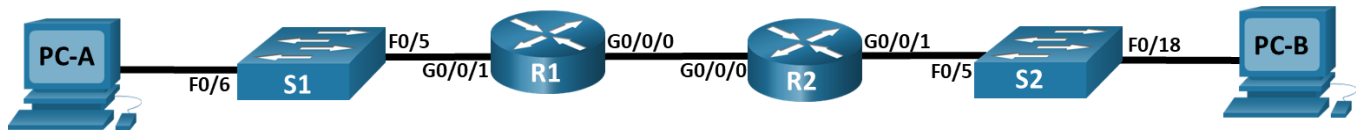


## Lab - Configure DHCPv6

### Topology



### Addressing Table

Device	Interface	IPv6 Address
R1	G0/0/0	2001:db8:acad:2::1 /64
		fe80::1
	G0/0/1	2001:db8:acad:1::1/64
		fe80::1
R2	G0/0/0	2001:db8:acad:2::2/64
		fe80::2
	G0/0/1	2001:db8:acad:3::1 /64
		fe80::1
PC-A	NIC	DHCP
PC-B	NIC	DHCP

### Objectives

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

**Part 2: Verify SLAAC address assignment from R1**

**Part 3: Configure and verify a Stateless DHCPv6 Server on R1**

**Part 4: Configure and verify a Stateful DHCPv6 Server on R1**

**Part 5: Configure and verify a DHCPv6 Relay on R2**

### Background / Scenario

The dynamic assignment of IPv6 global unicast addresses (GUA) can be configured the following three ways:

- Stateless Address Autoconfiguration (SLAAC)
- Stateless Dynamic Host Configuration Protocol for IPv6 (DHCPv6)
- Stateful DHCPv6

When using SLAAC to assign IPv6 addresses to hosts a DHCPv6 server is not used. Because a DHCPv6 server is not used when implementing SLAAC, hosts are unable to receive additional critical network information, including a domain name server (DNS) address as well as a domain name.

When using Stateless DHCPv6 to assign IPv6 addresses to host, a DHCPv6 server is used to assign the additional critical network information, however the IPv6 address is assigned using SLACC.

When implementing Stateful DHCPv6, a DHCPv6 server assigns all network information, including the IPv6 address.

The determination of how hosts obtain they dynamic IPv6 addressing is dependent on flag setting contain within the router advertisement (RA) messages.

In this scenario, the company has grown in size, and the network administrators can no longer assign IP addresses to devices manually. Your job is to configure the R2 router to assign IPv6 addresses on two different subnets connected to router R1.

**Note:** The routers used with CCNA hands-on labs are Cisco 4221 with Cisco IOS XE Release 16.9.4 (universalk9 image). The switches used in the labs are Cisco Catalyst 2960s with Cisco IOS Release 15.2(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 the output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of the lab for the correct interface identifiers.

**Note:** Ensure 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 4221 with Cisco IOS XE Release 16.9.4 universal image or comparable)
- 2 Switches (Cisco 2960 with Cisco IOS Release 15.2(2) lanbasek9 image or comparable) - **Optional**
- 2 PCs (Windows with a terminal emulation program, such as Tera Term)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet cables as shown in the topology

### Instructions

#### 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 switches.

##### Step 1: Cable the network as shown in the topology.

Attach the devices as shown in the topology diagram, and cable as necessary.

##### Step 2: Configure basic settings for each switch. (Optional)

- Assign a device name to the switch.
- Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.
- Assign **class** as the privileged EXEC encrypted password.
- Assign **cisco** as the console password and enable login.
- Assign **cisco** as the VTY password and enable login.
- Encrypt the plaintext passwords.
- Create a banner that warns anyone accessing the device that unauthorized access is prohibited.
- Shutdown all unused ports
- Save the running configuration to the startup configuration file.

### Step 3: Configure basic settings for each router.

- Assign a device name to the router.
- Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.
- Assign **class** as the privileged EXEC encrypted password.
- Assign **cisco** as the console password and enable login.
- Assign **cisco** as the VTY password and enable login.
- Encrypt the plaintext passwords.
- Create a banner that warns anyone accessing the device that unauthorized access is prohibited.
- Enable IPv6 Routing
- Save the running configuration to the startup configuration file.

### Step 4: Configure interfaces and routing for both routers.

- Configure the G0/0/0 and G0/0/1 interfaces on R1 and R2 with the IPv6 addresses specified in the table above.
- Configure a default route on each router pointed to the IP address of G0/0/0 on the other router.
- Verify routing is working by pinging R2's G0/0/1 address from R1
- Save the running configuration to the startup configuration file.

## Part 2: Verify SLAAC Address Assignment from R1

In Part 2, you will verify that Host PC-A receives an IPv6 address using the SLAAC method.

Power PC-A up and ensure that the NIC is configured for IPv6 automatic configuration.

After a few moments, the results of the command **ipconfig** should show that PC-A has assigned itself an address from the 2001:db8:1::/64 network.

```
C:\Users\Student> ipconfig
Windows IP Configuration

Ethernet adapter Ethernet 2:

    Connection-specific DNS Suffix  . : 
    IPv6 Address. . . . . : 2001:db8:acad:1:5c43:ee7c:2959:da68
    Temporary IPv6 Address. . . . . : 2001:db8:acad:1:3c64:e4f9:46e1:1f23
    Link-local IPv6 Address . . . . . : fe80::5c43:ee7c:2959:da68%6
    IPv4 Address. . . . . : 169.254.218.104
    Subnet Mask . . . . . : 255.255.0.0
    Default Gateway . . . . . : fe80::1%6
```

Where did the host-id portion of the address come from?

**Host generates a random 64-bit address**

## Part 3: Configure and Verify a DHCPv6 server on R1

In Part 3, you will configure and verify a stateless DHCP server on R1. The objective is to provide PC-A with DNS server and Domain information.

### Step 1: Examine the configuration of PC-A in more detail.

- Issue the command **ipconfig /all** on PC-A and take a look at the output.

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

```
Windows IP Configuration
```

```
Host Name . . . . . : DESKTOP-3FR7RKA
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
```

```
Ethernet adapter Ethernet0:
```

```
Connection-specific DNS Suffix . :
Description . . . . . : Intel(R) 852574L Gigabit Network Connection
Physical Address. . . . . : 00-50-56-83-63-6D
IPv6 Address. . . . . : 2001:db8:acad:1:5c43:ee7c:2959:da68 (Preferred)
Temporary IPv6 Address. . . . . : 2001:db8:acad:1:3c64:e4f9:46e1:1f23 (Preferred)
Link-local IPv6 Address . . . . . : fe80::5c43:ee7c:2959:da68%6 (Preferred)
IPv4 Address. . . . . : 169.254.218.104 (Preferred)
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : fe80::1%6
DHCPv6 IAID . . . . . : 50334761
DHCPv6 Client DUID. . . . . : 00-01-00-01-24-F5-CE-A2-00-50-56-B3-63-6D
DNS Servers . . . . . : fec0:0:0:ffff::1%1
                        fec0:0:0:ffff::2%1
                        fec0:0:0:ffff::3%1
NetBIOS over Tcpip. . . . . : Enabled
```

- Notice that there is no Primary DNS suffix. Also note that the DNS server addresses provided are “site local anycast” addresses, and not unicast addresses, as would be expected.

### Step 2: Configure R1 to provide stateless DHCPv6 for PC-A.

- Create an IPv6 DHCP pool on R1 named R1-STATELESS. As a part of that pool, assign the DNS server address as 2001:db8:acad::1 and the domain name as stateless.com.

```
R1(config)# ipv6 dhcp pool R1-STATELESS
```

```
R1(config-dhcp)# dns-server 2001:db8:acad::254
```

```
R1(config-dhcp)# domain-name STATELESS.com
```

- Configure the G0/0/1 interface on R1 to provide the OTHER config flag to the R1 LAN, and specify the DHCP pool you just created as the DHCP resource for this interface.

```
R1(config)# interface g0/0/1
```

```
R1(config-if)# ipv6 nd other-config-flag
```

```
R1(config-if)# ipv6 dhcp server R1-STATELESS
```

- c. Save the running configuration to the startup configuration file.
- d. Restart PC-A.
- e. Examine the output of **ipconfig /all** and notice the changes.

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

```
Windows IP Configuration
```

```
Host Name . . . . . : DESKTOP-3FR7RKA
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : STATELESS.com
```

```
Ethernet adapter Ethernet0:
```

```
Connection-specific DNS Suffix . : STATELESS.com
Description . . . . . : Intel(R) 82574L Gigabit Network Connection
Physical Address. . . . . : 00-50-56-83-63-6D
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IPv6 Address. . . . . : 2001:db8:acad:1:5c43:ee7c:2959:da68(Preferred)
Temporary IPv6 Address. . . . . : 2001:db8:acad:1:3c64:e4f9:46e1:1f23(Preferred)
Link-local IPv6 Address . . . . . : fe80::5c43:ee7c:2959:da68%6(Preferred)
IPv4 Address. . . . . : 169.254.218.104(Preferred)
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : fe80::1%6
DHCPv6 IAID . . . . . : 50334761
DHCPv6 Client DUID. . . . . : 00-01-00-01-24-F5-CE-A2-00-50-56-B3-63-6D
DNS Servers . . . . . : 2001:db8:acad::254
NetBIOS over Tcpip. . . . . : Enabled
Connection-specific DNS Suffix Search List :
                                     STATELESS.com
```

- f. Test connectivity by pinging R2's G0/0/1 interface IP address.

## Part 4: Configure a stateful DHCPv6 server on R1

In Part 4, you will configure R1 to respond to DHCPv6 requests from the LAN on R2.

- a. Create a DHCPv6 pool on R1 for the 2001:db8:acad:3:aaa::/80 network. This will provide addresses to the LAN connected to interface G0/0/1 on R2. As a part of the pool, set the DNS server to 2001:db8:acad::254, and set the domain name to STATEFUL.com.

```
R1(config)# ipv6 dhcp pool R2-STATEFUL
R1(config-dhcp)# address prefix 2001:db8:acad:3:aaa::/80
R1(config-dhcp)# dns-server 2001:db8:acad::254
R1(config-dhcp)# domain-name STATEFUL.com
```

- b. Assign the DHCPv6 pool you just created to interface g0/0/0 on R1.

```
R1(config)# interface g0/0/0
R1(config-if)# ipv6 dhcp server R2-STATEFUL
```

## Part 5: Configure and verify DHCPv6 relay on R2.

In Part 5, you will configure and verify DHCPv6 relay on R2, allowing PC-B to receive an IPv6 Address.

### Step 1: Power on PC-B and examine the SLAAC address that it generates.

```
C:\Users\Student> ipconfig /all
Windows IP Configuration
```

```
Host Name . . . . . : DESKTOP-3FR7RKA
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
```

```
Ethernet adapter Ethernet0:
```

```
Connection-specific DNS Suffix . :
Description . . . . . : Intel(R) 82574L Gigabit Network Connection
Physical Address. . . . . : 00-50-56-B3-7B-06
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IPv6 Address. . . . . : 2001:db8:acad:3:a0f3:3d39:f9fb:a020(Preferred)
Temporary IPv6 Address. . . . . : 2001:db8:acad:3:d4f3:7b16:eeee:b2b5(Preferred)
Link-local IPv6 Address . . . . . : fe80::a0f3:3d39:f9fb:a020%6(Preferred)
IPv4 Address. . . . . : 169.254.160.32(Preferred)
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : fe80::1%6
DHCPv6 IAID . . . . . : 50334761
DHCPv6 Client DUID. . . . . : 00-01-00-01-24-F2-08-38-00-50-56-B3-7B-06
DNS Servers . . . . . : fec0:0:0:ffff::1%1
                       : fec0:0:0:ffff::2%1
                       : fec0:0:0:ffff::3%1
NetBIOS over Tcpip. . . . . : Enabled
```

Notice in the output that the prefix used is 2001:db8:acad:3::

### Step 2: Configure R2 as a DHCP relay agent for the LAN on G0/0/1.

- Configure the **ipv6 dhcp relay** command on R2 interface G0/0/1, specifying the destination address of the G0/0/0 interface on R1. Also configure the **managed-config-flag** command.

```
R2(config)# interface g0/0/1
R2(config-if)# ipv6 nd managed-config-flag
R2(config-if)# ipv6 dhcp relay destination 2001:db8:acad:2::1 g0/0/0
```

- Save your configuration.

### Step 3: Attempt to acquire an IPv6 address from DHCPv6 on PC-B.

- Restart PC-B.

- b. Open a command prompt on PC-B and issue the command **ipconfig /all** and examine the output to see the results of the DHCPv6 relay operation.

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

```
Windows IP Configuration
```

```
Host Name . . . . . : DESKTOP-3FR7RKA
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : STATEFUL.com
```

```
Ethernet adapter Ethernet0:
```

```
Connection-specific DNS Suffix . : STATEFUL.com
Description . . . . . : Intel(R) 852574L Gigabit Network Connection
Physical Address. . . . . : 00-50-56-B3-7B-06
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IPv6 Address. . . . . : 2001:db8:acad3:aaaa:7104:8b7d:5402(Preferred)
Lease Obtained. . . . . : Sunday, October 6, 2019 3:27:13 PM
Lease Expires . . . . . : Tuesday, October 8, 2019 3:27:13 PM
Link-local IPv6 Address . . . . . : fe80::a0f3:3d39:f9fb:a020%6(Preferred)
IPv4 Address. . . . . : 169.254.160.32(Preferred)
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : fe80::2%6
DHCPv6 IAID . . . . . : 50334761
DHCPv6 Client DUID. . . . . : 00-01-00-01-24-F2-08-38-00-50-56-B3-7B-06
DNS Servers . . . . . : 2001:db8:acad::254
NetBIOS over Tcpip. . . . . : Enabled
Connection-specific DNS Suffix Search List :
                                           STATEFUL.com
```

- c. Test connectivity by pinging R1's G0/0/1 interface IP address.