LAB 6: DYNAMIC ROUTING CONFIGURATION: RIP, EIGRP, OSPF, BGP

OBJECTIVES

1. To understand the working principles of dynamic routing protocols including RIP, EIGRP, OSPF, and BGP.

2. To configure these protocols on routers using Cisco Packet Tracer to enable automatic route discovery and communication between different networks.

HARDWARE AND SOFTWARE REQUIREMENTS

1. Cisco Packet Tracer (Version 6.2 or higher)

2. Windows PC/Laptop

THEORY

1. RIP (Routing Information Protocol)

RIP is a distance-vector routing protocol that uses hop count as its primary metric.

Operation: It works by sending the entire routing table to directly connected neighbors every 30 seconds. It limits the hop count to 15; 16 is considered unreachable.

Application: Used in small networks where simplicity is required, though it has slow convergence times.

2. EIGRP (Enhanced Interior Gateway Routing Protocol)

EIGRP is an advanced distance-vector protocol (often called hybrid) developed by Cisco.

Operation: It uses the Diffusing Update Algorithm (DUAL) to calculate the shortest path. It sends partial updates only when topology changes occur, rather than full periodic updates.

Application: Used in Cisco-based enterprise networks requiring fast convergence and efficient bandwidth usage.

3. OSPF (Open Shortest Path First)

OSPF is a link-state routing protocol that maintains a map of the network topology.

Operation: It uses the Dijkstra algorithm (Shortest Path First) to calculate the best path. Routers exchange Link State Advertisements (LSAs) to build a topology database.

Application: Used in large, scalable enterprise networks because it supports hierarchical design using Areas (e.g., Area 0).

4. BGP (Border Gateway Protocol)

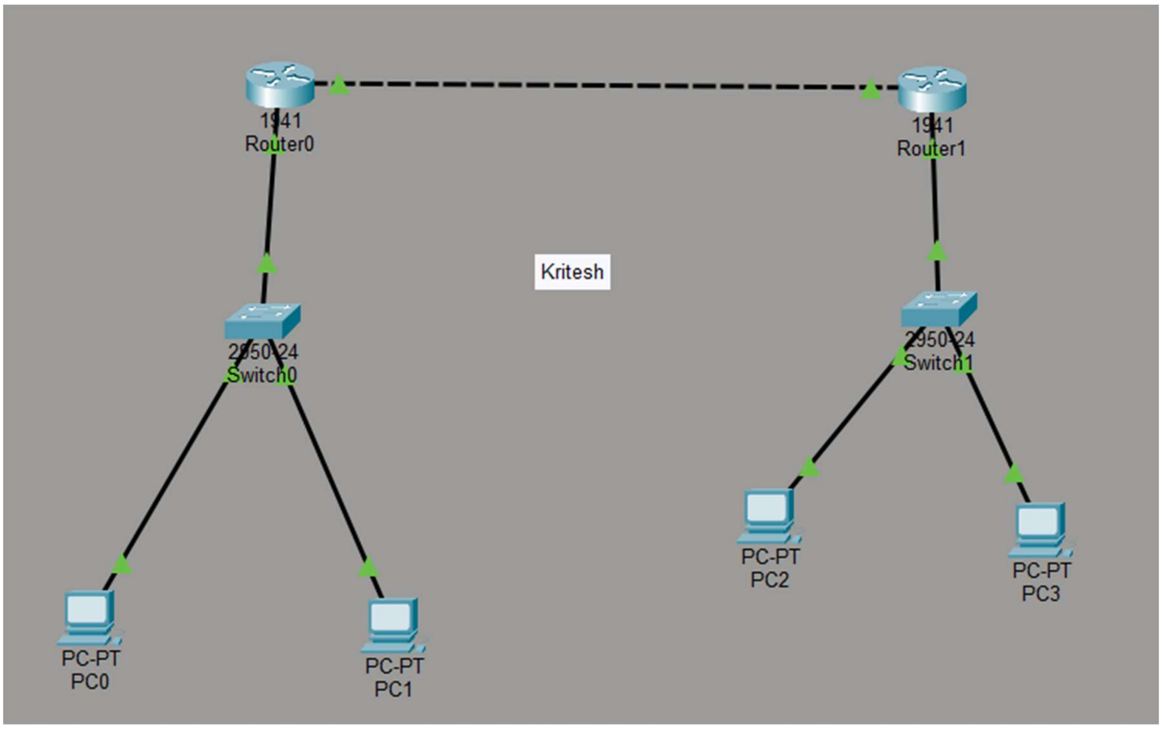
BGP is a path-vector protocol used to exchange routing information between different autonomous systems (AS).

Operation: It makes routing decisions based on paths, network policies, or rule-sets configured by a network administrator rather than just technical metrics.

Application: It is the primary protocol used to route traffic across the Internet (ISP to ISP).

NETWORK TOPOLOGY

A topology was created using Router0 and Router1 connected via a serial/WAN link. Switch0 connects PC0 and PC1 to Router0 (Network 192.168.1.0/24). Switch1 connects PC2 and PC3 to Router1 (Network 192.168.2.0/24).



Configuration Table:

IP Configuration Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
Router0	Gig0/1	192.168.1.1	255.255.255.0	N/A
Router0	Gig0/0	10.0.0.1	255.0.0.0	N/A
Router1	Gig0/1	192.168.2.1	255.255.255.0	N/A
Router1	Gig0/0	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

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 successfully configured using the various dynamic routing protocols. To verify the connectivity, a ping request was sent from PC0 (192.168.1.2) connected to Router0 to PC2 (192.168.2.2) connected to Router1. For each protocol configured (RIP, EIGRP, OSPF, and BGP), the routing tables were updated automatically, and all packets were sent and received successfully which validates the connection is correct.

```
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=11ms TTL=126
Reply from 192.168.2.2: bytes=32 time=12ms TTL=126
Reply from 192.168.2.2: bytes=32 time=4ms 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 = 12ms, Average = 6ms
```

Fig: Ping in RIP configuration

```
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=11ms TTL=126
Reply from 192.168.2.2: bytes=32 time=12ms TTL=126
Reply from 192.168.2.2: bytes=32 time=12ms 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 = 12ms, Average = 8ms
```

Fig: Ping in EIGRP

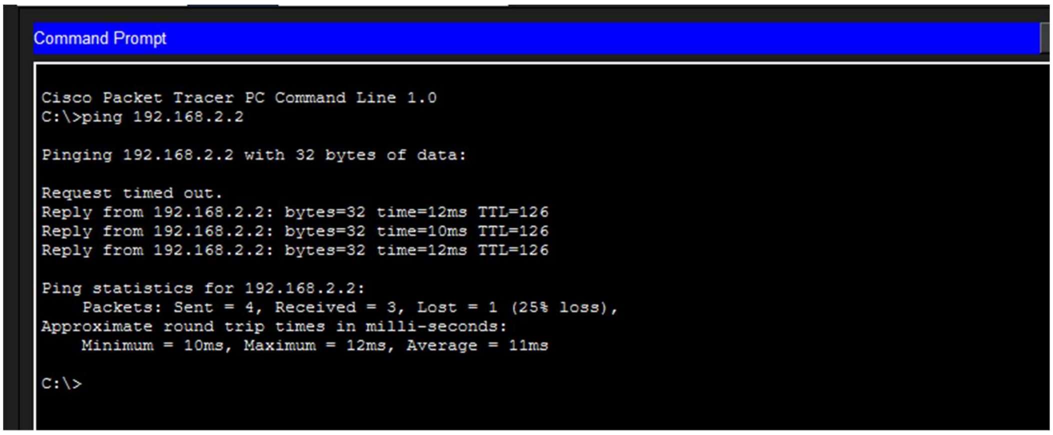
```
C:\>ping 192.168.2.2

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=11ms 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 = 11ms, Average = 3ms
```

Fig: Ping in OSPF



```
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:

Request timed out.
Reply from 192.168.2.2: bytes=32 time=12ms TTL=126
Reply from 192.168.2.2: bytes=32 time=10ms TTL=126
Reply from 192.168.2.2: bytes=32 time=12ms TTL=126

Ping statistics for 192.168.2.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 10ms, Maximum = 12ms, Average = 11ms

C:\>
```

Fig: Ping in BGP

DISCUSSION AND CONCLUSION

During the lab session, we implemented the concept of dynamic routing to better understand how routers automatically exchange information. RIP showed us basic distance-vector routing, while EIGRP demonstrated faster convergence. OSPF allowed us to understand link-state databases, and BGP introduced inter-AS routing concepts.

Hence the lab was completed with a proper knowledge and implementation of dynamic routing protocols using Cisco Packet Tracer.