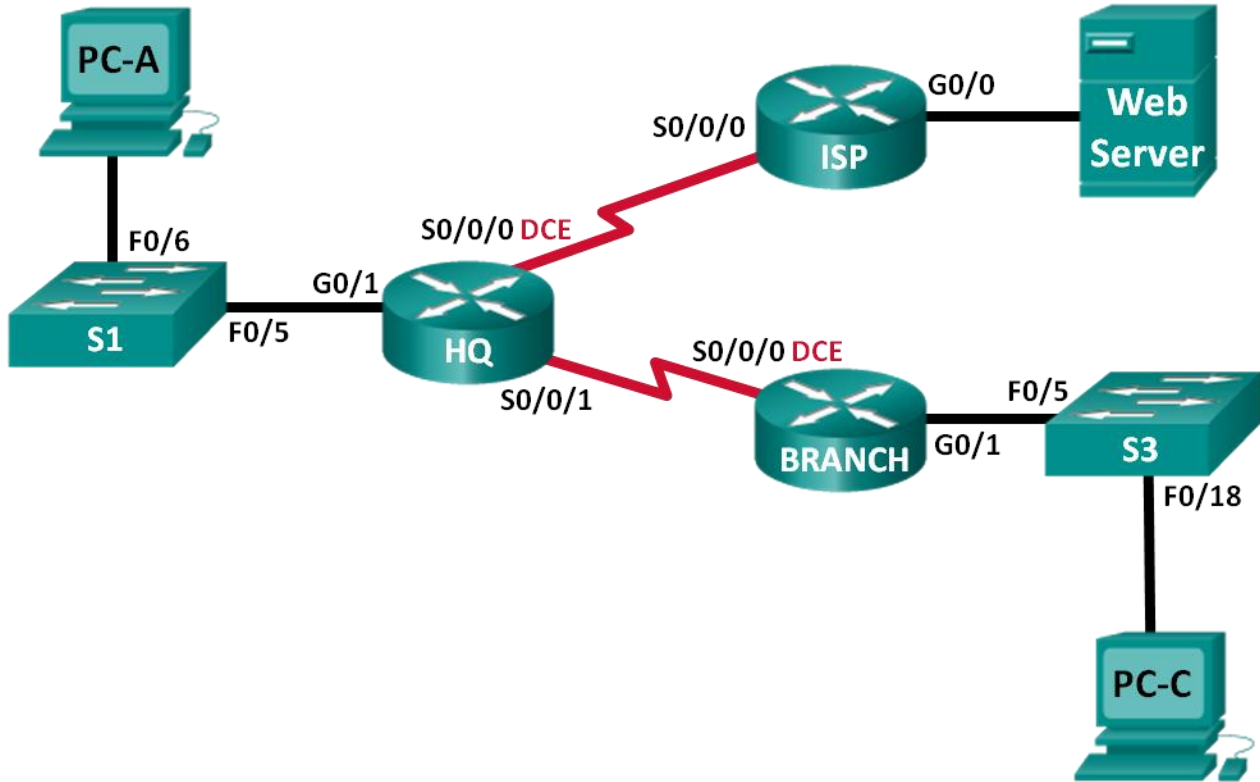


# Lab – Troubleshooting IPv4 and IPv6 Static Routes

## Topology



## Addressing Table

Device	Interface	IP Address	Default Gateway
HQ	G0/1	192.168.0.1/25 2001:DB8:ACAD::1/64 FE80::1 link-local	N/A
	S0/0/0 (DCE)	10.1.1.2/30 2001:DB8:ACAD::20:2/64	N/A
	S0/0/1	192.168.0.253/30 2001:DB8:ACAD:2::1/30	N/A
ISP	G0/0	172.16.3.1/24 2001:DB8:ACAD:30::1/64 FE80::1 link-local	N/A
	S0/0/0	10.1.1.1/30 2001:DB8:ACAD:20::/64	N/A
BRANCH	G0/1	192.168.1.1/24 2001:DB8:ACAD:1::1/64 FE80::1 link-local	N/A
	S0/0/0 (DCE)	192.168.0.254/30 2001:DB8:ACAD:2::2/64	N/A
S1	VLAN 1	N/A	N/A
S3	VLAN 1	N/A	N/A
PC-A	NIC	192.168.0.3/25 2001:DB8:ACAD::3/64	192.168.0.1 FE80::1
Web Server	NIC	172.16.3.3/24 2001:DB8:ACAD:30::3/64	172.16.3.1 FE80::1
PC-C	NIC	192.168.1.3/24 2001:DB8:ACAD:1::3/64	192.168.1.1 FE80::1

## Objectives

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

**Part 2: Troubleshoot Static Routes in an IPv4 Network**

**Part 3: Troubleshoot Static Routes in an IPv6 Network**

## Background / Scenario

As a network administrator, you must be able to configure routing of traffic using static routes. Understanding how to configure and troubleshoot static routing is a requirement. Static routes are commonly used for stub networks and default routes. Your company's ISP has hired you to troubleshoot connectivity issues on the network. You will have access to the HQ, BRANCH, and the ISP routers.

In this lab, you will begin by loading configuration scripts on each of the routers. These scripts contain errors that will prevent end-to-end communication across the network. You will need to troubleshoot each router to determine the configuration errors, and then use the appropriate commands to correct the configurations. When you have corrected all of the configuration errors, the hosts on the network should be able to communicate with each other.

**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

- 3 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)
- 3 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 set up the network topology and configure the routers and switches with some basic settings, such as passwords and IP addresses. Preset configurations are also provided for you for the initial router configurations. You will also configure the IP settings for the PCs in the topology.

#### 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: Initialize and reload the routers and switches.

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

- a. Disable DNS lookup.
- b. Configure device name as shown in the topology.
- c. Assign **class** as the privileged EXEC mode password.
- d. Assign **cisco** as the console and vty passwords.
- e. Configure **logging synchronous** to prevent console messages from interrupting command entry.

#### Step 4: Configure hosts and Web Server.

- a. Configure IP addresses for IPv4 and IPv6.
- b. Configure IPv4 default gateway.

### Step 5: Load router configurations.

#### Router HQ

```
hostname HQ
ipv6 unicast-routing
interface GigabitEthernet0/1
  ipv6 address 2001:DB8:ACAD::1/64
  ip address 192.168.0.1 255.255.255.128
  ipv6 address FE80::1 link-local
interface Serial0/0/0
  ipv6 address 2001:DB8:ACAD:20::2/64
  ip address 10.1.1.2 255.255.255.252
  clock rate 800000
  no shutdown
interface Serial0/0/1
  ipv6 address 2001:DB8:ACAD:2::3/64
  ip address 192.168.0.253 255.255.255.252
  no shutdown
ip route 172.16.3.0 255.255.255.0 10.1.1.1
ip route 192.168.1.0 255.255.255.0 192.16.0.254
ipv6 route 2001:DB8:ACAD:1::/64 2001:DB8:ACAD:2::2
ipv6 route 2001:DB8:ACAD:30::/64 2001:DB8:ACAD::20:1
```

#### Router ISP

```
hostname ISP
ipv6 unicast-routing
interface GigabitEthernet0/0
  ipv6 address 2001:DB8:ACAD:30::1/64
  ip address 172.16.3.11 255.255.255.0
  ipv6 address FE80::1 link-local
  no shutdown
interface Serial0/0/0
  ipv6 address 2001:DB8::ACAD:20:1/64
  ip address 10.1.1.1 255.255.255.252
  no shutdown
ip route 192.168.1.0 255.255.255.0 10.1.1.2
ipv6 route 2001:DB8:ACAD::/62 2001:DB8:ACAD:20::2
```

#### Router BRANCH

```
hostname BRANCH
ipv6 unicast-routing
interface GigabitEthernet0/1
  ipv6 address 2001:DB8:ACAD:1::1/64
  ip address 192.168.1.1 255.255.255.0
  ipv6 address FE80::1 link-local
  no shutdown
```

```
interface Serial0/0/0
  ipv6 address 2001:DB8:ACAD:2::2/64
  clock rate 128000
  ip address 192.168.0.249 255.255.255.252
  clock rate 128000
  no shutdown
  ip route 0.0.0.0 0.0.0.0 10.1.1.2
  ipv6 route ::/0 2001:DB8:ACAD::1
```

## Part 2: Troubleshoot Static Routes in an IPv4 Network

### IPv4 Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
HQ	G0/1	192.168.0.1	255.255.255.0	N/A
	S0/0/0 (DCE)	10.1.1.2	255.255.255.252	N/A
	S0/0/1	192.168.0.253	255.255.255.252	N/A
ISP	G0/0	172.16.3.1	255.255.255.0	N/A
	S0/0/0	10.1.1.1	255.255.255.252	N/A
BRANCH	G0/1	192.168.1.1	255.255.255.0	N/A
	S0/0/0 (DCE)	192.168.0.254	255.255.255.252	N/A
S1	VLAN 1	192.168.0.11	255.255.255.128	192.168.0.1
S3	VLAN 1	192.168.1.11	255.255.255.0	192.168.1.1
PC-A	NIC	192.168.0.3	255.255.255.128	192.168.0.1
Web Server	NIC	172.16.3.3	255.255.255.0	172.16.3.1
PC-C	NIC	192.168.1.3	255.255.255.0	192.168.1.1

### Step 1: Troubleshoot the HQ router.

The HQ router is the link between the ISP router and the BRANCH router. The ISP router represents the outside network while the BRANCH router represents the corporate network. The HQ router is configured with static routes to ISP and BRANCH networks.

- Display the status of the interfaces on HQ. Enter **show ip interface brief**. Record and resolve any issues as necessary.
- Ping from HQ router to BRANCH router (192.168.0.254). Were the pings successful?
- Ping from HQ router to ISP router (10.1.1.1). Were the pings successful?
- Ping from PC-A to the default gateway. Were the pings successful?
- Ping from PC-A to PC-C. Were the pings successful?
- Ping from PC-A to Web Server. Were the pings successful?

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- g. Display the routing table on HQ. What non-directly connected routes are shown in the routing table?
- h. Based on the results of the pings, routing table output, and static routes in the running configuration, what can you conclude about network connectivity?
- i. What commands (if any) need to be entered to resolve routing issues? Record the command(s).
- j. Repeat any of the steps from b to f to verify whether the problems have been resolved. Record your observations and possible next steps in troubleshooting connectivity.

### Step 2: Troubleshoot the ISP router.

For the ISP router, there should be a route to HQ and BRANCH routers. One static route is configured on ISP router to reach the 192.168.1.0/24, 192.168.0.0/25, and 192.168.0.252/30 networks.

- a. Display the status of interfaces on ISP. Enter **show ip interface brief**. Record and resolve any issues as necessary.
- b. Ping from the ISP router to the HQ router (10.1.1.2). Were the pings successful?
- c. Ping from Web Server to the default gateway. Were the pings successful?
- d. Ping from Web Server to PC-A. Were the pings successful?
- e. Ping from Web Server to PC-C. Were the pings successful?
- f. Display the routing table on ISP. What non-directly connected routes are shown in the routing table?
- g. Based on the results of the pings, routing table output, and static routes in the running configuration, what can you conclude about network connectivity?
- h. What commands (if any) need to be entered to resolve routing issues? Record the command(s).  
(Hint: ISP only requires one summarized route to the company's networks 192.168.1.0/24, 192.168.0.0/25, and 192.168.0.252/32.)

- i. Repeat any of the steps from b to e to verify whether the problems have been resolved. Record your observations and possible next steps in troubleshooting connectivity.

### Step 3: Troubleshoot the BRANCH router.

For the BRANCH router, a default route is set to reach the rest of the network and ISP.

- a. Display the status of the interfaces on BRANCH. Enter **show ip interface brief**. Record and resolve any issues, as necessary.
  
- b. Ping from the BRANCH router to the HQ router (192.168.0.253). Were the pings successful?
- c. Ping from PC-C to the default gateway. Were the pings successful?
- d. Ping from PC-C to PC-A. Were the pings successful?
- e. Ping from PC-C to Web Server. Were the pings successful?
- f. Display the routing table on BRANCH. What non-directly connected routes are shown in the routing table?
  
- g. Based on the results of the pings, routing table output, and static routes in the running configuration, what can you conclude about network connectivity?
  
- h. What commands (if any) need to be entered to resolve routing issues? Record the command(s).
  
- i. Repeat any of the steps from b to e to verify whether the problems have been resolved. Record your observations and possible next steps in troubleshooting connectivity.

### Part 3: Troubleshoot Static Routes in an IPv6 Network

Device	Interface	IPv6 Address	Prefix Length	Default Gateway
HQ	G0/1	2001:DB8:ACAD::1	64	N/A
	S0/0/0 (DCE)	2001:DB8:ACAD::20:2	64	N/A
	S0/0/1	2001:DB8:ACAD:2::1	64	N/A
ISP	G0/0	2001:DB8:ACAD:30::1	64	N/A
	S0/0/0	2001:DB8:ACAD:20::1	64	N/A
BRANCH	G0/1	2001:DB8:ACAD:1::1	64	N/A
	S0/0/0 (DCE)	2001:DB8:ACAD:2::2	64	N/A
PC-A	NIC	2001:DB8:ACAD::3	64	FE80::1
Web Server	NIC	2001:DB8:ACAD:30::3	64	FE80::1
PC-C	NIC	2001:DB8:ACAD:1::3	64	FE80::1

#### Step 1: Troubleshoot the HQ router.

The HQ router is the link between the ISP router and the BRANCH router. The ISP router represents the outside network while the BRANCH router represents the corporate network. The HQ router is configured with static routes to both the ISP and the BRANCH networks.

- a. Display the status of the interfaces on HQ. Enter **show ipv6 interface brief**. Record and resolve any issues, as necessary.
  
- b. Ping from the HQ router to the BRANCH router (2001:DB8:ACAD:2::2). Were the pings successful?
- c. Ping from the HQ router to the ISP router (2001:DB8:ACAD:20::1). Were the pings successful?
- d. Ping from PC-A to the default gateway. Were the pings successful?
- e. Ping from PC-A to Web Server. Were the pings successful?
- f. Ping from PC-A to PC-C. Were the pings successful?
- g. Display the routing table by issuing a **show ipv6 route** command. What non-directly connected routes are shown in the routing table?
  
- h. Based on the results of the pings, routing table output, and static routes in the running configuration, what can you conclude about network connectivity?
  
- i. What commands (if any) need to be entered to resolve routing issues? Record the command(s).



- j. Repeat any of the steps from b to f to verify whether the problems have been resolved. Record your observations and possible next steps in troubleshooting connectivity.

### Step 2: Troubleshoot the ISP router.

On the ISP router, one static route is configured to reach all the networks on HQ and BRANCH routers.

- a. Display the status of the interfaces on ISP. Enter **show ipv6 interface brief**. Record and resolve any issues, as necessary.
  
- b. Ping from the ISP router to the HQ router (2001:DB8:ACAD:20::2). Were the pings successful?
- c. Ping from Web Server to the default gateway. Were the pings successful?
- d. Ping from Web Server to PC-A. Were the pings successful?
- e. Ping from Web Server to PC-C. Were the pings successful?
- f. Display the routing table. What non-directly connected routes are shown in the routing table?
  
- g. Based on the results of the pings, routing table output, and static routes in the running configuration, what can you conclude about network connectivity?
  
- h. What commands (if any) need to be entered to resolve routing issues? Record the command(s).
  
- i. Repeat any of the steps from b to e to verify whether the problems have been resolved. Record your observations and possible next steps in troubleshooting connectivity.

### Step 3: Troubleshoot the BRANCH router.

For the BRANCH routers, there is a default route to the HQ router. This default route allows the BRANCH network to the ISP router and Web Server.

- a. Display the status of the interfaces on BRANCH. Enter **show ipv6 interface brief**. Record and resolve any issues, as necessary.
  
- b. Ping from the BRANCH router to the HQ router (2001:DB8:ACAD:2::1). Were the pings successful?
  
- c. Ping from the BRANCH router to the ISP router (2001:DB8:ACAD:20::1). Were the pings successful?

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- d. Ping from PC-C to the default gateway. Were the pings successful?
  - e. Ping from PC-C to PC-A. Were the pings successful?
  - f. Ping from PC-C to Web Server. Were the pings successful?
  - g. Display the routing table. What non-directly connected routes are shown in the routing table?
- h. Based on the results of the pings, routing table output, and static routes in the running configuration, what can you conclude about network connectivity?
- i. What commands (if any) need to be entered to resolve routing issues? Record the command(s).
- j. Repeat any of the steps from b to f to verify whether the problems have been resolved. Record your observations and possible next steps in troubleshooting connectivity.

### 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)

**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. 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.