Static and Dynamic Routing

There are many advantages to dynamic routing as compared to static routing. The major advantage is the way that dynamic routing automatically adjusts to changes in the network whereas static routing requires manual changes to the configuration in order to accommodate such changes.

Learning Outcomes

After completing this exercise, you will be able to:

- Compare static and dynamic routing

Your Devices

You will be using the following devices in this lab. Please make sure these are powered on before proceeding.

- **NYEDGE1** (Cisco 2911 Router)
- **NYEDGE2** (Cisco 2911 Router)
- **NYWAN1** (Cisco 2911 Router)

Task 1 - Compare Static and Dynamic Routing

In the previous two exercises, you configured a static route on **NYEDGE1** to the **172.16.16.0/24** network, a static route on **NYWAN1** to the 172.14.0.0/24 network and you configured dynamic routing between **NYEDGE1** and **NYEDGE2**. In this exercise, you will see how these configurations are affected by changes in the network.

Step 1

First, you will test connectivity to the **GigabitEthernet 0/1** interface of the **NYEDGE1** router from both the **NYWAN1** router and the **NYEDGE2** router. The first test will use the static route you configured while the second test will use the dynamic routing you implemented. Connect to the **NYWAN1** router and issue the following command:

```
NYWAN1#ping 172.14.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.14.0.1, timeout
is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip
min/avg/max = 1/1/4 ms

NYWAN1#
```

Connect to the **NYEDGE2** router and attempt the same command:

```
NYEDGE2#ping 172.14.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.14.0.1, timeout
is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip
min/avg/max = 1/1/4 ms

NYEDGE2#
```

Connectivity is successful in both cases.

Step 2

In this step, you will implement a change to the network. Specifically, you will change the IP address of the **GigabitEthernet 0/1** interface of the **NYEDGE1** router from **172.14.0.1/24** to **172.15.0.1/24** as this will place this interface in a completely new subnet. You will then add this new network to the RIP advertised networks. Connect to the **NYEDGE1** router and issue the following commands:

```
NYEDGE1#configure terminal

Enter configuration commands, one per line.  End with
CNTL/Z.

NYEDGE1(config)#interface GigabitEthernet 0/1

NYEDGE1(config-if)#ip address 172.15.0.1 255.255.255.0

NYEDGE1(config-if)#exit

NYEDGE1(config)#router rip

NYEDGE1(config-router)#network 172.15.0.0

NYEDGE1(config-router)#exit

NYEDGE1(config)#
```

Step 3

Next, you will attempt to reach this new IP address from both the **NYWAN1** and the **NYEDGE2** routers:

```
NYWAN1#ping 172.15.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.14.1.1, timeout
is 2 seconds:

.....

Success rate is 0 percent (0/5)

NYWAN1#
```

As expected, the attempt from **NYWAN1** has failed.

```
NYEDGE2#ping 172.15.0.1

Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 172.15.0.1, timeout
is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip
min/avg/max = 1/1/4 ms

NYEDGE2#
```

The attempt from **NYEDGE2**, however, is successful.

Step 4

Examine the routing table of **NYEDGE2**:

```
NYEDGE2#show ip route | begin Gateway

Gateway of last resort is not set

      172.14.0.0/16 is variably subnetted, 2 subnets, 2
masks

C        172.14.0.0/24 is directly connected,
GigabitEthernet0/1

L        172.14.0.2/32 is directly connected,
GigabitEthernet0/1

R     172.15.0.0/16 [120/1] via 192.168.16.1, 00:00:19,
GigabitEthernet0/0

R     172.18.0.0/16 [120/1] via 192.168.16.1, 00:00:19,
GigabitEthernet0/0

      192.168.16.0/24 is variably subnetted, 2 subnets,
2 masks

C        192.168.16.0/24 is directly connected,
GigabitEthernet0/0

L        192.168.16.2/32 is directly connected,
GigabitEthernet0/0

NYEDGE2#
```

You should notice two things. First of all, a new route entry has been added with a destination of **172.15.0.0** via **192.168.16.1**. This is to be expected as this is the new network that was added to **NYEDGE1** and advertised via RIP.

The second thing is a little more subtle. The routing entry of **172.18.0.0** now has only one possible route whereas before, there were two. This is because the second or redundant route was via **172.14.0.1** which *was* the IP address of the **GigabitEthernet 0/1** interface of **NYEDGE1**. You have now changed the IP address of this interface and thus belongs to a different subnet. Therefore this route is no longer available. Notice that this information was exchanged between the two routers automatically via the RIP routing protocol.

Step 5

Unlike the automatically updated routes in **NYEDGE2**, in order to successfully route from **NYWAN1** to the new IP address on **NYEDGE1**, you must manually reconfigure the static route on **NYWAN1**. To do this, connect to **NYWAN1.** You will first remove the static route that you had configured in a previous exercise by issuing the following command:

```
NYWAN1#configure terminal

Enter configuration commands, one per line. End with
```

```
CNTL/Z.

NYWAN1(config)#no ip route 172.14.0.0 255.255.255.0
192.168.16.1

NYWAN1(config)#
```

You will then implement the new static route:

```
NYWAN1(config)#ip route 172.15.0.0 255.255.255.0
192.168.16.1

NYWAN1(config)#exit

NYWAN1#
```

Step 6

Finally, you will test to see if this new static route is configured correctly by pinging the new IP address of the interface on **NYEDGE1**:

```
NYWAN1#ping 172.15.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.15.0.1, timeout
is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip
min/avg/max = 1/1/1 ms

NYWAN1#
```

The ping is successful.

Note: *The network that you configured in this lab involved three routers. You might be able to successfully administrate a network of this size with static routing. However, imagine configuring routing in a network that has ten or twenty routers. If you configured static routing, you would have to configure each router separately. This would not only be time-consuming, but it would also require long periods of network downtime. Such a configuration would also be prone to errors and would require extensive troubleshooting. Dynamic routing protocols, on the other hand, allow you to make a change to the network in one location without having to change anything else on any other device. The changes are propagated throughout the network quickly, automatically and accurately.*

Leave the devices in their current states and continue on to the next exercise.