EXPERIMENT 5

AIM

To explore the basics of routing, understand IP address assignment on PCs and routers, study how communication happens between multiple networks, and apply these ideas by creating a routing simulation in Cisco Packet Tracer.

THEORY

Routing is the method of deciding the path for data packets to move from a sender to the correct receiver across different networks.

A **router** is the device responsible for linking two or more networks and directing traffic according to IP addresses.

Routers maintain a **routing table**, which keeps track of networks and the ways to reach them.

Two main types of routing exist:
1. **Static Routing** – Network paths are added manually by the administrator.
2. **Dynamic Routing** – Routers learn and update routes automatically using protocols like OSPF, RIP, or EIGRP.

Example: If a computer in 192.168.1.0/24 needs to reach another in 192.168.2.0/24, the router looks at its table and forwards the packet to the right destination.

How Routing Functions Between Networks

1. When a device needs to communicate with another system outside its own subnet, it first sends the packet to its default gateway (the router).

2. The router then analyzes the destination IP address and refers to its routing table to decide the next step.

3. If the target network is directly connected, the router forwards the packet through the corresponding interface. Otherwise, it hands the packet over to another router (next hop) until it eventually reaches the correct network.

Illustration: Suppose a host in the 192.168.1.0/24 network needs to contact a host in 192.168.2.0/24. The data packet is sent to the router, which knows the route to 192.168.2.0/24 and delivers it accordingly.

Thus, routing enables smooth communication between devices located in different subnets.

IP Address Allocation

- **On PCs**
    - Each system is given a unique IP.
    - A subnet mask is set to indicate the local network.
    - The default gateway (router's IP) is specified to allow communication with other networks.
- **On Routers**
    - Every interface of a router has its own IP from the subnet it connects to.
    - This makes the router part of multiple networks, enabling it to forward data between them.

Example: A PC with 192.168.10.5/24 and gateway 192.168.10.1 connects to a router with interface 192.168.10.1/24. The router may also have another interface like 192.168.20.1/24 for a different network.

Simulation in CISCO Packet Tracer

- Devices in the same subnet can talk without issues.
- To connect devices from different subnets, a **router** is needed since switches only work within a single network.
- In Packet Tracer, IPs can be manually set using the **Config tab** of each device.
- A default gateway (router interface IP) is required for PCs to reach other networks.
- Successful configuration can be checked using **ping**.

Procedure

1. Designing the Topology

- Insert 2 routers (2911), 2 switches, and 4 PCs into Cisco Packet Tracer.
- Connect the devices as follows:
    - PC0 and PC2 → Switch0
    - PC3 and PC4 → Switch1
    - Switch0 → Router2 (GigabitEthernet0/0)
    - Switch1 → Router3 (GigabitEthernet0/0)
    - Router2 ↔ Router3 (serial or Ethernet link)

2. Configuring IP Addresses on PCs

On each PC, go to **Desktop → IP Configuration** and set the IP, subnet mask, and default gateway:

- PC0 → 192.168.1.10 / 255.255.255.0 / Gateway 192.168.1.1
- PC2 → 192.168.1.20 / 255.255.255.0 / Gateway 192.168.1.1
- PC3 → 192.168.2.10 / 255.255.255.0 / Gateway 192.168.2.1
- PC4 → 192.168.2.20 / 255.255.255.0 / Gateway 192.168.2.1

3. Configuring Router Interfaces (GUI Method)

On each router, open **Config → Interfaces** and set the following addresses:

- **Router2**
  - Gi0/0 → 192.168.1.1 / 255.255.255.0
  - Serial0/0/0 → 10.0.0.1 / 255.255.255.252
- **Router3**
  - Gi0/0 → 192.168.2.1 / 255.255.255.0
  - Serial0/0/0 → 10.0.0.2 / 255.255.255.252

4. Setting Up Static Routes

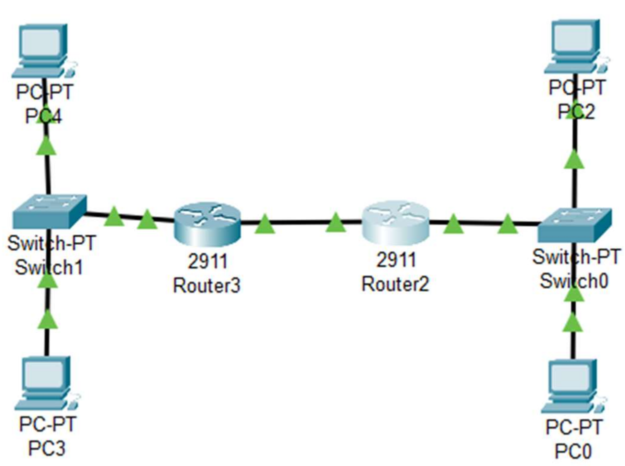
In each router: **Config → Routing → Static**

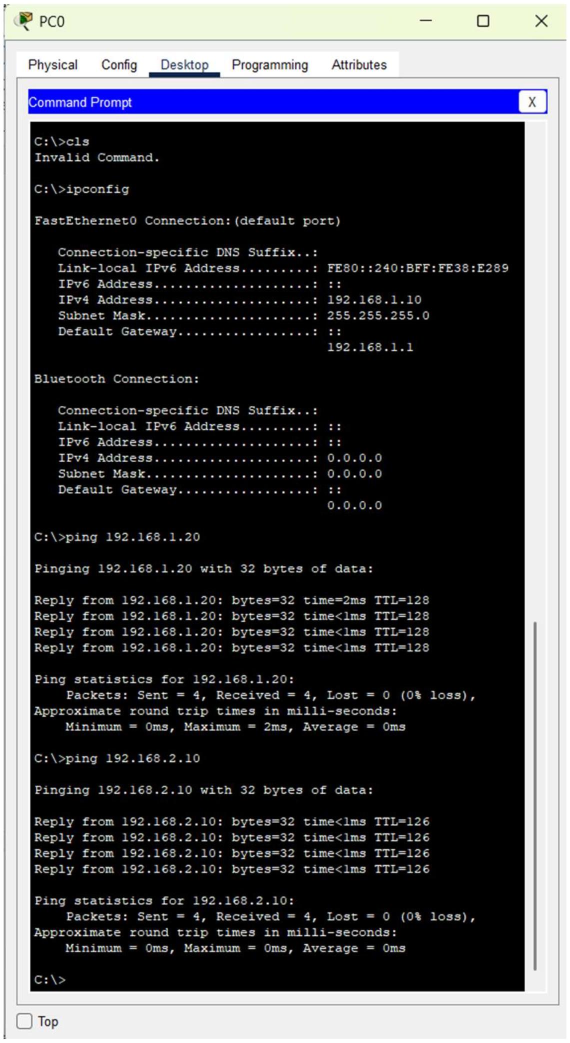
- On Router2 → add:
  - Destination Network: 192.168.2.0
  - Mask: 255.255.255.0
  - Next Hop: 10.0.0.2

- On Router3 → add:
  - Destination Network: 192.168.1.0
  - Mask: 255.255.255.0
  - Next Hop: 10.0.0.1

5. Verifying the Network

- From PC0, open **Command Prompt** → run ipconfig to confirm IP configuration.
- Perform connectivity tests:
  - Ping PC2 → should succeed (within the same LAN).
  - Ping PC3 and PC4 → should succeed (across different LANs through routers).
- Repeat the ping test from other PCs for full confirmation.





Observations

1. The IP configuration of **PC0** was verified:
    - IPv4 Address → 192.168.1.10
    - Subnet Mask → 255.255.255.0
    - Default Gateway → 192.168.1.1
2. **Ping Test Results:**
    - Ping from PC0 → PC2 (192.168.1.20) was successful with 0% packet loss.
    - Ping from PC0 → PC3 (192.168.2.10) was also successful with 0% packet loss.
    - The round-trip times were minimal, showing stable and fast communication.

CONCLUSION:

The experiment clearly demonstrated the key concepts of routing and how routers enable connectivity between separate networks. By manually assigning IP addresses, subnet masks, and default gateways on both PCs and routers in Cisco Packet Tracer, communication between two individual LANs was successfully achieved. Implementing static routes guaranteed that packets were correctly transmitted between Router2 and Router3. Ping tests verified complete end-to-end connectivity without any packet loss, validating the accuracy of the routing setup. Overall, the experiment highlights the essential role of accurate IP configuration, proper gateway assignment, and correct routing in ensuring effective communication across multiple networks.