Dynamic Routing

In this exercise, you will learn how to implement dynamic routing. In contrast to static routing, dynamic routing involves the exchange of routing information between devices using a routing protocol. From this information, each device builds a topology of the network. There are many different routing protocols, some are industry standard, and some are proprietary. These routing protocols fall into two major categories depending on how they function. These categories are **distance vector** and **link state**.

Learning Outcomes

After completing this exercise, you will be able to:

- Use RIP to implement 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 - Configuring Routing Information Protocol

In this task, you will configure Routing Information Protocol (RIP) which is a distance vector routing protocol.

Step 1

Before making any routing configurations on the routers, you will first activate a loopback interface that has been preconfigured on the **NYEDGE1** router. This loopback interface will simulate a subnet that will be advertised by RIP.

> *Think of a **looback** interface as a virtual router interface. It is essentially just like any other router interface except that it has no physical counterpart. It has many purposes in the real world. However, its purpose for this lab is to allow for additional networks to exist on the router without the need for additional physical ports. For more information, use your favorite search engine to search for **loopback** interfaces.*

The **loopback 0** interface has an IP address of **172.18.0.1/24** and thus is in the **172.18.0.0/24** subnet.

Issue the following commands to activate the **loopback 0** interface:

```
NYEDGE1#configure terminal

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

NYEDGE1(config)#interface loopback 0

NYEDGE1(config-if)#no shutdown

NYEDGE1(config-if)#exit

Sep 11 23:59:23.339: %LINK-3-UPDOWN: Interface
Loopback0, changed state to up

Sep 11 23:59:24.339: %LINEPROTO-5-UPDOWN: Line protocol
on Interface Loopback0, changed state to up

NYEDGE1(config)#
```

Step 2

Next, you will enable the RIP protocol with the following command:

```
NYEDGE1(config)#router rip

NYEDGE1(config-router)#
```

RIP has now been enabled on the **NYEDGE1** router. Notice how the prompt changes to **NYEDGE1(config-router)**#. This is because you are now in the configuration mode in which you can configure all of the RIP parameters of the router.

Step 3

At this point, RIP is enabled, however, no routes are being advertised to other RIP routers. You must indicate to the router which directly connected networks will participate in the RIP process. To do this, you can use the **network** command as follows:

```
NYEDGE1(config-router)#network 172.14.0.0

NYEDGE1(config-router)#network 192.168.16.0

NYEDGE1(config-router)#network 172.18.0.0

NYEDGE1(config-router)#exit

NYEDGE1(config)#exit

NYEDGE1#
```

Remember to include the **172.18.0.0** network which belongs to the **loopback 0** interface.

The router has now begun advertising these three networks out of all its active interfaces. Notice that these are the networks to which the two active physical interfaces and the looback interface of the router are directly connected.

*When adding networks with the **network** command, these must be **directly connected networks**. It is possible to add any network using this command as you will not get an error message, however, a **network** command that contains a network other than the **directly connected networks** will have no effect on any configuration.*

By advertising these networks, the router is essentially saying that any other router that wants to get to these network destinations should send their packets to it. At this point, however, there is no other router configured to listen to such advertisements.

Step 4

In this step, you will configure the RIP protocol on the **NYEDGE2** router as follows:

```
NYEDGE2#configure terminal

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

NYEDGE2(config)#router rip

NYEDGE2(config-router)#
```

Step 5

Just as before, RIP is enabled, but no routes are being advertised. Indicate which

directly connected networks will participate in the RIP process, again, by using the **network** command as follows:

```
NYEDGE2(config-router)#network 172.14.0.0

NYEDGE2(config-router)#network 192.168.16.0

NYEDGE2(config-router)#exit

NYEDGE2(config)#exit

NYEDGE2#
```

Notice once again that these are the networks to which the two active interfaces of the router are directly connected.

Step 6

Now take a look at 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     172.18.0.0/16 [120/1] via 192.168.16.1, 00:00:01,
GigabitEthernet0/0

                    [120/1] via 172.14.0.1, 00:00:07,
GigabitEthernet0/1

      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#
```

A new entry in the routing table appears with the **R** code indicating that the route was learned via the RIP protocol. The destination network is that of the loopback 0 interface on **NYEDGE1**. You will also note that in order to reach this new network of **172.18.0.0**, there are two possible routes: one via the **192.168.16.1** next hop and one via **172.14.0.1**. These are the **GigabitEthernet 0/0** and **0/1** interfaces of **NYEDGE1** router respectively. Both options are equally viable routes to reach the desired network.

> *In general, when using dynamic routing protocols, when multiple routes are available to a specific network destination, only the best route is included in the routing table. The only exception is when the routes are of both equal **cost** and equal **administrative distance** as is the case in this example. In this instance, both routes will be used to reach this destination. This has benefits because you can now have redundant paths to your destination and you can load balance the traffic between these routes as well. You will find out more about these concepts in later lab modules, or you can use your favorite search engine to research them further.*

Step 7

Test to make sure that this new route that was added is functioning correctly. Attempt to ping the **loopback 0** interface of the **NYEDGE1** router from the **NYEDGE2** router and examine the results:

```
NYEDGE2#ping 172.18.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.18.0.1, timeout
is 2 seconds:

!!!!!

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

NYEDGE2#
```

The ping should be successful.

You have successfully configured dynamic routing between the **NYEDGE1** and **NYEDGE2** routers.

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