Alan Palayil
ECE 407

ECE 407

Introduction to Computer Networks Laboratory

Practice 6 – Configuring and Troubleshooting Static Routing

Objectives

The goal of this experiment is to:

1. Familiarize students with routing, and router's directly connected networks.
2. Familiarize students with configuring and troubleshooting IP static routing.

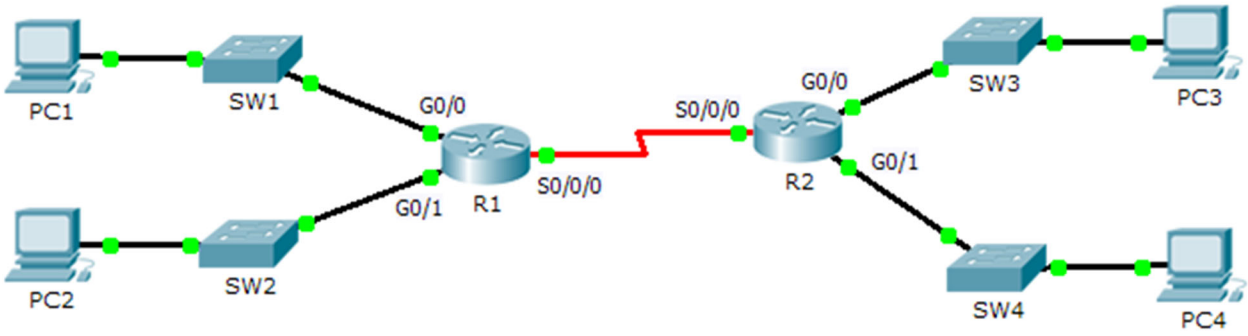
Background

A router uses a routing table to determine where to send packets. The routing table contains a set of routes that describe which gateway or interface the router uses to reach a specified network. Initially, the routing table contains only directly connected networks. To communicate with distant networks, routes must be specified and added to the routing table.

Routes in a routing cable can be classified into three categories, based on the way the router has learned these routes. First, direct routes are those routes to directly connected networks. A router can learn the existence of directly connected networks on its own, from its interfaces which usually act as gateways to those directly connected networks. Those routes are labeled with (c) in Cisco IOS's routing table. Second, static and default routes are manually configured routes by network administrators. Static routes specify remote networks based on a next-hop IP address or exit interface. Static routes are commonly used for stub networks and default routes. A default route is a type of static route that specifies a gateway to use when the routing table does not contain a path for the destination network. Static routes are labeled with (s) in Cisco IOS's routing table. Third, dynamic routes are learned based on algorithms which involve routers exchanging messages with each other. Dynamic routing algorithms and routes will be explored in future experiments.

Exercise 1: Investigating IPv4 Directly Connected Routes (1.3.2.5)

Topology



The network in this exercise is already configured. Please open file "1.3.2.5.pka".

Note: The user EXEC password is **cisco** and the privileged exec password is **class.**

Step 1: Use show commands to gather information about the IPv4 directly connected networks.

Enter the following command on **R1**:

R1> **show ip route ?**

a. What option would be most beneficial in determining the networks assigned to the interfaces of the router?

connected

b. Which networks are directly connected on **R1**? Hint: Use the option determined above.

- C 172.31.20.0/23 through GigabitEthernet0/0
- C 172.31.22.0/23 through GigabitEthernet0/1
- C 209.165.200.224/30 through Serial0/0/0

c. Which IP addresses are assigned to the LAN interfaces on **R1**?

- Interface IP-Address Method Status Protocol
- GigabitEthernet0/0 172.31.21.254 manual up up
- GigabitEthernet0/1 172.31.23.254 manual up up

d. Which networks are directly connected on **R2**?

- C 172.31.24.0/24 is directly connected, GigabitEthernet0/0
- C 172.31.25.0/24 is directly connected, GigabitEthernet0/1
- C 209.165.200.224/30 is directly connected, Serial0/0/0

e. Which IP addresses are assigned to the LAN interfaces on **R2**?

- Interface IP-Address OK? Method Status Protocol
- GigabitEthernet0/0 172.31.24.254 YES manual up up
- GigabitEthernet0/1 172.31.25.254 YES manual up up

Step 2: Verify PC addressing and test connectivity.

a. Open a command prompt on **PC1**. Issue the command to display the IP settings. Based on the output, would you expect **PC1** to be able to communicate with all interfaces on the router? Provide a short answer describing your expectations.

Yes you would as the correct gateway is there and all of the connected networks exist.

b. Open a command prompt on **PC2**. Issue the command to display the IP settings. Based on the output, would you expect **PC2** to be able to communicate with **PC1**? Verify your expectations.

Yes it will.

c. Determine the IP addresses of **PC3** and **PC4**. Record the results and determine if **PC3** and **PC4** are able to communicate.

PC3 has IP address 172.31.24.10 and PC4 has IP address 172.31.25.10

d. Test connectivity from **PC1** to **PC3**. Was the test successful?

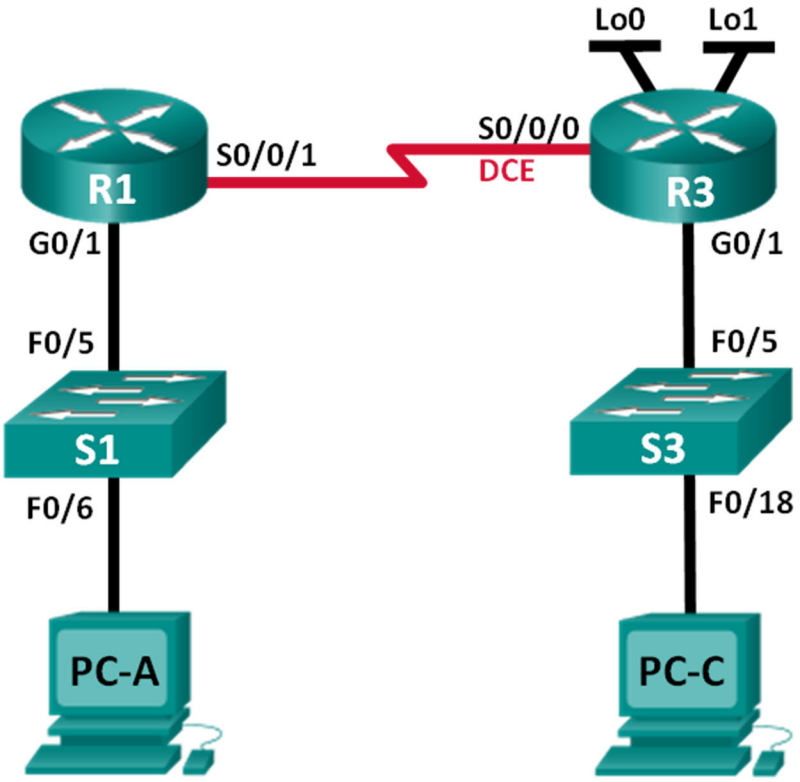
Yes

e. **Bonus**: Looking at the outputs of the routing tables on **R1** and **R2**, what might indicate a reason for the success or failure of communication between **PC1** and **PC3**?

It is because of the default route 0.0.0.0/0

Exercise 2: Configuring IPv4 Static and Default Routes (2.2.2.5)

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/1	192.168.0.1	255.255.255.0	N/A
	S0/0/1	10.1.1.1	255.255.255.252	N/A
R3	G0/1	192.168.1.1	255.255.255.0	N/A
	S0/0/0 (DCE)	10.1.1.2	255.255.255.252	N/A
	Lo0	209.165.200.225	255.255.255.224	N/A
	Lo1	198.133.219.1	255.255.255.0	N/A

PC-A	NIC	192.168.0.10	255.255.255.0	192.168.0.1
PC-C	NIC	192.168.1.10	255.255.255.0	192.168.1.1

A. Set Up the Topology and Initialize Devices in Cisco Packet Tracer

B. Configure Basic Device Settings and Verify Connectivity

Here, you will configure basic settings, such as the interface IP addresses, device access, and passwords. You will verify LAN connectivity and identify routes listed in the routing tables for R1 and R3.

Step 1: Configure the PC interfaces.

Step 2: Configure basic settings on the routers.

a. Configure device names, as shown in the Topology and Addressing Table.

b. Disable DNS lookup.

c. Assign **class** as the enable password and assign **cisco** as the console and vty password.

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

Step 3: Configure IP settings on the routers.

a. Configure the R1 and R3 interfaces with IP addresses according to the Addressing Table.

b. The S0/0/0 connection is the DCE connection and requires the **clock rate** command. The R3 S0/0/0 configuration is displayed below.

R3(config)# **interface s0/0/0**

R3(config-if)# **ip address 10.1.1.2 255.255.255.252**

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

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

Step 4: Verify connectivity of the LANs.

a. Test connectivity by pinging from each PC to the default gateway that has been configured for that host.

From PC-A, is it possible to ping the default gateway? Yes

From PC-C, is it possible to ping the default gateway? Yes

b. Test connectivity by pinging between the directly connected routers.

From R1, is it possible to ping the S0/0/0 interface of R3? Yes

If the answer is **no** to any of these questions, troubleshoot the configurations and correct the error.

c. Test connectivity between devices that are not directly connected.

From PC-A, is it possible to ping PC-C? No

From PC-A, is it possible to ping Lo0? No

From PC-A, is it possible to ping Lo1? No

Were these pings successful? Why or why not?

No as the router isn't connected to the distant networks.

Step 5: Gather information.

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

How many interfaces are activated on R1? 2

b. Check the status of the interfaces on R3.

How many interfaces are activated on R3? 4

c. View the routing table information for R1 using the **show ip route** command.

What networks are present in the Addressing Table of this lab, but not in the routing table for R1?

- 192.168.1.0
- 198.133.219.0
- 209.165.200.224

d. View the routing table information for R3.

What networks are present in the Addressing Table in this lab, but not in the routing table for R3?

192.168.0.0

Why are all the networks not in the routing tables for each of the routers?

The routers do not contain static/dynamic routing so it only may recognize direct connections.

C. Configure Static Routes

In this part, you will employ multiple ways to implement static and default routes, you will confirm that the routes have been added to the routing tables of R1 and R3, and you will verify connectivity based on the introduced routes.

Note: Minimal assistance with the actual commands necessary to configure static routing is provided here. However, the required commands are provided in Appendix A.

1. Configure a recursive static route.

With a recursive static route, the next-hop IP address is specified. Because only the next-hop IP is specified, the router must perform multiple lookups in the routing table before forwarding packets. To configure recursive static routes, use the following syntax:

Router(config)# **ip route** *network-address subnet-mask ip-address*

i. On the R1 router, configure a static route to the 192.168.1.0 network using the IP address of the Serial 0/0/0 interface of R3 as the next-hop address. Write the command you used in the space provided.

R1(config)# ip route 192.168.1.0 255.255.255.0 10.1.1.2

ii. View the routing table to verify the new static route entry.

How is this new route listed in the routing table?

S 192.168.1.0/24 [1/0] via 10.1.1.2

From host PC-A, is it possible to ping the host PC-C? No

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 192.168.0.0 network in the routing table.

2. Configure a directly connected static route.

With a directly connected static route, the *exit-interface* parameter is specified, which allows the router to resolve a forwarding decision in one lookup. A directly connected static route is typically used with a point-to-point serial interface. To configure directly connected static routes with an exit interface specified, use the following syntax:

Router(config)# **ip route** *network-address subnet-mask exit-intf*

i. On the R3 router, configure a static route to the 192.168.0.0 network using S0/0/0 as the exit interface. Write the command you used in the space provided.

R3(config)# ip route 192.168.0.0 255.255.255.0 s0/0/0

ii. View the routing table to verify the new static route entry.

How is this new route listed in the routing table?

S 192.168.0.0/24 is directly connected, Serial0/0/0

iii. From host PC-A, is it possible to ping the host PC-C? Yes

This ping should be successful.

3. **Configure a static route.**

   i. On the R1 router, configure a static route to the 198.133.219.0 network using one of the static route configuration options from the previous steps. Write the command you used in the space provided.

      R1(config)# ip route 198.133.219.0 255.255.255.0 S0/0/1

   ii. On the R1 router, configure a static route to the 209.165.200.224 network on R3 using the other static route configuration option from the previous steps. Write the command you used in the space provided.

      R1(config)# ip route 209.165.200.224 255.255.255.224 S0/0/1

   iii. View the routing table to verify the new static route entry.

   How is this new route listed in the routing table?

   S 198.133.219.0/24 is directly connected, Serial0/0/1

   iv. From host PC-A, is it possible to ping the R1 address 198.133.219.1? Yes

   This ping should be successful.

4. **Remove static routes for loopback addresses.**

   i. On R1, use the **no** command to remove the static routes for the two loopback addresses from the routing table. Write the commands you used in the space provided.

      R1(config)# no ip route 209.165.200.224 255.255.255.224 10.1.1.2

      R1(config)# no ip route 198.133.219.0 255.255.255.0 S0/0/1

   ii. View the routing table to verify the routes have been removed.

   How many network routes are listed in the routing table on R1? 3

   Is the Gateway of last resort set? No it is not.

D. Configure and Verify a Default Route

Now, you will implement a default route, confirm that the route has been added to the routing table, and verify connectivity based on the introduced route.

A default route identifies the gateway to which the router sends all IP packets for which it does not have a learned or static route. A default static route is a static route with 0.0.0.0 as the destination IP address and subnet mask. This is commonly referred to as a "quad zero" route.

In a default route, either the next-hop IP address or exit interface can be specified. To configure a default static route, use the following syntax:

Router(config)# **ip route 0.0.0.0 0.0.0.0** {*ip-address or exit-intf*}

i. Configure the R1 router with a default route using the exit interface of S0/0/1. Write the command you used in the space provided.

R1(config)# ip route 0.0.0.0 0.0.0.0 s0/0/1

ii. View the routing table to verify the new static route entry.

How is this new route listed in the routing table?

S* 0.0.0.0/0 is directly connected, Serial0/0/1

What is the Gateway of last resort?

It would be 0.0.0.0 to network 0.0.0.0

iii. From host PC-A, is it possible to ping the 209.165.200.225? Yes

iv. From host PC-A, is it possible to ping the 198.133.219.1? Yes

These pings should be successful.

Reflection

1. A new network 192.168.3.0/24 is connected to interface G0/0 on R1. What commands could be used to configure a static route to that network from R3?

   ip route192.168.3.0 255.255.255.0 s0/0/0

2. Is there a benefit to configuring a directly connected static route instead of a recursive static route?

   It would allow the routing table to settle into the exit interface with one search rather than needing multiple searches.

3. Why is it important to configure a default route on a router?

   This would stop the router from losing packets to unknown destinations.

Appendix A: Configuration Commands for Parts B, C, and D

The commands listed in Appendix A are for reference only. This Appendix does not include all the specific commands necessary to complete this lab.

Basic Device Settings

Configure IP settings on the router.

R3(config)# **interface s0/0/0**

R3(config-if)# **ip address 10.1.1.2 255.255.255.252**

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

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

Static Route Configurations

Configure a recursive static route.

R1(config)# **ip route 192.168.1.0 255.255.255.0 10.1.1.2**

Configure a directly connected static route.

R3(config)# **ip route 192.168.0.0 255.255.255.0 s0/0/0**

Remove static routes.

R1(config)# **no ip route 209.165.200.224 255.255.255.224 serial0/0/1**

or

R1(config)# **no ip route 209.165.200.224 255.255.255.224 10.1.1.2**

or

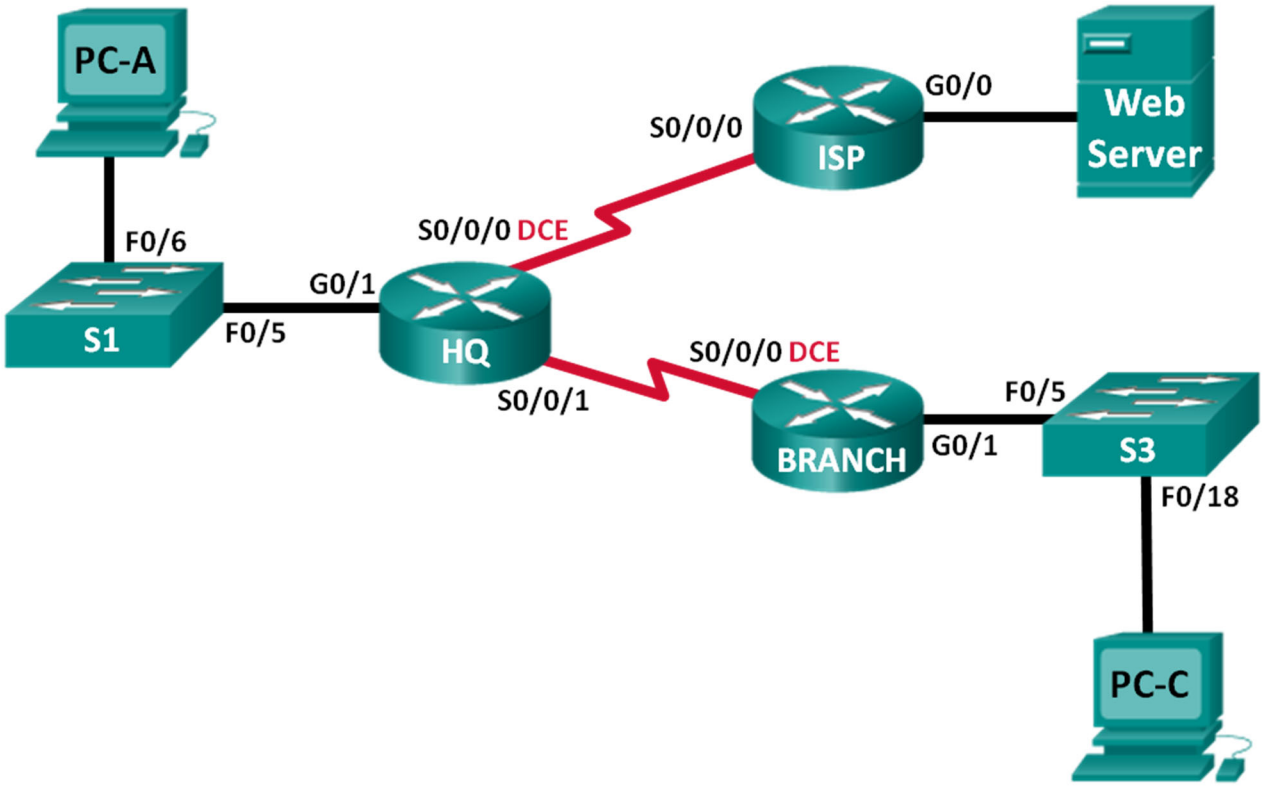
R1(config)# **no ip route 209.165.200.224 255.255.255.224**

Default Route Configuration

R1(config)# **ip route 0.0.0.0 0.0.0.0 s0/0/1**

Exercise 3: Troubleshooting IPv4 and IPv6 Static Routes (2.3.2.4)

Topology



Addressing Table

Device	Interface	IP Address	Default Gateway
HQ	G0/1	192.168.0.1/25	N/A
	S0/0/0 (DCE)	10.1.1.2/30	N/A
	S0/0/1	192.168.0.253/30	N/A
ISP	G0/0	172.16.3.1/24	N/A
	S0/0/0	10.1.1.1/30	N/A
BRANCH	G0/1	192.168.1.1/24	N/A
	S0/0/0 (DCE)	192.168.0.254/30	N/A

PC-A	NIC	192.168.0.3/25	192.168.0.1
Web Server	NIC	172.16.3.3/24	172.16.3.1
PC-C	NIC	192.168.1.3/24	192.168.1.1

Scenario

In this exercise, 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.

A. Build the Network and Configure Basic Device Settings

Step 1: Cable the network as shown in the topology in Cisco Packet Tracer.

Step 2: Configure basic settings for each router.

i. Disable DNS lookup.
ii. Configure device name as shown in the topology.
iii. Assign **class** as the privileged EXEC mode password.
iv. Assign **cisco** as the console and vty passwords.
v. Configure **logging synchronous** to prevent console messages from interrupting command entry.

Step 3: Configure hosts and Web Server.

i. Configure IP addresses for IPv4 and IPv6.
ii. Configure IPv4 default gateway.

Step 4: Load router configurations as follows.

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
```

B. Troubleshoot Static Routes in an IPv4 Network

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.

i. Display the status of the interfaces on HQ. Enter **show ip interface brief**. Record and resolve any issues as necessary.

   The g0/1 has a status of being administratively/protocol down. Although the no shutdown command will fix this.

ii. Ping from HQ router to BRANCH router (192.168.0.254). Were the pings successful? No

iii. Ping from HQ router to ISP router (10.1.1.1). Were the pings successful? Yes

iv. Ping from PC-A to the default gateway. Were the pings successful? Yes

v. Ping from PC-A to PC-C. Were the pings successful? No

vi. Ping from PC-A to Web Server. Were the pings successful? No

vii. Display the routing table on HQ. What non-directly connected routes are shown in the routing table?

   There was No route to 192.168.1.0/24 and a static route to 172.16.3.0/24 via 10.1.1.1

   172.16.0.0/24 is subnetted, 1 subnets

   172.16.3.0 [1/0] via 10.1.1.1

viii. Based on the results of the pings, routing table output, and static routes in the running configuration, what can you conclude about network connectivity?

For the route to PC C it is static but it is not in the table, this will need to be manually configured with the proper destination IP. A static route exists for the 172.16.3.0 network but the web is not reachable.

ix. What commands (if any) need to be entered to resolve routing issues? Record the command(s).

HQ(config)# no ip route 192.168.1.0 255.255.255.0 192.16.0.254

now we reconfigure:

HQ(config)# ip route 192.168.1.0 255.255.255.0 192.168.0.254

x. 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.

These were not fixed. The BRANCH router is not able to be pinged by the HQ. Through this we may find an error within the BRANCH router that limits it from pinging PC A to PC C. The HQ allows a connection to the ISP although PC A is still unable to connect to the web. This indicates that there may be an error within the ISP.

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.

i. Display the status of interfaces on ISP. Enter **show ip interface brief**. Record and resolve any issues as necessary.

For g0/0 there is an incorrect configuration of IP.

ISP(config)# interface GigabitEthernet0/0

ISP(config-if)# ip address 172.16.3.1 255.255.255.0

ISP# show ip interface brief

Interface	IP-Address	OK?	Method	Status	Protocol
Embedded-Service-Engine0/0	unassigned	YES	unset	administratively down	down
GigabitEthernet0/0	172.16.3.11	YES	manual	up	up
GigabitEthernet0/1	unassigned	YES	unset	administratively down	down
Serial0/0/0	10.1.1.1	YES	manual	up	up
Serial0/0/1	unassigned	YES	unset	administratively down	down

ii. Ping from the ISP router to the HQ router (10.1.1.2). Were the pings successful? Yes

iii. Ping from Web Server to the default gateway. Were the pings successful? Yes

iv. Ping from Web Server to PC-A. Were the pings successful? No

v. Ping from Web Server to PC-C. Were the pings successful? No

vi. Display the routing table on ISP. What non-directly connected routes are shown in the routing table?

There was No route to 192.168.0.252/30 and a Static route to 192.168.1.0/24 via 10.1.1.2

192.168.1.0/24 [1/0] via 10.1.1.2

vii. Based on the results of the pings, routing table output, and static routes in the running configuration, what can you conclude about network connectivity?

There would have to be a summary route to 192.168.0.0/23 in order to meet with 192.168.1.0/24 and 192.168.0.252/30

viii. 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.)

ISP(config)# no ip route 192.168.1.0 255.255.255.0 10.1.1.2

ISP(config)# ip route 192.168.0.0 255.255.254.0 10.1.1.2

ix. 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.

The Web Server is now able to reach PC A although not PC C, along with that other problems exist throughout the network.

Step 3: Troubleshoot the BRANCH router.

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

i. Display the status of the interfaces on BRANCH. Enter **show ip interface brief**. Record and resolve any issues, as necessary.

The S0/0/1 is not properly configured

Interface	IP-Address	OK?	Method	Status	Protocol
Embedded-Service-Engine0/0	unassigned	YES	unset	administratively down	down
GigabitEthernet0/0	unassigned	YES	unset	administratively down	down

GigabitEthernet0/1 192.168.1.1 YES manual up up

Serial0/0/0 192.168.0.249 YES manual up up

Serial0/0/1 unassigned YES unset administratively down down

ii. Ping from the BRANCH router to the HQ router (192.168.0.253). Were the pings successful? Yes

iii. Ping from PC-C to the default gateway. Were the pings successful? Yes

iv. Ping from PC-C to PC-A. Were the pings successful? No

v. Ping from PC-C to Web Server. Were the pings successful? No

vi. Display the routing table on BRANCH. What non-directly connected routes are shown in the routing table?

There are none.

vii. Based on the results of the pings, routing table output, and static routes in the running configuration, what can you conclude about network connectivity?

There does not exist any static routes meaning that there was an error with the default route.

viii. What commands (if any) need to be entered to resolve routing issues? Record the command(s).

BRANCH# show run | include ip route

ip route 0.0.0.0 0.0.0.0 10.1.1.2

BRANCH(config)# no ip route 0.0.0.0 0.0.0.0 10.1.1.2

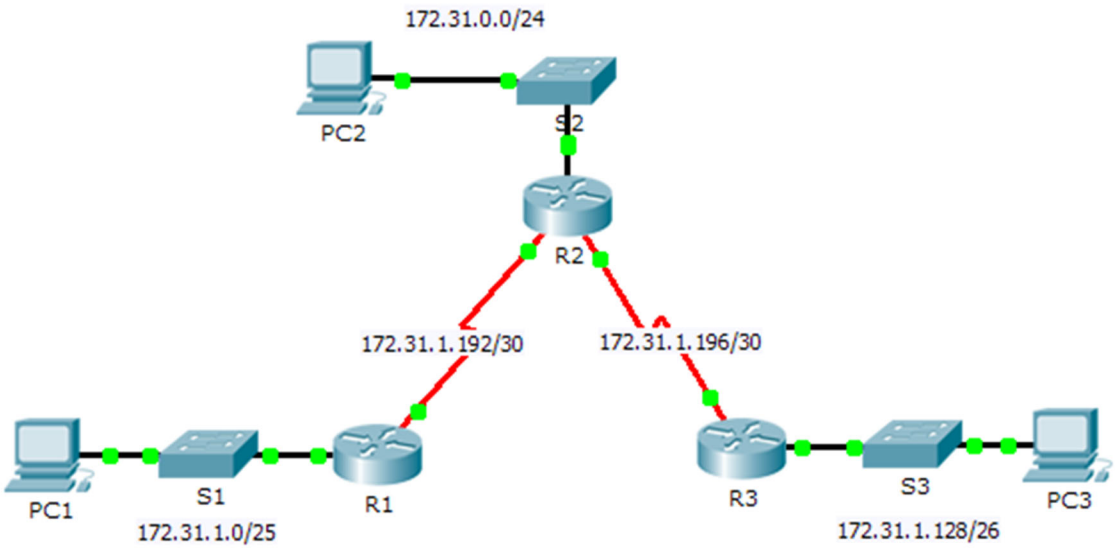
BRANCH(config)# ip route 0.0.0.0 0.0.0.0 192.168.0.253

ix. 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.

The issue has been properly resolved as we have corrected the Gateway of last resort to be 192.168.0.253 to network 0.0.0.0

Exercise 4: (Bonus) Configuring IPv4 Static and Default Routes (2.2.2.4)

Topology



Note: The topology in this exercise is already configured. Please open "exp7-2.2.2.4.pka."

Addressing Table

Device	Interface	IPv4 Address	Subnet Mask	Default Gateway
R1	G0/0	172.31.1.1	255.255.255.128	N/A
	S0/0/0	172.31.1.194	255.255.255.252	N/A
R2	G0/0	172.31.0.1	255.255.255.0	N/A
	S0/0/0	172.31.1.193	255.255.255.252	N/A
	S0/0/1	172.31.1.197	255.255.255.252	N/A
R3	G0/0	172.31.1.129	255.255.255.192	N/A
	S0/0/1	172.31.1.198	255.255.255.252	N/A
PC1	NIC	172.31.1.126	255.255.255.128	172.31.1.1
PC2	NIC	172.31.0.254	255.255.255.0	172.31.0.1
PC3	NIC	172.31.1.190	255.255.255.192	172.31.1.129

A. Examine the Network and Evaluate the Need for Static Routing

i. Looking at the topology diagram, how many networks are there in total? 5

ii. How many networks are directly connected to R1, R2, and R3?

R1: 2

R2: 3

R3: 2

iii. How many static routes are required by each router to reach networks that are not directly connected?

R1: 3

R2: 2

R3: 3

iv. Test connectivity to the R2 and R3 LANs by pinging PC2 and PC3 from PC1.

Why were you unsuccessful?

This is because no routes exists to these from R1

B. Configure Static and Default Routes

1. Configure recursive static routes on R1.

i. What is a recursive static route?

These depend on the next hop to another router for packets to be sent properly to the destination.

ii. Why does a recursive static route require two routing table lookups?

This is because it originally goes to look for the destination network then follows up by looking for the exit direction of the network for the following hop.

iii. Configure a recursive static route to every network not directly connected to R1, including the WAN link between R2 and R3.

ip route 172.31.0.0 255.255.255.0 172.31.1.193

ip route 172.31.1.196 255.255.255.252 172.31.1.193

ip route 172.31.1.128 255.255.255.192 172.31.1.193

iv. Test connectivity to the R2 LAN and ping the IP addresses of PC2 and PC3.

Why were you unsuccessful?

R1 may properly route to R2 and R3 although it is unable to work in the reverse order looking like a one way street.

2. Configure directly attached static routes on R2.

i. How does a directly attached static route differ from a recursive static route?

Through a directly attached it depends heavily on the exit interface for packets to deliver to the destination while recursive just uses the IP address of the next hop.

ii. Configure a directly attached static route from R2 to every network not directly connected.

ip route 172.31.1.0 255.255.255.128 Serial0/0/0

ip route 172.31.1.128 255.255.255.192 Serial0/0/1

iii. Which command only displays directly connected networks?

show ip route connected

iv. Which command only displays the static routes listed in the routing table?

show ip route static

v. When viewing the entire routing table, how can you distinguish between a directly attached static route and a directly connected network?

The static route contains a S on the left and directly connected contains a C on the left.

3. Configure a default route on R3.

i. How does a default route differ from a regular static route?

A default is the same as the gateway of last resort. This is the network route used when no other routes are given for a destination. A static route may be used differently in that we can redirect the route traffic to a said given network.

ii. Configure a default route on R3 so that every network not directly connected is reachable.

ip route 0.0.0.0 0.0.0.0 Serial0/0/1

iii. How is a static route displayed in the routing table?

It contains a S*

4. Verify static route configurations.

Use the appropriate **show** commands to verify correct configurations.

Which **show** commands can you use to verify that the static routes are configured correctly?

- show ip route
- show ip route static
- show ip route [network]

C. Verify Connectivity

Every device should now be able to ping every other device. If not, review your static and default route configurations.