

## **EXPERIMENT 10 – Dynamic Routing**

### **Objective:**

To understand the concept of dynamic routing using Routing Information Protocol (RIP)

### **Dynamic Routing:**

Dynamic routing is a mechanism through which routing information is exchanged between routers to determine the optimal path between network devices. Dynamic routing involves the use of routing protocols that exchange routing information between routing devices. Dynamic routing protocols were designed to address the shortcomings of static routing such as the need for human involvement to route traffic around failures, the human mistakes made when typing route information, and the scaling limit of the few routes one person can track in a text file. These benefits come at the expense of requiring significant computing power in the routers, and the need for training network administrators who specialize in taming routing algorithms.

Routing protocols perform these functions:

- Discovery of remote networks
- Best path calculation to remote networks
- Updating the routing table
- Recalculating a best new path in the case of failure of the current best path

### **Routing Information Protocol (RIP):**

Routing Information Protocol (RIP) is a distance-vector routing protocol. Routers running the distance-vector protocol send all or a portion of their routing tables in routing-update messages to their neighbours. Routing Information Protocol (RIP) is a dynamic routing protocol that uses hop count as a routing metric to find the best path between the source and the destination network. Hop count is the number of routers occurring in between the source and destination network. The path with the lowest hop count is considered as the best route to reach a network and therefore placed in the routing table. RIP prevents routing loops by limiting the number of hops allowed in a path from source and destination. The maximum hop count allowed for RIP is 15 and a hop count of 16 is considered as network unreachable.

### **Features of RIP:**

- Updates of the network are exchanged periodically
- Full routing tables are sent in updates
- Routers always trust routing information received from neighbor routers. This is also known as Routing on rumors.

## Downsides of RIP:

- RIP sends the entire routing table every 30 seconds, which can consume a lot of network bandwidth.
- It lacks some more advanced features of the newer routing protocols like OSPF or EIGRP and is not widely used in modern networks. For example, RIP doesn't support route summarization.

## RIP Versions:

There are two versions of Routing Information Protocol – **RIP Version1**, and **RIP Version2**.

**RIP v1** is known as Classful Routing Protocol because it doesn't send information of subnet mask in its routing update while **RIP v2** is known as Classless Routing Protocol because it sends information of subnet mask in its routing update.

## Command Syntax:

Following is the command syntax for RIP configuration on Cisco router:

```
Router(config)# router rip  
Router(config-router)# version 2  
Router(config-router)# network 192.168.10.0  
Router(config-router)# network 192.168.20.0
```

Where 192.168.10.0 and 192.168.20.0 are the network addresses of directly connected networks to this router.

## Topology:

RIP routing topology consists of three LAN segments. Network 1 consists of a Cisco 2960 switch and one endpoint with IP address in 192.168.10.0/24 IP address range. Network 3 consists of a Cisco 2960 switch and one endpoint with IP address in 192.168.30.0/24 IP address range. Network 2 is used for the interconnection of two routers (Router1 and Router2).

Router1 is directly connected to two networks (Network 1 and Network 2), and it is indirectly connected (via Router2) to Network 3. Router2 is directly connected to two networks (Network 2 and Network 3), and it is indirectly connected (via Router1) to Network 1.

Once we enable RIP protocol, Router1 will advertise the networks (192.168.10.0/24 and 192.168.20.0/24) directly connected to it and Router2 will advertise the networks (192.168.20.0/24 and 192.168.30.0/24) directly connected to it. Both routers will build their own routing tables after receiving the routing updates advertised from other router.

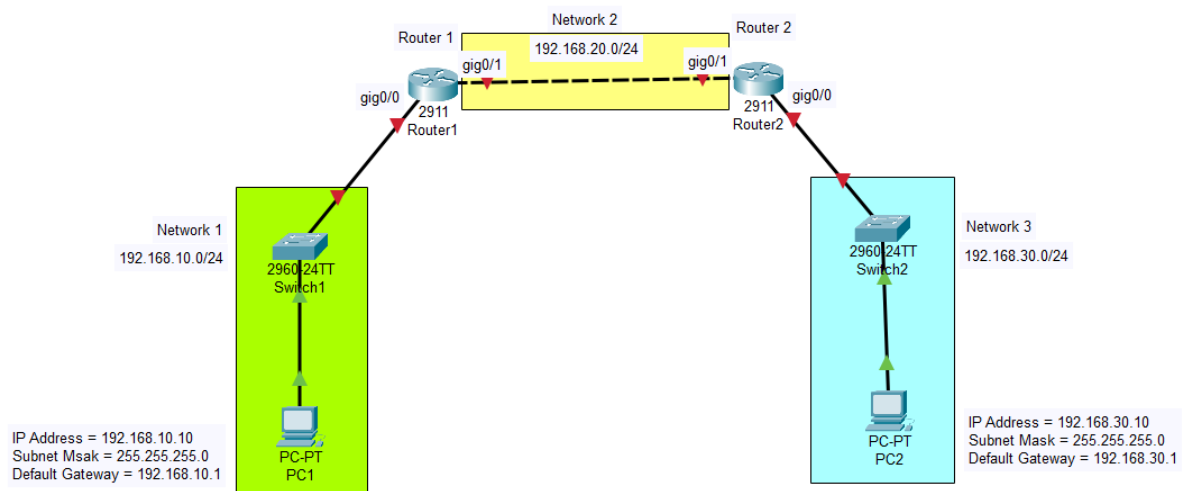


Figure 1 - RIP Routing Topology

## Steps:

Assign the static IP address, subnet mask and default gateway on first PC as shown below:

PC1

Physical Config **Desktop** Programming Attributes

IP Configuration

Interface: FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address: 192.168.10.10

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.10.1

DNS Server: 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::201:63FF:FE40:6CED

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

Authentication: MD5

Username:

Password:

☐ Top

Assign the static IP address, subnet mask and default gateway on second PC shown below:

PC2

Physical Config **Desktop** Programming Attributes

**IP Configuration** X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.30.10

Subnet Mask 255.255.255.0

Default Gateway 192.168.30.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::207:ECFF:FE99:442D

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

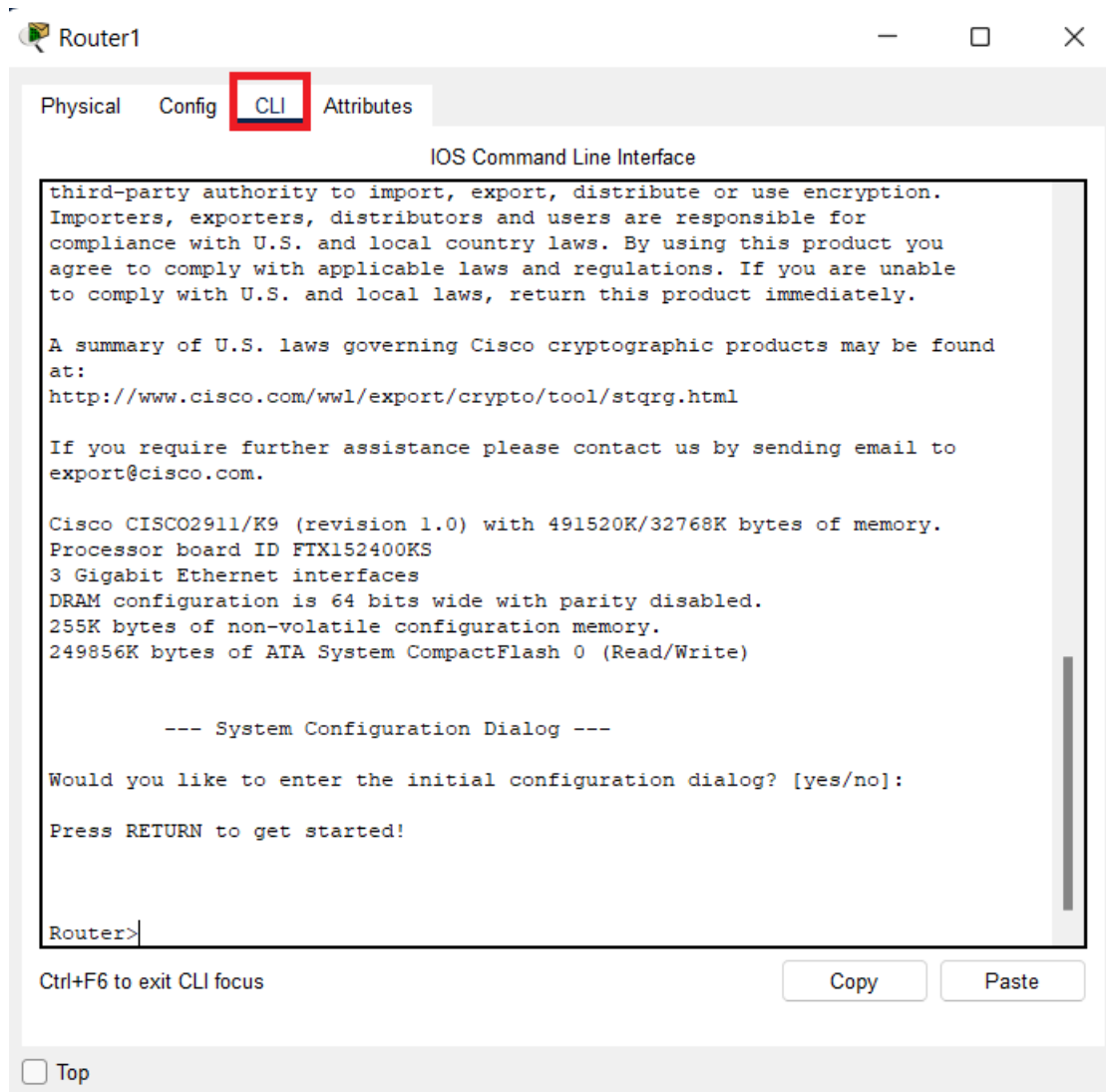
Authentication MD5

Username


Password

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Select the Router1 and click on CLI tab. Do not enter the initial configuration dialog as shown below:



As shown in the topology diagram, we need to configure two router interfaces gig0/0 and gig0/1 with respective gateway IP addresses. We will configure the gateway IP addresses on both router interfaces followed by “no shutdown” command. After configuring the interfaces, we will advertise directly connected networks to Router1 through RIP.

 Router1

Physical

Config

CLI

Attributes

IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface gig0/0
Router(config-if)#ip address 192.168.10.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed
state to up

Router(config-if)#exit
Router(config)#
Router(config)#
Router(config)#interface gig0/1
Router(config-if)#ip address 192.168.20.10 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

Router(config-if)#exit
Router(config)#
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 192.168.10.0
Router(config-router)#network 192.168.20.0
Router(config-router)#exit
Router(config)#
```


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We will repeat the similar configuration on Router2 by configuring the gateway IP addresses on both gig0/0 and gig0/1. After configuring the interfaces, we will advertise directly connected networks to Router2 through RIP.

 Router2

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface gig0/0
Router(config-if)#ip address 192.168.30.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed
state to up

Router(config-if)#exit
Router(config)#
Router(config)#interface gig0/1
Router(config-if)#ip address 192.168.20.20 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed
state to up

Router(config-if)#exit
Router(config)#
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 192.168.20.0
Router(config-router)#network 192.168.30.0
Router(config-router)#exit
Router(config)#
Router(config)#
```

Ctrl+F6 to exit CLI focus

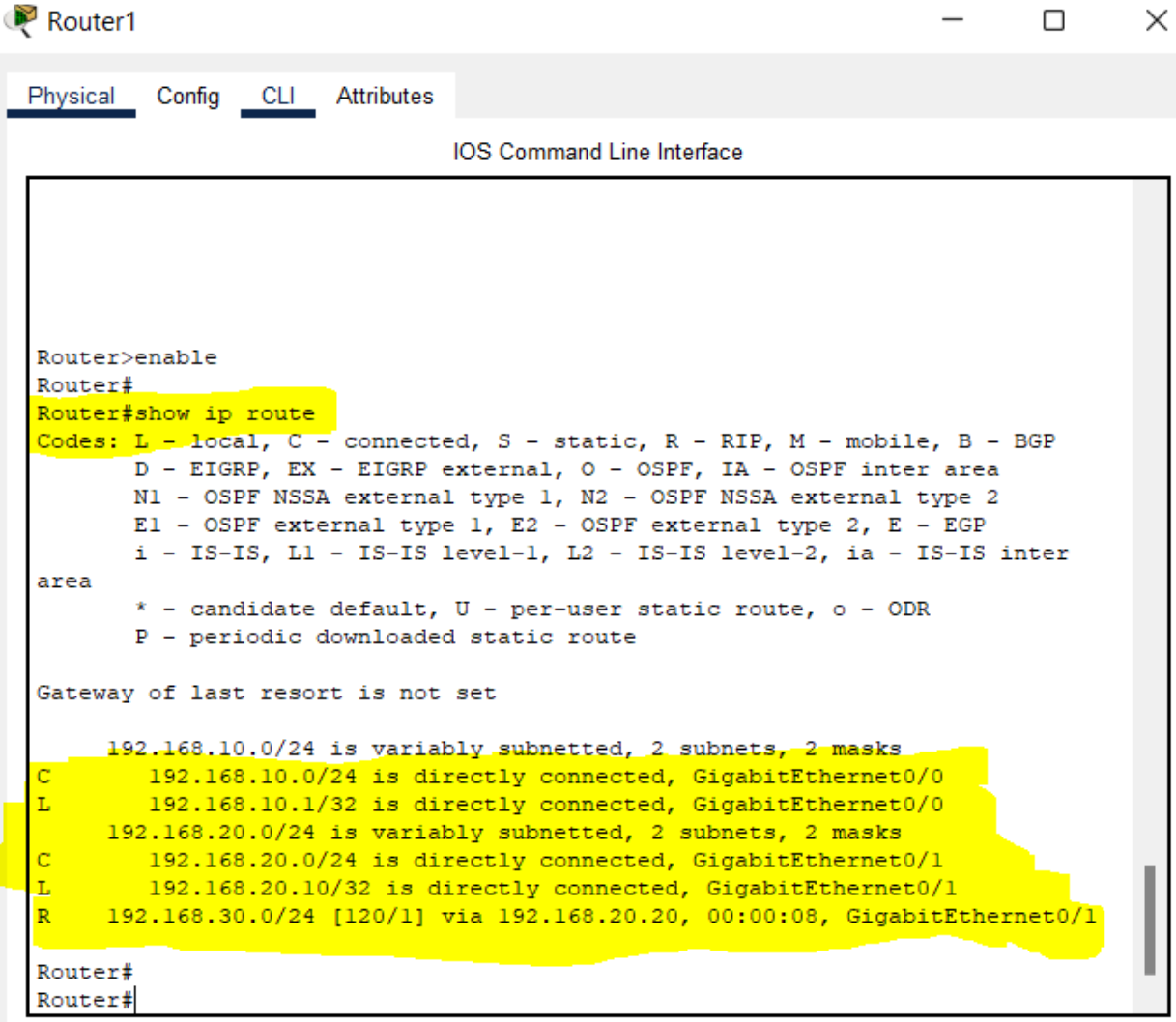
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## Routing Table:

We can check the routing table of Router1 using "**show ip route**" command from the privileged exec mode. Entries in routing table that start with C represent directly connected networks, these are the network segments that are directly connected with the router, for example, in our topology network 1 (192.168.10.0/24) and network 2 (192.168.20.0/24) are directly connected networks for Router1. Routes learned through RIP protocol appear in the routing table starting with **R** as shown in the below snippet (192.168.30.0/24 network is learned by Router1 using RIP protocol)



The screenshot shows the Router1 CLI interface with the 'CLI' tab selected. The command 'show ip route' has been executed, displaying the routing table. The output includes codes for route types (L, C, S, R, M, B, D, EX, O, IA, N1, N2, E1, E2, E, i, L1, L2, ia, \*, U, o, P) and a list of routes. The routes are: 192.168.10.0/24 (C), 192.168.10.1/32 (L), 192.168.20.0/24 (C), 192.168.20.10/32 (L), and 192.168.30.0/24 (R). The routes are highlighted in yellow in the original image.

```
Router>enable
Router#
Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter
       area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

    192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.10.0/24 is directly connected, GigabitEthernet0/0
L       192.168.10.1/32 is directly connected, GigabitEthernet0/0
    192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/24 is directly connected, GigabitEthernet0/1
L       192.168.20.10/32 is directly connected, GigabitEthernet0/1
R       192.168.30.0/24 [120/1] via 192.168.20.20, 00:00:08, GigabitEthernet0/1

Router#
Router#
```

Ctrl+F6 to exit CLI focus

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We can check the routing table of Router2 using “*show ip route*” command from the privileged exec mode. Entries in routing table that start with C represent directly connected networks, these are the network segments that are directly connected with the router, for example, in our topology network 2 (192.168.20.0/24) and network 3 (192.168.30.0/24) are directly connected networks for Router2. Routes learned through RIP protocol appear in the routing table starting with R as shown in the below snippet (192.168.10.0/24 network is learned by Router2 using RIP protocol)

```
Router>
Router>enable
Router#
Router#
Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter
       area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

R    192.168.10.0/24 [120/1] via 192.168.20.10, 00:00:23, GigabitEthernet0/1
     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C     192.168.20.0/24 is directly connected, GigabitEthernet0/1
L     192.168.20.20/32 is directly connected, GigabitEthernet0/1
     192.168.30.0/24 is variably subnetted, 2 subnets, 2 masks
C     192.168.30.0/24 is directly connected, GigabitEthernet0/0
L     192.168.30.1/32 is directly connected, GigabitEthernet0/0

Router#
Router#
```

Ctrl+F6 to exit CLI focus

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