Lab – Configuring IPv4 Static and Default Routes
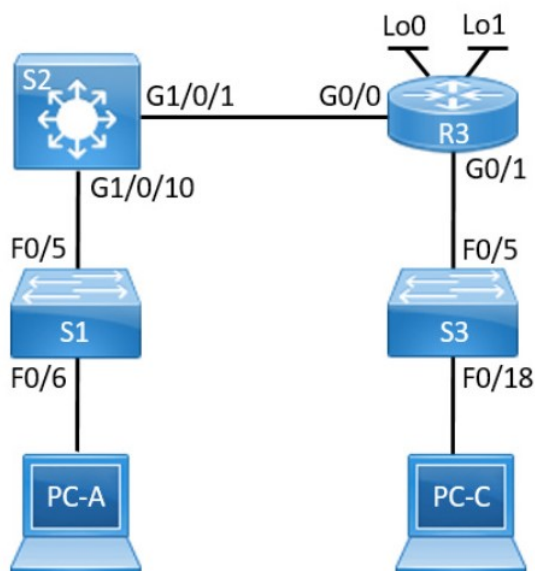
Topology

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
S2	VLAN 1	192.168.0.1	255.255.255.0	N/A
	G1/0/1	10.1.1.1	255.255.255.252	N/A
R3	G0/1	192.168.1.1	255.255.255.0	N/A
	G0/0	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

Objectives

Part 1: Set Up the Topology and Initialize Devices

Part 2: Configure Basic Device Settings and Verify Connectivity

Part 3: Configure Static Routes

- Configure a recursive static route.
- Configure a directly connected static route.
- Configure and remove static routes.

Part 4: Configure and Verify a Default Route

Background / Scenario

A router or layer-3 switch 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.

In this lab, you will manually configure a static route to a specified distant network based on a next-hop IP address or exit interface. You will also configure a static default route. 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.

Note: The router used with CCNA hands-on labs is Cisco 2911 Integrated Services Routers (ISRs) with Cisco IOS Release 15.2(4)M3 (universalk9 image). The switches used are Cisco Catalyst 3650 with IOS-XE Release 3.3.5SE and Cisco Catalyst 2960s with 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.

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

- 1 Router (Cisco 2911 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
- 1 Layer-3 Switch (Cisco 3650 with Cisco IOS-XE Release 3.3.5SE image or comparable)
- 2 Layer-2 Switches (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
- 2 PCs (Windows 10 with 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

Part 1: Set Up the Topology and Initialize Devices

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

Step 2: Initialize and reload the router and switch.

Part 2: Configure Basic Device Settings and Verify Connectivity

In Part 2, you will configure basic settings, such as the interface IP addresses. You will verify LAN connectivity and identify routes listed in the routing tables for S2 and R3.

Step 1:   Configure the PC interfaces.

Step 2:   Configure basic settings on the switches and router.

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

   b.   Disable DNS lookup.

Step 3:   Configure IP settings on the layer-3 switch and router.

   a.   Configure S2 and R3 interfaces with IP addresses according to the Addressing Table.

   b.   For a layer-3 switch, its ports can be configured to behave like a router port. Specifically, the S2 G1/0/1 configuration is displayed below.

```
S2(config)# interface g1/0/1
S2(config-if)# no switchport
S2(config-if)# ip address 10.1.1.1 255.255.255.252
S2(config-if)# no shutdown
```

   c.   Remember to enable routing in the layer-3 switch.

```
S2(config)# ip routing
```

Step 4:   Configure loopback addresses on the router.

   a.   Cisco routers have a loopback address feature where you can use it to simulate external Internet networks to make isolated lab network environment more realistic.

   b.   To configure a loopback address, use the commands

```
Router(config)# interface loopback number
      or
Router(config)# interface lo number

Router(config-if)# ip address ip-address subnet-mask
Router(config-if)# exit
```

   where *number* can be any value between 0 – 2147483647.

Step 5: 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?

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

b. Test connectivity by pinging between the directly connected router and layer-3 switch.

From S2, is it possible to ping the G0/0 interface of R3?

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

From PC-A, is it possible to ping PC-C?

From PC-A, is it possible to ping Lo0?

From PC-A, is it possible to ping Lo1?

Were these pings successful? Why or why not?

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

Step 6: Gather information.

a. Check the status of the interfaces on S2 with the **show ip interface brief** command.

How many interfaces are activated on S2?

b. Check the status of the interfaces on R3.

How many interfaces are activated on R3?

c. View the routing table information for S2 using the **show ip route** command.

What networks are present in the Addressing Table of this lab, but not in the routing table for S2?

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?

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

Part 3: Configure Static Routes

In Part 3, 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 S2 and R3, and you will verify connectivity based on the introduced routes.

Step 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:

```
Device(config)# ip route network-address subnet-mask ip-address
```

a. On the S2 switch, configure a static route to the 192.168.1.0 network using the IP address of the G0/0 interface of R3 as the next-hop address.

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

   How is this new route listed in the routing table?

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

Step 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:

```
Device(config)# ip route network-address subnet-mask exit-intf
```

a. On the R3 router, configure a static route to the 192.168.0.0 network using G0/0 as the exit interface.

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

   How is this new route listed in the routing table?

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

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

Step 3: Configure a static route.

a. On the S2 switch, configure a static route to the 198.133.219.0 network using one of the static route configuration options from the previous steps.

b. On the S2 switch, configure a static route to the 209.165.200.224 network on R3 using the other static route configuration option from the previous steps.

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

How is this new route listed in the routing table?

d. From host PC-A, is it possible to ping the Lo0 address 198.133.219.1?

Step 4: Remove static routes for loopback addresses.

a. On S2, use the **no** command to remove the static routes for the two loopback addresses from the routing table.

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

How many network routes are listed in the routing table on S2?

Is the Gateway of last resort set?

Part 4: Configure and Verify a Default Route

In Part 4, 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:

```
Device(config)# ip route 0.0.0.0 0.0.0.0 {ip-address or exit-intf}
```

a. Configure the S2 switch with a default route using the IP address of the G0/0 interface of R3 as the next-hop address.

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

How is this new route listed in the routing table?

What is the Gateway of last resort?

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

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

Reflection

1. A new network 192.168.3.0/24 is connected to interface VLAN 3 on S2. What commands could be used to configure a static route to that network from R3?

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

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