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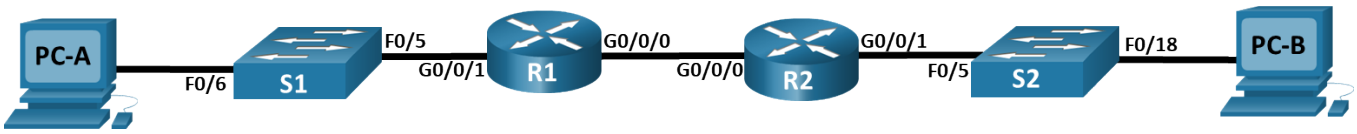
Lab 6.2 - Configure DHCPv6

Topology



Addressing Table

Device	Interface	IPv6 Address
R1	G0/0 or G0/0/0 This depends on your router model	2001:db8:acad:2::1 /64
		fe80::1
	G0/1 or G0/0/1 This depends on your router model	2001:db8:acad:1::1/64
		fe80::1
R2	G0/0 or G0/0/0 This depends on your router model	2001:db8:acad:2::2/64
		fe80::2
	G0/1 or G0/0/1 This depends on your router model	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 R2

Background / Scenario

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

- Stateless Address Auoconfiguration (SLACC)
- Stateless Dynamic Host Configuration Protocol for IPv6 (DHCPv6)

- Stateful DHCPv6

When using SLACC to assign IPv6 addresses to hosts a DHCPv6 server is not used. Because a DHCPv6 server is not used when implementing SLACC, 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 routers to assign IPv6 settings to two different subnets.

Required Resources

- 2 Routers (Cisco 1941 or comparable)
- 2 Switches- **Optional** (Cisco 2960 or comparable)
- 2 PCs
- 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)

a. Assign a device name to the switch.

b. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.

c. Assign **class** as the privileged EXEC encrypted password.

d. Assign **cisco** as the console password and enable login.

e. Assign **cisco** as the VTY password and enable login.

f. Encrypt the plaintext passwords.

g. Create a banner that warns anyone accessing the device that unauthorized access is prohibited.

h. Shutdown all unused ports

i. Save the running configuration to the startup configuration file.

Step 3: Configure basic settings for each router.

a. Assign a device name to the router.

b. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.

c. Assign **class** as the privileged EXEC encrypted password.

d. Assign **cisco** as the console password and enable login.

e. Assign **cisco** as the VTY password and enable login.

f. Encrypt the plaintext passwords.

g. Create a banner that warns anyone accessing the device that unauthorized access is prohibited.

h. Enable IPv6 Routing. Here is a sample for R1. Do the same step for R2 as well

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

Step 4: Configure interfaces and routing for both routers.

a. Configure the router interfaces with the IPv6 addresses specified in the table above. Here is a sample for the configuration of R1 G0/1. Perform similar configurations for R1 G0/0 and R2 interfaces

```
R1(config)# interface g0/1
R1(config-if)# ipv6 address fe80::1 link-local
R1(config-if)# ipv6 address 2001:db8:acad:1::1/64
R1(config-if)# no shutdown
```

b. Configure a default route on each router pointed to the IP address of G0/0/0 on the other router. Use the following commands to do so. Note that these are just to allow packet forwarding between the routers but are not yet part of the content of this course. You may copy and paste these into your router CLIs:

```
R1(config)# ipv6 route ::/0 2001:db8:acad:2::2

R2(config)# ipv6 route ::/0 2001:db8:acad:2::1
```

c. Verify routing is working by pinging R2's G0/0/1 address from R1

d. 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.

Step 1: Verify that R1 is part of the all-router multicast group.

Use the **show ipv6 interface g0/1** command on R1 to verify that G0//1 is part of the All-router multicast group (FF02::2). RA messages are not sent out G0/1 without that group assignment. At the same time, the output also indicates that SLAAC will be sed for host addressing on the network connected to this interface.

```
R1# show ipv6 interface g0/1
GigabitEthernet0/1 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):
    2001:DB8:ACAD:A::1, subnet is 2001:DB8:ACAD:A::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF00:1
  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 (using 30000)
ND advertised reachable time is 0 (unspecified)
ND advertised retransmit interval is 0 (unspecified)
ND router advertisements are sent every 200 seconds
ND router advertisements live for 1800 seconds
ND advertised default router preference is Medium
Hosts use stateless autoconfig for addresses.
```

Step 2: Acquire and verify IPv6 address settings on PC-A

a. Set the IP configuration of PC-A to use automatic IPv6 configuration

b. From the command prompt of PC-A , issue the command **ipconfig.** The output should should show that PC-A has assigned itself an address from the 2001:db8:acad:1::/64 network.

```
C:\>ipconfig

FastEthernet0 Connection:(default port)

Connection-specific DNS Suffix..:
Link-local IPv6 Address.........: FE80::20A:F3FF:FED7:D1D7
IPv6 Address....................: 2001:DB8:ACAD:1:20A:F3FF:FED7:D1D7
IPv4 Address....................: 0.0.0.0
Subnet Mask.....................: 0.0.0.0
Default Gateway.................: FE80::1
                                  0.0.0.0
```

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

This is randomly generated by the host.

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.

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

```
C:\>ipconfig /all

FastEthernet0 Connection:(default port)

Connection-specific DNS Suffix..:
Physical Address................: 000A.F3D7.D1D7
Link-local IPv6 Address.........: FE80::20A:F3FF:FED7:D1D7
IPv6 Address....................: 2001:DB8:ACAD:1:20A:F3FF:FED7:D1D7
IPv4 Address....................: 0.0.0.0
```

```
Subnet Mask.....................: 0.0.0.0
Default Gateway.................: FE80::1
                                  0.0.0.0
DHCP Servers....................: 0.0.0.0
DHCPv6 IAID.....................:
DHCPv6 Client DUID..............: 00-01-00-01-BE-54-B0-9C-00-0A-F3-D7-D1-D7
DNS Servers.....................: ::
```

Notice that there is no Connection-specific DNS suffix. Also note that the DNS server addresses provided are blank, and not unicast addresses, as would be expected.

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

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
```

b. Configure the G0/1 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 g0/1
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.

Step 3: Verify DHCPv6 settings on interface G0/0/1 on R1.

Use the **show ipv6 interface g0/1** command to verify that the interface is now part of the IPv6 multicast all-DHCPv6-servers group (FF02::1:2). The last line of the output from this **show** command verifies that the other-config-flag has been set.

```
R1# show ipv6 interface g0/1
GigabitEthernet0/1 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):
    2001:DB8:ACAD:1::1, subnet is 2001:DB8:ACAD:1::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:2
    FF02::1:FF00:1
    FF05::1:3
  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 30000)
  ND advertised reachable time is 0 (unspecified)
```

```
ND advertised retransmit interval is 0 (unspecified)
ND router advertisements are sent every 200 seconds
ND router advertisements live for 1800 seconds
ND advertised default router preference is Medium
Hosts use stateless autoconfig for addresses.
Hosts use DHCP to obtain other configuration.
```

Step 4: Examine PC-A address settings

a. Reacquire IPv6 automatic address settings on PC-A by temporarily setting it to static then placing ti ack to automatic.

b. Examine the output of **ipconfig /all** and notice the changes.

What DNS suffix and DNS server settings were assigned to the PC?

DNS Server Settings: fec0:0:0:ffff::1%1, : fec0:0:0:ffff::2%1, : fec0:0:0:ffff::3%1

c. Test connectivity by pinging R2's G0/1 interface IP address.

Part 4: Configure a stateful DHCPv6 server on R2

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

Step 1: Configure R2 to provide stateful DHCPv6 for PC-B

a. Create a DHCPv6 pool on R2 for the 2001:db8:acad:3:aaaa::/80 network. This will provide addresses to the LAN connected to interface G0/1 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.

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

b. Configure the G0/0/1 interface on R2 to provide the MANAGED config flag to the R2 LAN, and specify the DHCP pool you just created as the DHCP resource for this interface.

```
R2(config)# interface g0/1
R2(config-if)# ipv6 nd managed-config-flag
R2(config-if)# ipv6 dhcp server R2-STATEFUL
```

Step 2: Verify Stateful DHCPv6 settings on R2.

a. Issue the **show ipv6 interface g0/1** command to verify that the interface is in Stateful DHCPv6 mode.

```
R2# show ipv6 interface g0/1
GigabitEthernet0/0/1 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):
    2001:DB8:ACAD:3::1, subnet is 2001:DB8:ACAD:3::/64
```

```
Joined group address(es):
  FF02::1
  FF02::2
  FF02::1:2
  FF02::1:FF00:1
  FF05::1:3
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 30000)
ND advertised reachable time is 0 (unspecified)
ND advertised retransmit interval is 0 (unspecified)
ND router advertisements are sent every 200 seconds
ND router advertisements live for 1800 seconds
ND advertised default router preference is Medium
Hosts use DHCP to obtain routable addresses.
```

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

a. Set PC-B to acquire an IPv6 address automatically.

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:\>ipconfig /all

FastEthernet0 Connection:(default port)

Connection-specific DNS Suffix..: STATEFUL.com
Physical Address................: 0001.9752.82AC
Link-local IPv6 Address.........: FE80::201:97FF:FE52:82AC
IPv6 Address....................: 2001:DB8:ACAD:3:AAA:26BA:B85:EF61
IPv4 Address....................: 0.0.0.0
Subnet Mask.....................: 0.0.0.0
Default Gateway.................: FE80::1
                                  0.0.0.0
DHCP Servers....................: 0.0.0.0
DHCPv6 IAID.....................: 1782665615
DHCPv6 Client DUID..............: 00-01-00-01-BE-54-B0-9C-00-0A-F3-D7-D1-D7
DNS Servers.....................: 2001:DB8:ACAD::254
```

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

Reflection

Among the three automatic IPv6 addressing methods - SLAAC, stateless DHCPv6 and stateful DHCPv6, which do you think uses more memory resources on the router? Why?

Our group thinks that among the three methods, stateful DHCPv6 uses more memory because this requires the router to maintain a stateful lease table, which stores IP address assignments and associated client information, which consumes more memory.