LAB 6: Dynamic Routing Configuration Using RIP, EIGRP, OSPF, and BGP

❖ Objectives

- To study the fundamental working concepts of dynamic routing protocols such as RIP, EIGRP, OSPF, and BGP.
- To configure and implement these routing protocols on routers using Cisco Packet Tracer for automatic route learning and communication between multiple networks.

❖ Hardware and Software Requirements

- Cisco Packet Tracer (Version 6.2 or above)
- Windows-based PC or Laptop

❖ Theory

1. Routing Information Protocol (RIP)

RIP is a distance-vector routing protocol that determines the best route based on hop count.

Operation:
Routers using RIP exchange their entire routing tables with directly connected neighbors at intervals of 30 seconds. The maximum allowable hop count is 15, and any route beyond this limit is considered unreachable.

Application:
RIP is generally used in small and simple network environments due to its easy configuration, although it suffers from slow convergence.

2. Enhanced Interior Gateway Routing Protocol (EIGRP)

EIGRP is an advanced routing protocol developed by Cisco, often referred to as a hybrid protocol.

Operation:
It uses the Diffusing Update Algorithm (DUAL) to calculate the most efficient path. Instead of sending periodic full updates, EIGRP transmits partial updates only when changes occur in the network topology.

Application:
EIGRP is widely used in Cisco-based enterprise networks where fast convergence and efficient use of bandwidth are required.

3. Open Shortest Path First (OSPF)

OSPF is a link-state routing protocol that maintains detailed information about the network topology.

Operation:
It applies the Dijkstra Shortest Path First (SPF) algorithm to determine optimal routing paths. Routers exchange Link State Advertisements (LSAs) to build and maintain a topology database.

Application:
OSPF is suitable for large and scalable networks as it supports hierarchical design through the use of areas such as Area 0.

4. Border Gateway Protocol (BGP)

BGP is a path-vector routing protocol used for exchanging routing information between different autonomous systems.

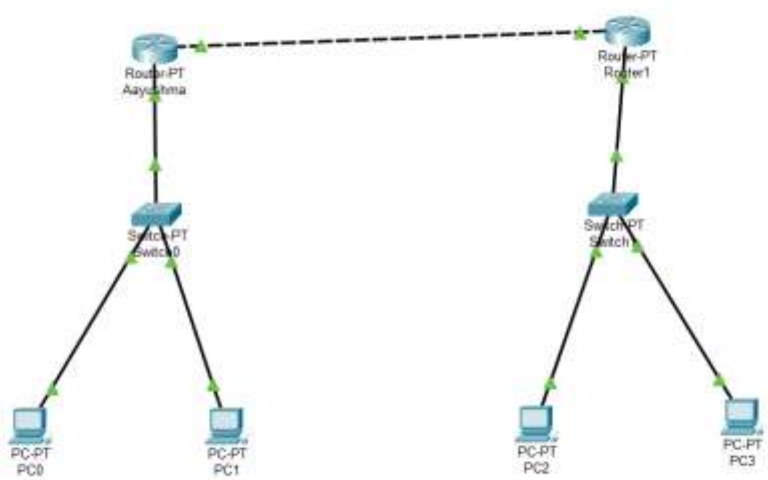
Operation:
Routing decisions in BGP are based on network policies, path attributes, and administrative rules rather than simple metrics like hop count.

Application:
BGP is the primary routing protocol used for Internet communication between Internet Service Providers (ISPs).

❖ <u>Implementation of Network Topology</u>

The network topology consists of two routers, **Aayushma** and **Router1**, connected through a serial or WAN link. **Switch0** connects **PC0** and **PC1** to Router0, forming the **192.168.1.0/24** network. Similarly, **Switch1** connects **PC2** and **PC3** to Router1, forming the **192.168.2.0/24** network. This setup enables communication between the two local area networks using dynamic routing protocols.

<u>Figure:</u>



<u>Configuration table:</u>

Device	Interface	IP Address	Subnet Mask	Default Gateway
Router0	FastEthernet0/1	192.168.1.1	255.255.255.0	N/A
Router0	FastEthernet0/0	10.0.0.1	255.0.0.0	N/A
Router1	FastEthernet0/1	192.168.2.1	255.255.255.0	N/A
Router1	FastEthernet0/0	10.0.0.2	255.0.0.0	N/A
PC0	FastEthernet0	192.168.1.2	255.255.255.0	192.168.1.1
PC1	FastEthernet0	192.168.1.3	255.255.255.0	192.168.1.1

PC2	FastEthernet0	192.168.2.2	255.255.255.0	192.168.2.1
PC3	FastEthernet0	192.168.2.3	255.255.255.0	192.168.2.1

❖ **Commands:**

1. RIP Configuration Commands

Router0:

Router(config)# router rip

Router(config-router)# version 2

Router(config-router)# network 192.168.1.0

Router(config-router)# network 10.0.0.0

Router(config-router)# no auto-summary

Router1:

Router(config)# router rip

Router(config-router)# version 2

Router(config-router)# network 192.168.2.0

Router(config-router)# network 10.0.0.0

Router(config-router)# no auto-summary

2. EIGRP Configuration Commands

Router0:

Router(config)# router eigrp 100

Router(config-router)# network 192.168.1.0 0.0.0.255

Router(config-router)# network 10.0.0.0 0.0.0.255

Router(config-router)# no auto-summary

Router1:

Router(config)# router eigrp 100

Router(config-router)# network 192.168.2.0 0.0.0.255

Router(config-router)# network 10.0.0.0 0.0.0.255

Router(config-router)# no auto-summary

3. OSPF Configuration Commands

Router0:

Router(config)# router ospf 1

Router(config-router)# network 192.168.1.0 0.0.0.255 area 0

Router(config-router)# network 10.0.0.0 0.0.0.255 area 0

Router1:

Router(config)# router ospf 1

Router(config-router)# network 192.168.2.0 0.0.0.255 area 0

Router(config-router)# network 10.0.0.0 0.0.0.255 area 0

4. BGP Configuration Commands

Router0 (AS 65001):

Router(config)# router bgp 65001

Router(config-router)# neighbor 10.0.0.2 remote-as 65002

Router(config-router)# network 192.168.1.0 mask 255.255.255.0

Router1 (AS 65002):

Router(config)# router bgp 65002

Router(config-router)# neighbor 10.0.0.1 remote-as 65001

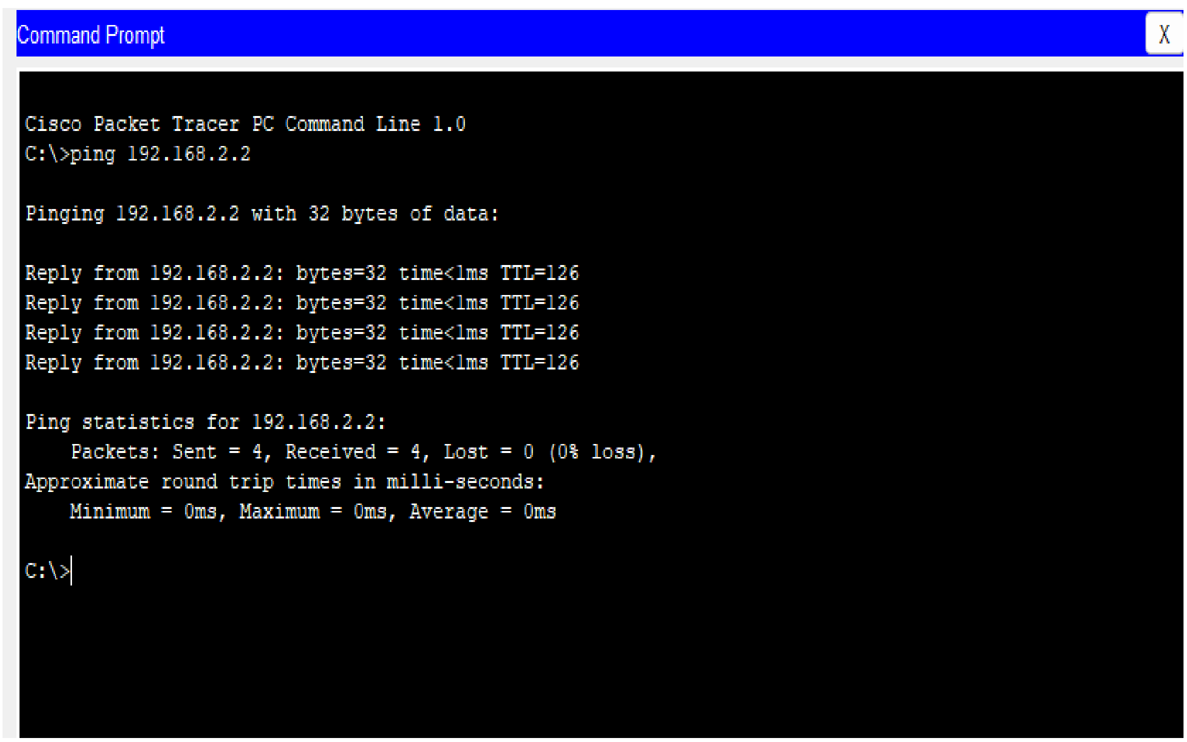
Router(config-router)# network 192.168.2.0 mask 255.255.255.0

❖ Result:

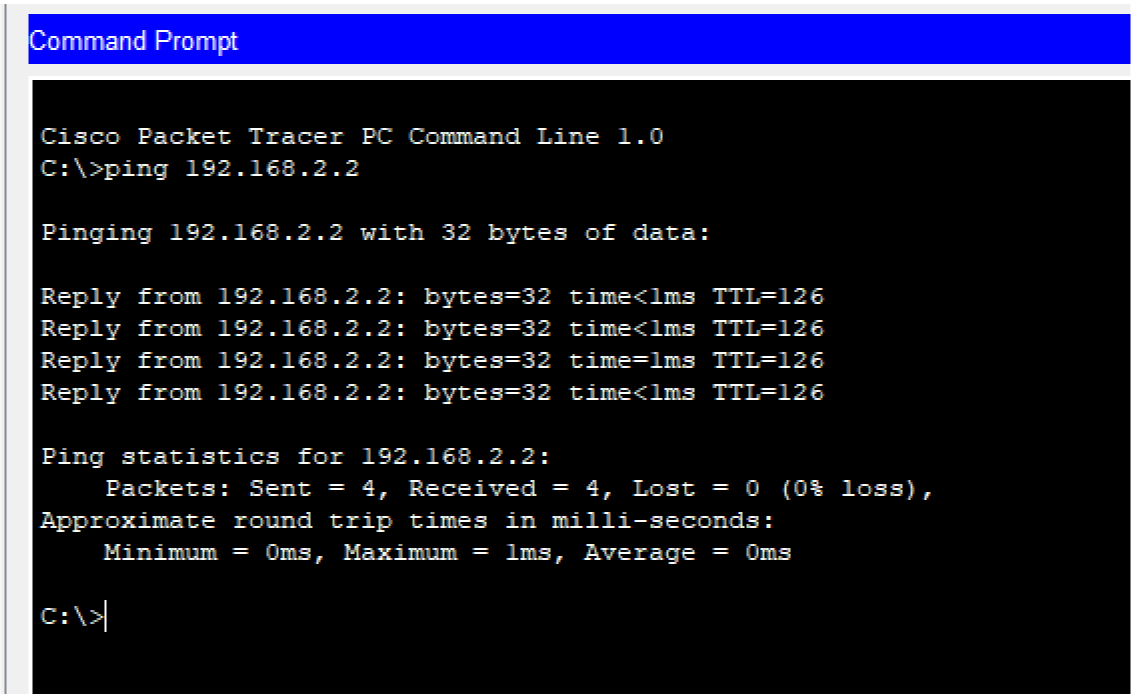
The network was configured successfully using different dynamic routing protocols. To confirm proper connectivity, a ping test was performed from PC0 (192.168.1.2) connected to Router0 to PC2 (192.168.2.2) connected to Router1. After configuring each protocol (RIP, EIGRP, OSPF, and BGP), the routers automatically updated their routing tables. The ping results showed that all packets were transmitted and received without any loss, confirming that the network connection was established correctly and the routing protocols were functioning properly.

Figure:

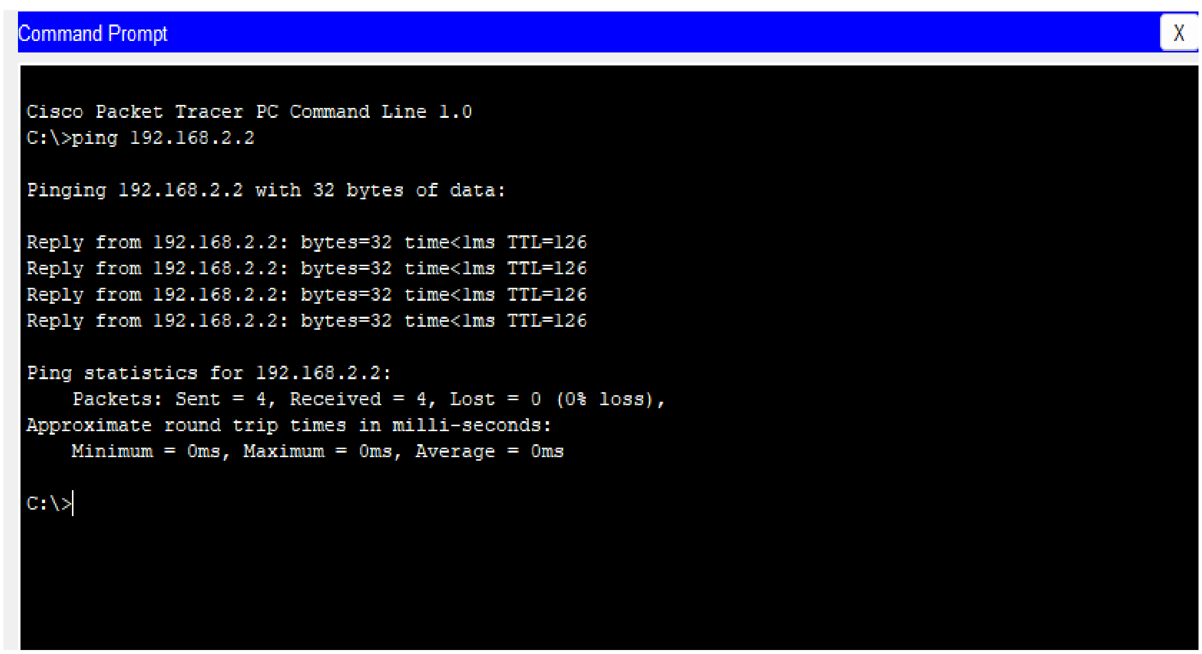
1. Ping in RIP



2. Ping in EIGRP



3. Ping in OSPF



4. Ping in BGP

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Command Prompt

Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:

Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Reply from 192.168.2.2: bytes=32 time=1ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.2.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

❖ Discussion:

In this lab, we configured and analyzed dynamic routing protocols such as RIP, EIGRP, OSPF, and BGP using Cisco Packet Tracer. First, we implemented the network topology to enable communication between two different LAN networks (192.168.1.0/24 and 192.168.2.0/24). Through this setup, we observed how routers automatically exchange routing information. Initially, we configured RIP and found that it was simple to set up; however, it has limitations such as slower convergence and hop-count restrictions. Next, we implemented EIGRP, which provided faster convergence and more efficient bandwidth usage through partial updates. After that, we configured OSPF and saw how it supports scalability using Area 0 and the SPF algorithm. Finally, we explored BGP, where we learned how routing between different autonomous systems is based on policies rather than simple metrics. Therefore, this practical implementation helped us clearly understand the operational differences and applications of each protocol.