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PULCHOWK CAMPUS

LAB – 6: Dynamic Routing using RIP

(Computer Network)

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Lab 6: Dynamic Routing using RIP

Objectives:

- To be familiar with dynamic routing and configuration of dynamic routing using RIP

- To observe how the dynamic routing can address changing network topology automatically

Requirements:

- Network simulation tool: Packet Tracer

Exercises:

1. What is dynamic routing? How does it differ with static routing? Explain briefly.

=> Dynamic routing is a network routing technique where routers automatically adjust paths and forward data packets based on the current network topology. It uses protocols like RIP (Routing Information Protocol) to transmit packets. In contrast, static routing involves manually configuring routes, which remain unchanged unless manually updated. Dynamic routing is more flexible and responsive to network changes, making it preferable for larger, more complex networks.

2. List out the dynamic routing configuration commands of the router (that you have used in this lab) for RIP as well as RIP version 2 with the syntax and examples.

=> The commands for RIP: router rip

network <network number>

The commands for RIP version 2: router rip

version 2

network <network number>

Example: router rip

network 222.22.22.0

network 222.22.23.0 ,and

router rip

version 2

network 222.22.22.0

3. How can dynamic routing address the changing topology of a network automatically? Explain with reference to the observation of your lab exercise.
=> Dynamic routing protocols automatically update routing tables in response to changes in the network, such as adding new routers, changing network paths, or dealing with router failures. During lab exercises, it was observed that when a link failed or a new route was added, the routing protocol (RIP) detected the change, recalculated the best paths, and updated the routing tables accordingly without manual intervention. This ensured continuous and efficient data forwarding, demonstrating the adaptive nature of dynamic routing in handling network topology changes.

Activities:

A. Create the following network topology using Packet Tracer and perform the followings:

1. The hostname, enable password and console password were configured in each router.
2. We enabled telnet with password on each router with command: line vty 0 4. password cisco
3. We configured each interface of the router with the IP address referring to figure 1.
4. We configured the IP address and default gateway on each computer.
5. The show ip route command in each routers are, Router0:

```
     202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/0
L       202.60.0.1/32 is directly connected, GigabitEthernet0/0
     202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/1
L       202.60.1.1/32 is directly connected, GigabitEthernet0/1
```

Router1:

```
     202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.2/32 is directly connected, GigabitEthernet0/0
     202.60.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.2.0/24 is directly connected, GigabitEthernet0/2
L       202.60.2.1/32 is directly connected, GigabitEthernet0/2
     202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.3.0/24 is directly connected, GigabitEthernet0/1
L       202.60.3.1/32 is directly connected, GigabitEthernet0/1
```

Router2:

```
     202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.3.0/24 is directly connected, GigabitEthernet0/0
L       202.60.3.2/32 is directly connected, GigabitEthernet0/0
     202.60.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.4.0/24 is directly connected, GigabitEthernet0/2
L       202.60.4.1/32 is directly connected, GigabitEthernet0/2
     202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.5.0/24 is directly connected, GigabitEthernet0/1
L       202.60.5.1/32 is directly connected, GigabitEthernet0/1
```

Router3:

```
     202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.5.0/24 is directly connected, GigabitEthernet0/0
L       202.60.5.2/32 is directly connected, GigabitEthernet0/0
     202.60.6.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.6.0/24 is directly connected, GigabitEthernet0/1
L       202.60.6.1/32 is directly connected, GigabitEthernet0/1
```

6. PC0 can ping to Server0 and its interface with the router0 only. I.e. within its network only as no routing configuration was done for communication between routers.
7. PC1 can ping only to PC4 and its interface with router1, which is within its network.
8. All the computers and routers can ping only to devices within their own network because routing configuration is not done for communication between routers.
9. For Router0, the RIP was configured for 2 networks connected to it.

```
C:\>telnet 202.60.0.1
Trying 202.60.0.1 ...Open
```

```
roshni_1(config)#router rip
roshni_1(config-router)#network 202.60.0.0
roshni_1(config-router)#network 202.60.1.0
roshni_1(config-router)#!
```

10. Similarly, for Router1, RIP was configured in a similar manner, by entering Router1 from Router0 through PC0.
11. RIP was configured for Router2 and Router3 as well.
12. Connection is now established between all the networks, and the ping command is successful.

The ip route configuration of Router0 is changed to this, the networks 2, 3, 4,5 and 6 have been added automatically as the RIP route.

```
Gateway of last resort is not set

     202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/0
L       202.60.0.1/32 is directly connected, GigabitEthernet0/0
     202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/1
L       202.60.1.1/32 is directly connected, GigabitEthernet0/1
R    202.60.2.0/24 [120/1] via 202.60.1.2, 00:00:18, GigabitEthernet0/1
R    202.60.3.0/24 [120/1] via 202.60.1.2, 00:00:18, GigabitEthernet0/1
R    202.60.4.0/24 [120/2] via 202.60.1.2, 00:00:18, GigabitEthernet0/1
R    202.60.5.0/24 [120/2] via 202.60.1.2, 00:00:18, GigabitEthernet0/1
R    202.60.6.0/24 [120/3] via 202.60.1.2, 00:00:18, GigabitEthernet0/1

roshni_1#
```

13. The tracert command showed each hop taken to reach the destination along with the time.

```
C:\>tracert 202.60.6.2

Tracing route to 202.60.6.2 over a maximum of 30 hops:

  1   0 ms      0 ms      0 ms      202.60.0.1
  2   0 ms      0 ms      0 ms      202.60.1.2
  3   0 ms      0 ms      0 ms      202.60.3.2
  4   0 ms      0 ms      0 ms      202.60.5.2
  5   0 ms      0 ms      0 ms      202.60.6.2

Trace complete.
```

And so on.

B. A new router, Router4 was added to connect Switch0 and Switch1. IP address was assigned to it as given, and RIP was also enabled.

1. After adding the new router, the routing configurations automatically changed. The shortest path to reach a network was automatically found from each router, to each of the networks.

```
     202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/0
L       202.60.0.1/32 is directly connected, GigabitEthernet0/0
     202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/1
L       202.60.1.1/32 is directly connected, GigabitEthernet0/1
R    202.60.2.0/24 [120/1] via 202.60.1.2, 00:00:21, GigabitEthernet0/1
R    202.60.3.0/24 [120/1] via 202.60.1.2, 00:00:21, GigabitEthernet0/1
R    202.60.4.0/24 [120/2] via 202.60.1.2, 00:00:21, GigabitEthernet0/1
R    202.60.5.0/24 [120/2] via 202.60.1.2, 00:00:21, GigabitEthernet0/1
                   [120/2] via 202.60.0.10, 00:00:18, GigabitEthernet0/0
R    202.60.6.0/24 [120/1] via 202.60.0.10, 00:00:18, GigabitEthernet0/0
```

2. The traceroute command showed how dynamic routing automatically changed the route using a shorter path to reach the destination after the network arrangement changed.

```
C:\>tracert 202.60.6.2

Tracing route to 202.60.6.2 over a maximum of 30 hops:

  1   0 ms      0 ms      0 ms      202.60.0.1
  2   *         0 ms      0 ms      202.60.0.10
  3   *         0 ms      0 ms      202.60.6.2

Trace complete.
```

3. We saw how a change in the network was automatically identified by the routers and the available path was followed. Ip route in each router also reflected this change due to the change in network

In router0

```
     202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/0
L       202.60.0.1/32 is directly connected, GigabitEthernet0/0
R    202.60.2.0/24 [120/4] via 202.60.0.10, 00:00:23, GigabitEthernet0/0
R    202.60.3.0/24 [120/3] via 202.60.0.10, 00:00:23, GigabitEthernet0/0
R    202.60.4.0/24 [120/3] via 202.60.0.10, 00:00:23, GigabitEthernet0/0
R    202.60.5.0/24 [120/2] via 202.60.0.10, 00:00:23, GigabitEthernet0/0
R    202.60.6.0/24 [120/1] via 202.60.0.10, 00:00:23, GigabitEthernet0/0
```

4. 5. We observed how the change in network topology was reflected in the routing table of each router and in the path followed using the traceroute command. Dynamic routing protocol, RIP automatically determined the optimal path to reach the destination networks.

C.

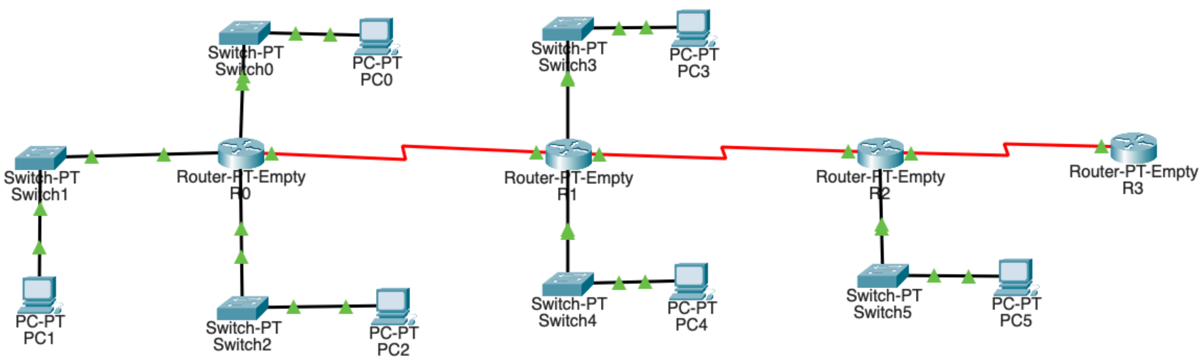

Fig: Network Topology 3

Network	Net-Id	Broadcast Address	Subnet Mask
B 70	222.22.22.0	222.22.22.127	255.255.255.128
A 60	222.22.22.128	222.22.22.191	255.255.255.192
C 50	222.22.22.192	222.22.22.255	255.255.255.192
E 40	222.22.23.0	222.22.23.63	255.255.255.192
F 20	222.22.23.64	222.22.23.95	255.255.255.224
D 10	222.22.23.96	222.22.23.111	255.255.255.240
G 2	222.22.23.112	222.22.23.115	255.255.255.252
H 2	222.22.23.116	222.22.23.119	255.255.255.252
I 2	222.22.23.120	222.22.23.123	255.255.255.252

Fig: Network addresses designated to the networks in topology

The remaining IP address range was 222.22.23.124 to 222.22.23.255.

1. We configured the network as shown in figure 3 of the lab sheet.

2. The hostname, console password and enable password were set and telnet was also enabled with given passwords.

```
Router(config)#hostname roshni_1
roshni_1(config)#line console 0
roshni_1(config-line)#password cisco
roshni_1(config-line)#login
roshni_1(config-line)#exit
roshni_1(config)#line vty 0 4
roshni_1(config-line)#password cisco
roshni_1(config-line)#login
roshni_1(config-line)#exit
roshni_1(config)#enable password class
```

3. We configured each interface of the router with appropriate IP address and subnet mask. Also, each computer was configured with an IP address, subnet mask and default gateway.

4. The routers showed the connected paths only, as no routing(static or dynamic) had been configured.
Router1:

```
     222.22.23.0/24 is variably subnetted, 4 subnets, 3 masks
C       222.22.23.0/26 is directly connected, FastEthernet2/0
C       222.22.23.96/28 is directly connected, FastEthernet1/0
C       222.22.23.112/30 is directly connected, Serial4/0
C       222.22.23.116/30 is directly connected, Serial5/0
```

5. We configured RIP version 2 in all the routers for classless addressing because here we are subnetting with VLSM.

6. The show ip route command reflected the change in the routing table, adding the dynamic routing configurations(RIP). All routers were configured to enable RIP for all their interconnected networks.

Router0

```
     222.22.22.0/24 is variably subnetted, 3 subnets, 2 masks
C       222.22.22.0/25 is directly connected, FastEthernet1/0
C       222.22.22.128/26 is directly connected, FastEthernet0/0
C       222.22.22.192/26 is directly connected, FastEthernet2/0
     222.22.23.0/24 is variably subnetted, 6 subnets, 4 masks
R       222.22.23.0/26 [120/1] via 222.22.23.114, 00:00:25, Serial4/0
R       222.22.23.64/27 [120/2] via 222.22.23.114, 00:00:25, Serial4/0
R       222.22.23.96/28 [120/1] via 222.22.23.114, 00:00:25, Serial4/0
C       222.22.23.112/30 is directly connected, Serial4/0
R       222.22.23.116/30 [120/1] via 222.22.23.114, 00:00:25, Serial4/0
R       222.22.23.120/30 [120/2] via 222.22.23.114, 00:00:25, Serial4/0
```

7. Any device could ping each other in the network.

8. The traceroute command showed hops made to the routers in the path to reach the destination ISP router here.

```
C:\>tracert 222.22.23.122

Tracing route to 222.22.23.122 over a maximum of 30 hops:

  1   0 ms      0 ms      0 ms      222.22.22.130
  2   2 ms      3 ms      0 ms      222.22.23.114
  3   0 ms      0 ms      2 ms      222.22.23.118
  4   5 ms      6 ms      1 ms      222.22.23.122
```

9. Trying to trace an IP address of IP address was not successful, the request reached the router's in the network only because default routing was not done. This kept on continuing and went till 30 hops.

```
C:\>tracert 1.1.1.1

Tracing route to 1.1.1.1 over a maximum of 30 hops:

  1   0 ms      0 ms      0 ms      222.22.22.130
  2   0 ms      *         0 ms      222.22.22.130
  3   *         0 ms      *         Request timed out.
  4   0 ms      *         0 ms      222.22.22.130
  5   *         0 ms      *         Request timed out.
  6   0 ms      *         0 ms      222.22.22.130
  7   *         0 ms      *         Request timed out.
```

10. Each router was configured with default routes, passing the requests to the ISP router.
roshni_1(config)# ip route 0.0.0.0 0.0.0.0 222.22.23.114
roshni_2(config)# ip route 0.0.0.0 0.0.0.0 222.22.23.118
roshni_3(config)# ip route 0.0.0.0 0.0.0.0 222.22.23.122

11. The show ip route command for each router showed the default route in addition to the previous routes in its routing table.
In router1,

```
     222.22.22.0/24 is variably subnetted, 3 subnets, 2 masks
C       222.22.22.0/25 is directly connected, FastEthernet1/0
C       222.22.22.128/26 is directly connected, FastEthernet0/0
C       222.22.22.192/26 is directly connected, FastEthernet2/0
     222.22.23.0/24 is variably subnetted, 6 subnets, 4 masks
R       222.22.23.0/26 [120/1] via 222.22.23.114, 00:00:08, Serial4/0
R       222.22.23.64/27 [120/2] via 222.22.23.114, 00:00:08, Serial4/0
R       222.22.23.96/28 [120/1] via 222.22.23.114, 00:00:08, Serial4/0
C       222.22.23.112/30 is directly connected, Serial4/0
R       222.22.23.116/30 [120/1] via 222.22.23.114, 00:00:08, Serial4/0
R       222.22.23.120/30 [120/2] via 222.22.23.114, 00:00:08, Serial4/0
S*   0.0.0.0/0 [1/0] via 222.22.23.114
```

12. Tracing the route to the IP address 1.1.1.1, we saw that the default route was followed up to the ISP router, as seen by the hops made. Then, no further hops were made, resulting in the request being timed out, because no further routing to the destination was made from the ISP router. After 30 hops, the request was dropped.

```
C:\>tracert 1.1.1.1

Tracing route to 1.1.1.1 over a maximum of 30 hops:

  1   9 ms      0 ms      0 ms      222.22.22.130
  2   0 ms      9 ms      1 ms      222.22.23.114
  3   2 ms      0 ms      0 ms      222.22.23.118
  4   2 ms      3 ms      6 ms      222.22.23.122
  5   3 ms      *         2 ms      222.22.23.122
  6   *         15 ms     *         Request timed out.
  7   1 ms      *         1 ms      222.22.23.122
  8   *         2 ms      *         Request timed out.
  9   0 ms      *         1 ms      222.22.23.122
  10   *         2 ms      *         Request timed out.
  11   17 ms     *         2 ms      222.22.23.122
  12   *         2 ms      *         Request timed out.
  13   1 ms      *         2 ms      222.22.23.122
```

After configuring default route, routing reaches upto ISP router, while before configuration it couldn't proceed further from network A.

Discussion

In this lab on dynamic routing using RIP (Routing Information Protocol), we explored the practical implementation and advantages of dynamic routing protocols in a simulated network environment using Cisco Packet Tracer. Dynamic routing, as opposed to static routing, offers the significant benefit of automatically adjusting to changes in network topology. This adaptability is crucial for maintaining efficient data transmission in larger and more complex networks.

Through the lab exercises, we configured routers with RIP and RIP version 2, which allowed us to observe the automatic updating of routing tables. This automatic adjustment was particularly evident when network changes occurred, such as the addition or removal of links and routers. The routing protocol recalculated the best paths and updated the routing tables without manual intervention, demonstrating the efficiency and responsiveness of dynamic routing.

We also examined specific commands used to configure RIP, gaining practical experience in setting up dynamic routing on routers. The exercises included enabling telnet access, configuring IP addresses and default gateways, and verifying routing configurations with commands like `show ip route` and `traceroute`. These activities reinforced our understanding of how dynamic routing protocols operate and how they can enhance network performance by ensuring continuous communication even when network topologies change.

Conclusion

This lab provided a comprehensive understanding of dynamic routing using RIP and highlighted the key advantages of dynamic routing protocols. By configuring and testing RIP in various scenarios, we demonstrated that dynamic routing effectively manages network changes, ensuring optimal path selection and maintaining efficient data flow. The hands-on experience with Cisco Packet Tracer allowed us to observe the practical application of these concepts, solidifying our knowledge of dynamic routing mechanisms and their importance in modern network management. Through this lab, we confirmed that dynamic routing is essential for achieving robust and scalable network infrastructures.