R3(config-if)# clock rate 128000
```

```
R3(config-if)# no shutdown
```

```
R3(config-if)# exit
```

### Step 4: Disable IPv4 addressing and enable IPv6 SLAAC for the PC network interfaces.

- On both PC-A and PC-C, navigate to the **Start** menu > **Control Panel**. Click the **Network and Sharing Center** link while viewing with icons. In the Network and Sharing Center window, click the **Change adapter settings** link on the left side of the window to open the Network Connections window.
- In the Network Connections window, you see the icons for your network interface adapters. Double-click the Local Area Connection icon for the PC network interface that is connected to the switch. Click the **Properties** to open the Local Area Connection Properties dialogue window.
- With the Local Area Connection Properties window open, scroll down through the items and uncheck the item **Internet Protocol Version 4 (TCP/IPv4)** check box to disable the IPv4 protocol on the network interface.
- With the Local Area Connection Properties window still open, click the **Internet Protocol Version 6 (TCP/IPv6)** check box, and then click **Properties**.
- With the Internet Protocol Version 6 (TCP/IPv6) Properties window open, check to see if the radio buttons for **Obtain an IPv6 address automatically** and **Obtain DNS server address automatically** are selected. If not, select them.
- With the PCs configured to obtain an IPv6 address automatically, they will contact the routers to obtain the network subnet and gateway information, and auto-configure their IPv6 address information. In the next step, you will verify the settings.

### Step 5: Use ipconfig and ping to verify LAN connectivity.

- From PC-A, open a command prompt, type **ipconfig /all** and press Enter. The output should look similar to that shown below. In the output, you should see that the PC now has an IPv6 global unicast address, a link-local IPv6 address, and a link-local IPv6 default gateway address. You may also see a temporary IPv6 address and under the DNS server addresses, three site-local addresses that start with FEC0. Site-local addresses are private addresses that were meant to be backwards compatible with NAT. However, they are not supported in IPv6 and are replaced by unique-local addresses.

```
C:\Users\User1> ipconfig /all
```

```
Windows IP Configuration
```

```
<Output omitted>
```

## Lab – Configuring IPv6 Static and Default Routes

---

Ethernet adapter Local Area Connection:

```
Connection-specific DNS Suffix . : 
Description . . . . . : Intel(R) 82577LC Gigabit Network Connection
Physical Address. . . . . : 1C-C1-DE-91-C3-5D
DHCP Enabled. . . . . : No
Autoconfiguration Enabled . . . . : Yes
IPv6 Address. . . . . : 2001:db8:acad:a:7c0c:7493:218d:2f6c (Preferred)
Temporary IPv6 Address. . . . . : 2001:db8:acad:a:bc40:133a:54e7:d497 (Preferred)
Link-local IPv6 Address . . . . . : fe80::7c0c:7493:218d:2f6c%13 (Preferred)
Default Gateway . . . . . : fe80::6273:5cff:fe0d:1a61%13
DNS Servers . . . . . : fec0:0:0:ffff::1%1
                       : fec0:0:0:ffff::2%1
                       : fec0:0:0:ffff::3%1
NetBIOS over Tcpip. . . . . : Disabled
```

Based on your network implementation and the output of the **ipconfig /all** command, did PC-A receive IPv6 addressing information from R1?

- b. What is the PC-A global unicast IPv6 address?
- c. What is the PC-A link-local IPv6 address?
- d. What is the PC-A default gateway IPv6 address?
- e. From PC-A, use the **ping -6** command to issue an IPv6 ping to the link-local default gateway address. You should see replies from the R1 router.

```
C:\Users\User1> ping -6 <default-gateway-address>
```

Did PC-A receive replies to the ping from PC-A to R1?

- f. Repeat Step 5a from PC-C.  
Did PC-C receive IPv6 addressing information from R3?
- g. What is the PC-C global unicast IPv6 address?
- h. What is the PC-C link-local IPv6 address?
- i. What is the PC-C default gateway IPv6 address?
- j. From PC-C, use the **ping -6** command to ping the PC-C default gateway.  
Did PC-C receive replies to the pings from PC-C to R3?
- k. Attempt an IPv6 **ping -6** from PC-A to the PC-C IPv6 address.

```
C:\Users\User1> ping -6 PC-C-IPv6-address
```

Was the ping successful? Why or why not?

### Step 6: Use show commands to verify IPv6 settings.

- a. Check the status of the interfaces on R1 with the **show ipv6 interface brief** command.

What are the two IPv6 addresses for the G0/1 interface and what kind of IPv6 addresses are they?

What are the two IPv6 addresses for the S0/0/1 interface and what kind of IPv6 addresses are they?

- b. To see more detailed information on the IPv6 interfaces, type a **show ipv6 interface** command on R1 and press Enter.

What are the multicast group addresses for the Gigabit Ethernet 0/1 interface?

What are the multicast group addresses for the S0/0/1 interface?

What is an FF02::1 multicast address used for?

What is an FF02::2 multicast address used for?

What kind of multicast addresses are FF02::1:FF00:1 and FF02::1:FF0D:1A60, and what are they used for?

- c. View the IPv6 routing table information for R1 using the **show ipv6 route** command. The IPv6 routing table should have two connected routes, one for each interface, and three local routes, one for each interface and one for multicast traffic to a Null0 interface.

In what way does the routing table output of R1 reveal why you were unable to ping PC-C from PC-A?

## Part 2: Configure IPv6 Static and Default Routes

In Part 2, you will configure IPv6 static and default routes three different ways. You will confirm that the routes have been added to the routing tables, and you will verify successful connectivity between PC-A and PC-C.

You will configure three types of IPv6 static routes:

- **Directly Connected IPv6 Static Route** – A directly connected static route is created when specifying the outgoing interface.
- **Recursive IPv6 Static Route** – A recursive static route is created when specifying the next-hop IP address. This method requires the router to execute a recursive lookup in the routing table in order to identify the outgoing interface.
- **Default IPv6 Static Route** – Similar to a quad zero IPv4 route, a default IPv6 static route is created by making the destination IPv6 prefix and prefix length all zeros, ::/0.

### Step 1: Configure a directly connected IPv6 static route.

In a directly connected IPv6 static route, the route entry specifies the router outgoing interface. A directly connected static route is typically used with a point-to-point serial interface. To configure a directly attached IPv6 static route, use the following command format:

```
Router(config)# ipv6 route <ipv6-prefix/prefix-length> <outgoing-interface-type> <outgoing-interface-number>
```

- a. On router R1, configure an IPv6 static route to the 2001:DB8:ACAD:B::/64 network on R3, using the R1 outgoing S0/0/1 interface.

```
R1(config)# ipv6 route 2001:DB8:ACAD:B::/64 serial 0/0/1
```

```
R1(config)#
```

- b. View the IPv6 routing table to verify the new static route entry.

What is the code letter and routing table entry for the newly added route in the routing table?

- c. Now that the static route has been configured on R1, is it now possible to ping the host PC-C from PC-A?

These pings should fail. If the recursive static route is correctly configured, the ping arrives at PC-C. PC-C sends a ping reply back to PC-A. However, the ping reply is discarded at R3 because R3 does not have a return route to the 2001:DB8:ACAD:A::/64 network in the routing table. To successfully ping across the network, you must also create a static route on R3.

- d. On router R3, configure an IPv6 static route to the 2001:DB8:ACAD:A::/64 network, using the R3 outgoing S0/0/0 interface.

```
R3(config)# ipv6 route 2001:DB8:ACAD:A::/64 serial 0/0/0
```

```
R3(config)#
```

- e. Now that both routers have static routes, attempt an IPv6 **ping -6** from PC-A to the PC-C global unicast IPv6 address.

Was the ping successful? Why?

### Step 2: Configure a recursive IPv6 static route.

In a recursive IPv6 static route, the route entry has the next-hop router IPv6 address. To configure a recursive IPv6 static route, use the following command format:

```
Router(config)# ipv6 route <ipv6-prefix/prefix-length> <next-hop-ipv6-address>
```

- a. On router R1, delete the directly attached static route and add a recursive static route.

```
R1(config)# no ipv6 route 2001:DB8:ACAD:B::/64 serial 0/0/1
```

```
R1(config)# ipv6 route 2001:DB8:ACAD:B::/64 FC00::2
```

```
R1(config)# exit
```

- b. On router R3, delete the directly attached static route and add a recursive static route.

```
R3(config)# no ipv6 route 2001:DB8:ACAD:A::/64 serial 0/0/0
R3(config)# ipv6 route 2001:DB8:ACAD:A::/64 FC00::1
R3(config)# exit
```

- c. View the IPv6 routing table on R1 to verify the new static route entry.

What is the code letter and routing table entry for the newly added route in the routing table?

- d. Verify connectivity by issuing a **ping -6** command from PC-A to PC-C.

Was the ping successful?

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

### Step 3: Configure a default IPv6 static route.

In a default static route, the destination IPv6 prefix and prefix length are all zeros.

```
Router(config)# ipv6 route ::/0 <outgoing-interface-type> <outgoing-
interface-number> {and/or} <next-hop-ipv6-address>
```

- a. On router R1, delete the recursive static route and add a default static route.

```
R1(config)# no ipv6 route 2001:DB8:ACAD:B::/64 FC00::2
R1(config)# ipv6 route ::/0 serial 0/0/1
R1(config)#
```

- b. Delete the recursive static route and add a default static route on R3.

- c. View the IPv6 routing table on R1 to verify the new static route entry.

What is the code letter and routing table entry for the newly added default route in the routing table?

- d. Verify connectivity by issuing a **ping -6** command from PC-A to PC-C.

Was the ping successful?

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

### Reflection

1. This lab focuses on configuring IPv6 static and default routes. Can you think of a situation where you would need to configure both IPv6 and IPv4 static and default routes on a router?
2. In practice, configuring an IPv6 static and default route is very similar to configuring an IPv4 static and default route. Aside from the obvious differences between the IPv6 and IPv4 addressing, what are some other differences when configuring and verifying an IPv6 static route as compared to an IPv4 static route?

**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)
<b>Note:</b> 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.				