Practical – 5

Aim of the Practical :- To configure and test static routing in Cisco Packet Tracer among five interconnected networks

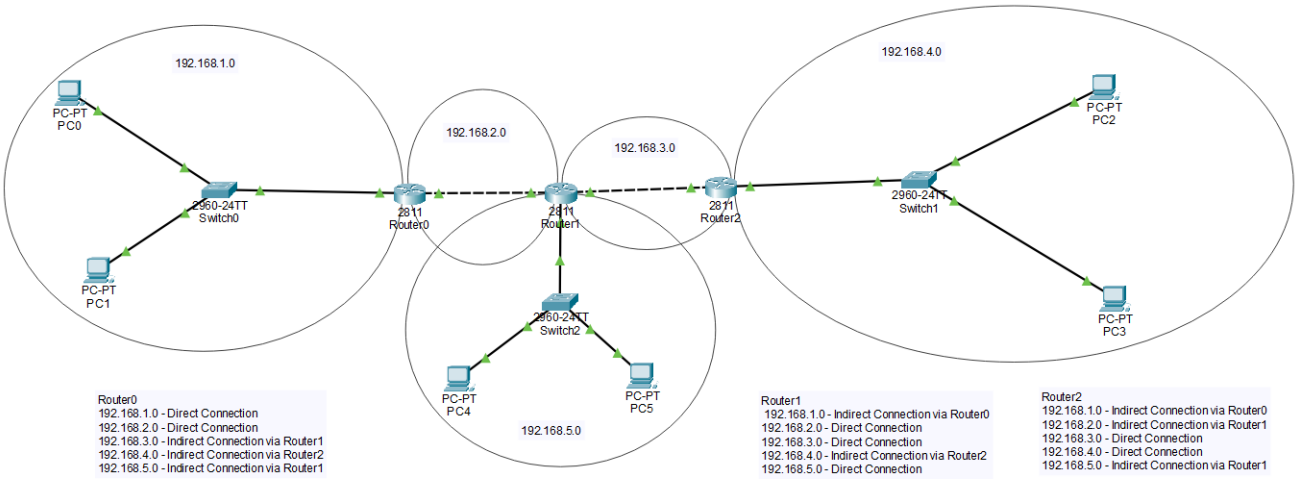
Requirements :- Cisco Packet Tracer, PC's, Switches, Ethernet cable and Router.

Objectives

1. To learn and apply the principles of static routing by manually configuring routes on interconnected routers to enable communication between multiple, non-directly connected networks.

2. To verify and troubleshoot network connectivity using essential networking commands such as ping, traceroute, and show ip route to confirm proper routing and packet forwarding.

Practical:



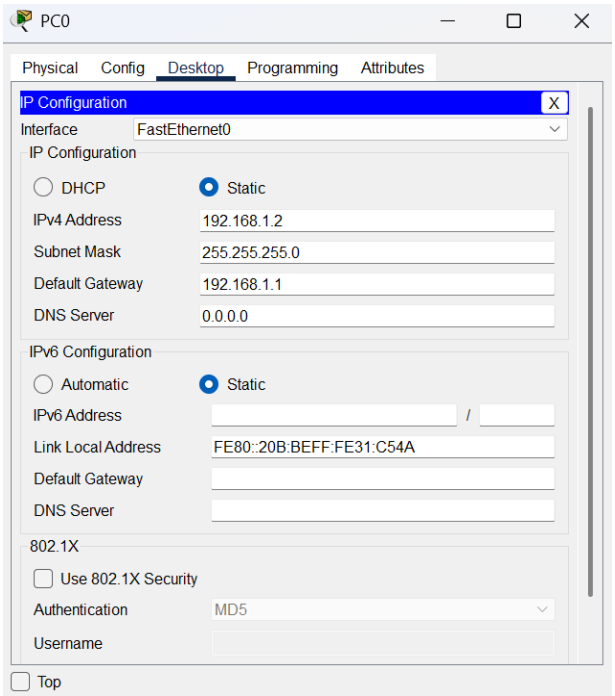
The diagram shows a multi-network environment created in Cisco Packet Tracer. The topology is built around a central backbone of three routers (**Router0**, **Router1**, **Router2**) which link together three distinct Local Area Networks (LANs) and two point-to-point Wide Area Network (WAN) links.

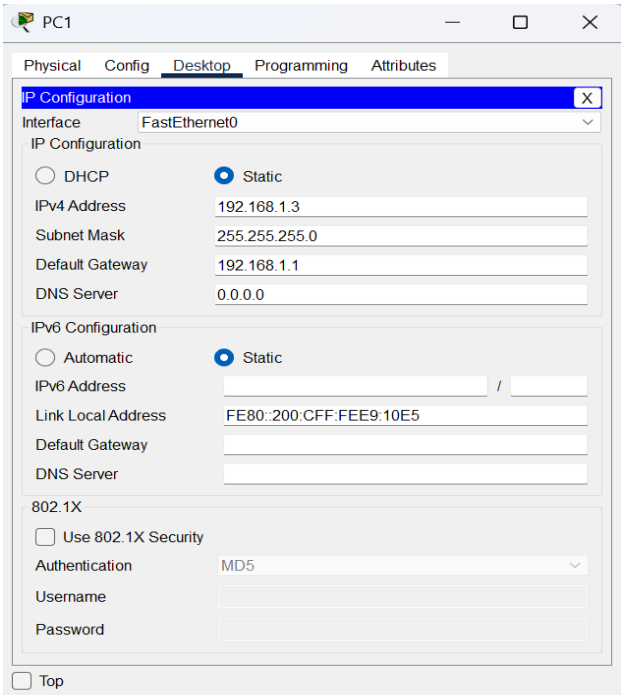
The five networks are organized as follows:

- **Left LAN (192.168.1.0/24):** Contains Switch0 connecting PC0 and PC1 to Router9.
- **Central LAN (192.168.5.0/24):** Contains Switch2 connecting PC4 and PC5 to Router10.
- **Right LAN (192.168.4.0/24):** Contains Switch1 connecting PC2 and PC3 to Router11.
- **WAN Links:** The routers are interconnected serially. The link between Router9 and Router10 constitutes the 192.168.2.0/24 network, and the link between Router10 and Router11 constitutes the 192.168.3.0/24 network.

CONFIGURATION OF ALL DEVICES

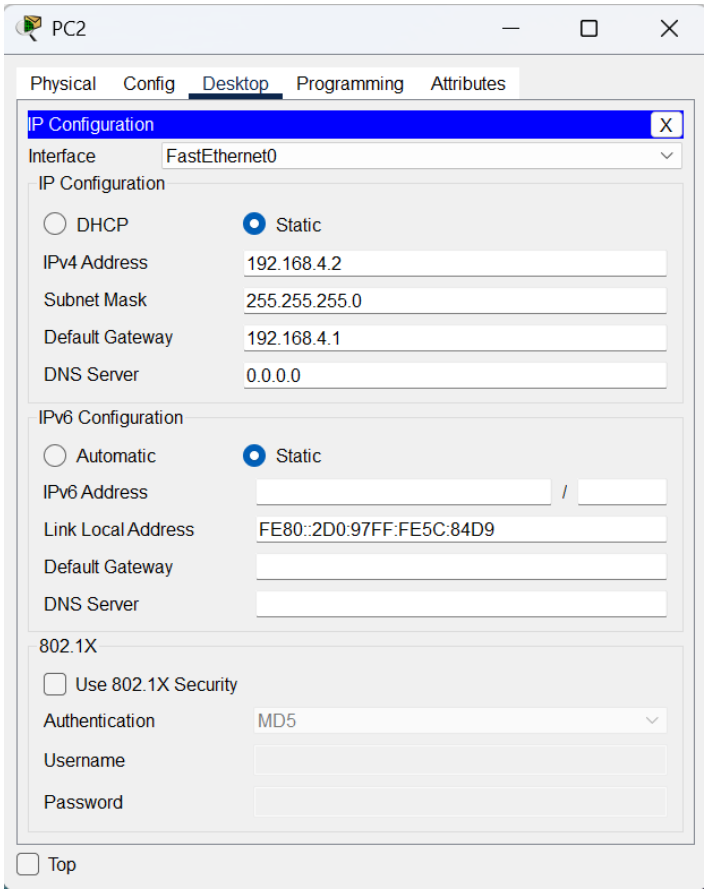
• PC Configuration:

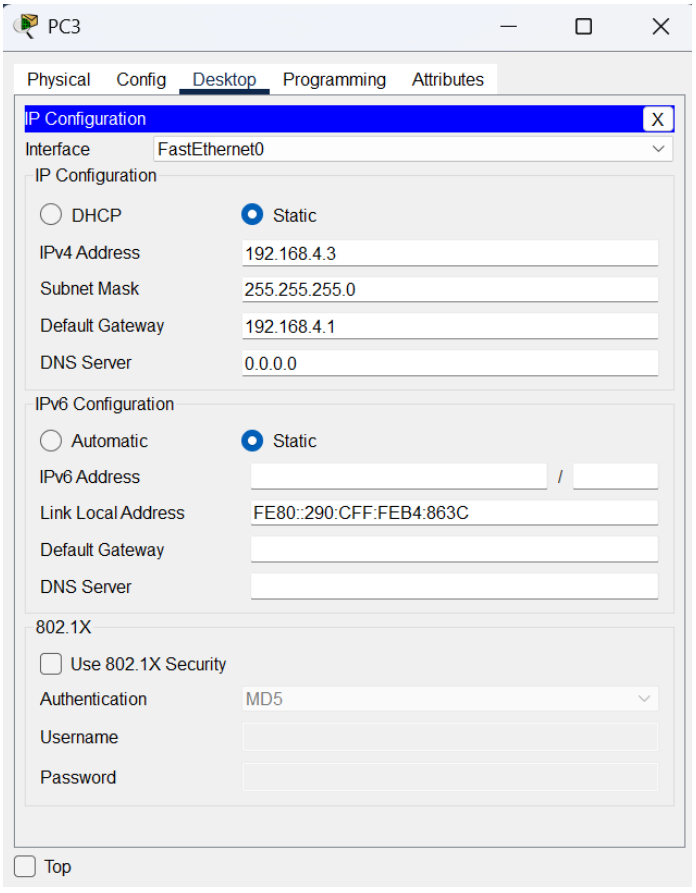




- PC0 Configuration:
  - IPv4 Address: 192.168.1.2
  - Subnet Mask: 255.255.255.0
  - Default Gateway: 192.168.1.1
- PC1 Configuration:
  - IPv4 Address: 192.168.1.3
  - Subnet Mask: 255.255.255.0
  - Default Gateway: 192.168.1.1

Both PCs are correctly configured to be on the same local network. Critically, they both point to 192.168.1.1 as their default gateway.

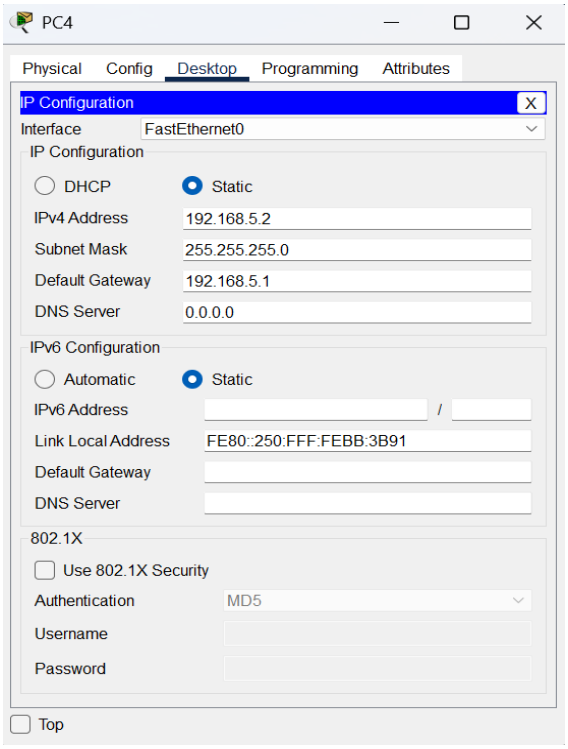


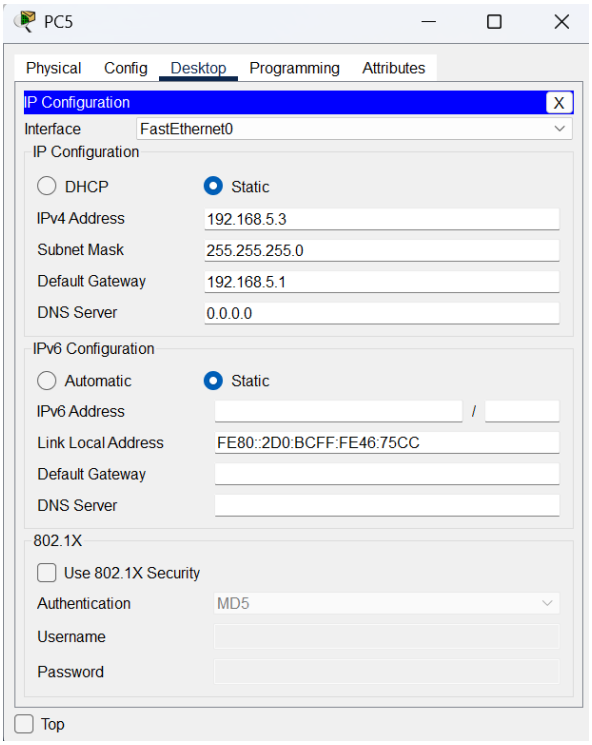


- **PC2 Configuration**:
  - **IPv4 Address**: 192.168.4.2
  - **Subnet Mask**: 255.255.255.0
  - **Default Gateway**: 192.168.4.1

- **PC3 Configuration**:
  - **IPv4 Address**: 192.168.4.3
  - **Subnet Mask**: 255.255.255.0
  - **Default Gateway**: 192.168.4.1

Both PCs are assigned unique IP addresses within the same subnet. They share a **Default Gateway** of **192.168.4.1**, which is the IP address of the local interface on **Router11**.





- **PC4 Configuration**:
  - **IPv4 Address**: 192.168.5.2
  - **Subnet Mask**: 255.255.255.0
  - **Default Gateway**: 192.168.5.1
- **PC5 Configuration**:
  - **IPv4 Address**: 192.168.5.3
  - **Subnet Mask**: 255.255.255.0
  - **Default Gateway**: 192.168.5.1

Both PCs are assigned the **Default Gateway** address of **192.168.5.1**. This IP corresponds to the interface on the central router, **Router10**, which serves as the gateway for this entire LAN.

• Router Configuration:

– Configure interfaces with the specified IP addresses and subnet masks.

– Configure static routes on each router to reach all non-directly connected networks.

Router 0

```
Router#show running-config
Building configuration...

Current configuration : 772 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
!
license // not shown due to security
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
```

```
!
!
!
!
!
!
interface FastEthernet0/0
ip address 192.168.1.1 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet0/1
ip address 192.168.2.1 255.255.255.0
duplex auto
speed auto
!
interface Vlan1
no ip address
shutdown
!
ip classless
ip route 192.168.3.0 255.255.255.0 192.168.2.2
ip route 192.168.4.0 255.255.255.0 192.168.3.2
ip route 192.168.5.0 255.255.255.0 192.168.2.2
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
```

```
!
!
end
```

This is the leftmost router, serving as the gateway for the 192.168.1.0/24 LAN.

Interface Configuration

- **interface FastEthernet0/0**: Configured with 192.168.1.1, serving as the default gateway for PC0 and PC1.
- **interface FastEthernet0/1**: Configured with 192.168.2.1, connecting to Router1.

Static Route Configuration

- **ip route 192.168.3.0 255.255.255.0 192.168.2.2**: To reach the link between Router1 and Router2, this route forwards packets to Router1.
- **ip route 192.168.4.0 255.255.255.0 192.168.3.2**: To reach the far-right LAN, this route forwards packets to Router1.
- **ip route 192.168.5.0 255.255.255.0 192.168.2.2**: To reach the central LAN, this route forwards packets to Router1.

Router 1

```
Router#show running-config
Building configuration...


Current configuration : 896 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
```

```
no ip cef
no ipv6 cef
!
!
!
!
license // not shown due to security
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface FastEthernet0/0
ip address 192.168.2.2 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet0/1
ip address 192.168.3.1 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet1/0
ip address 192.168.5.1 255.255.255.0
duplex auto
speed auto
!
```

```
interface FastEthernet1/1
no ip address
duplex auto
speed auto
shutdown
!
interface Vlan1
no ip address
shutdown
!
ip classless
ip route 192.168.4.0 255.255.255.0 192.168.3.2
ip route 192.168.1.0 255.255.255.0 192.168.2.1
!
ip flow-export version 9
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end
```

This is the central router, connecting all three LANs and both WAN links.

Interface Configuration

- **interface FastEthernet0/0**: Configured with 192.168.2.2, connecting to Router0.
- **interface FastEthernet0/1**: Configured with 192.168.3.1, connecting to Router2.
- **interface FastEthernet1/0**: Configured with 192.168.5.1, serving as the **default gateway** for PC4 and PC5.

Static Route Configuration

- ip route 192.168.1.0 255.255.255.0 192.168.2.1: To reach the far-left network, this route correctly forwards packets to Router0.
- ip route 192.168.4.0 255.255.255.0 192.168.3.2: To reach the far-right network, this route correctly forwards packets to Router2.

Router 2

```
Router#show running-config
Building configuration...

Current configuration : 772 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
!
license udi pid CISCO2811/K9 sn FTX1017CSWT-
!
!
!
!
!
```

```
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface FastEthernet0/0
ip address 192.168.3.2 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet0/1
ip address 192.168.4.1 255.255.255.0
duplex auto
speed auto
!
interface Vlan1
no ip address
shutdown
!
ip classless
ip route 192.168.2.0 255.255.255.0 192.168.3.1
ip route 192.168.1.0 255.255.255.0 192.168.2.1
ip route 192.168.5.0 255.255.255.0 192.168.3.1
!
ip flow-export version 9
!
!
!
!
!
!
!
```

```
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end
```

This is the rightmost router, serving as the gateway for the 192.168.4.0/24 LAN.

Interface Configuration

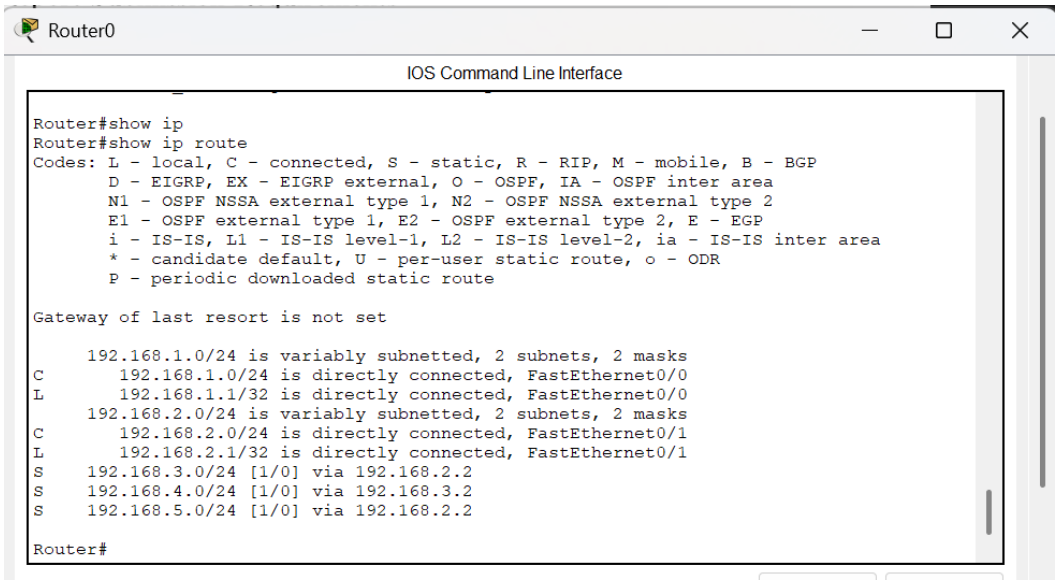
- **interface FastEthernet0/1**: Configured with 192.168.4.1, serving as the default gateway for PC2 and PC3.
- **interface FastEthernet0/0**: Configured with 192.168.3.2, connecting to Router1.

Static Route Configuration

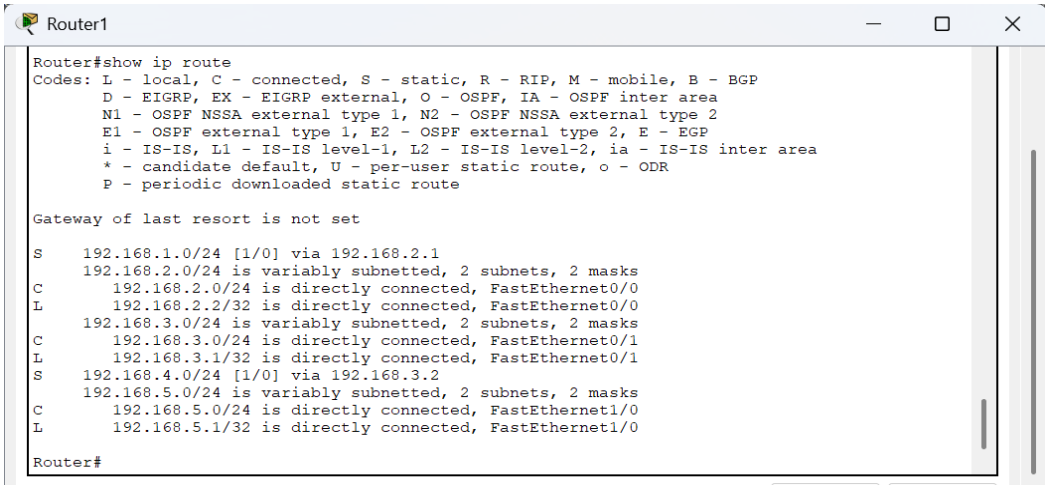
- **ip route 192.168.1.0 255.255.255.0 192.168.2.1**: To reach the far-left LAN, this route forwards packets to Router1.
- **ip route 192.168.2.0 255.255.255.0 192.168.3.1**: To reach the link between Router0 and Router1, this route forwards packets to Router1.
- **ip route 192.168.5.0 255.255.255.0 192.168.3.1**: To reach the central LAN, this route forwards packets to Router1.

ROUTING TABLES

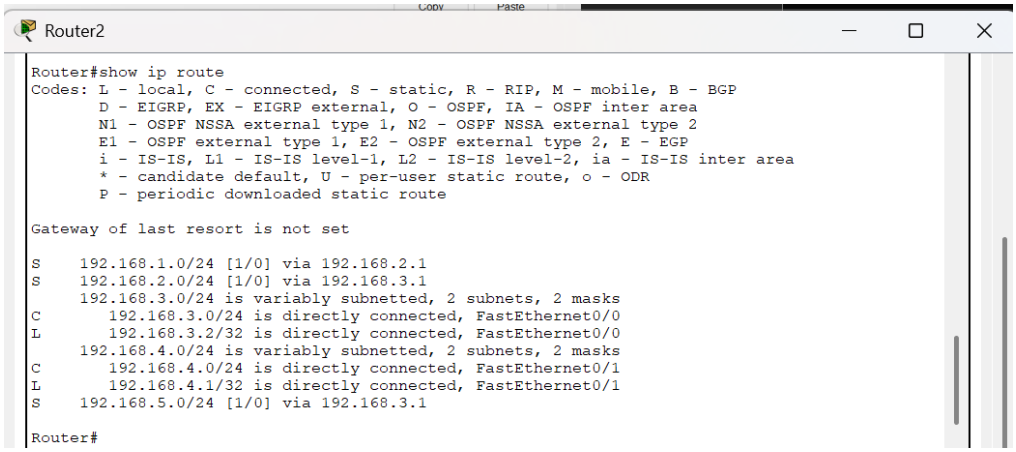
Router0



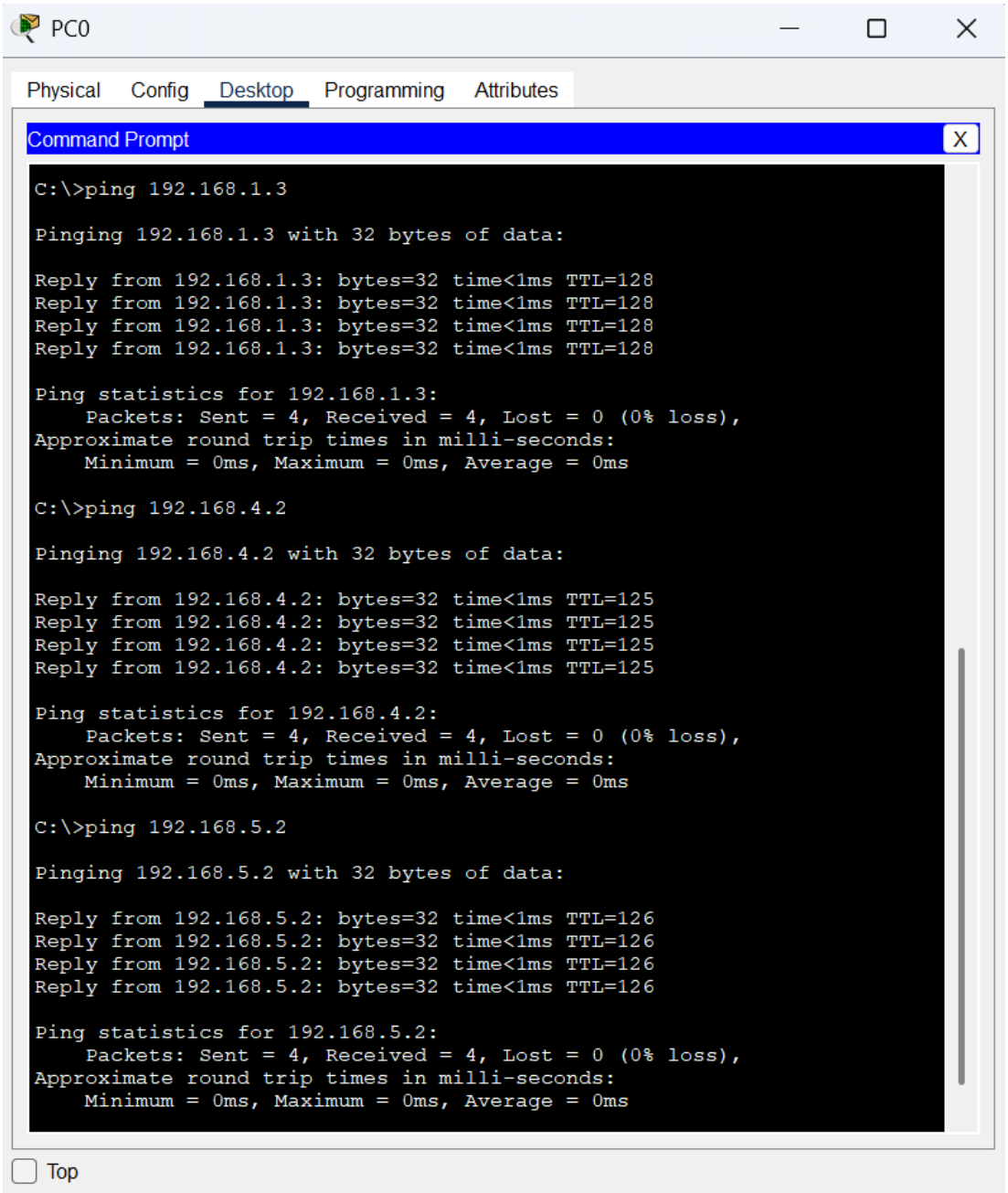
Router1



Router2

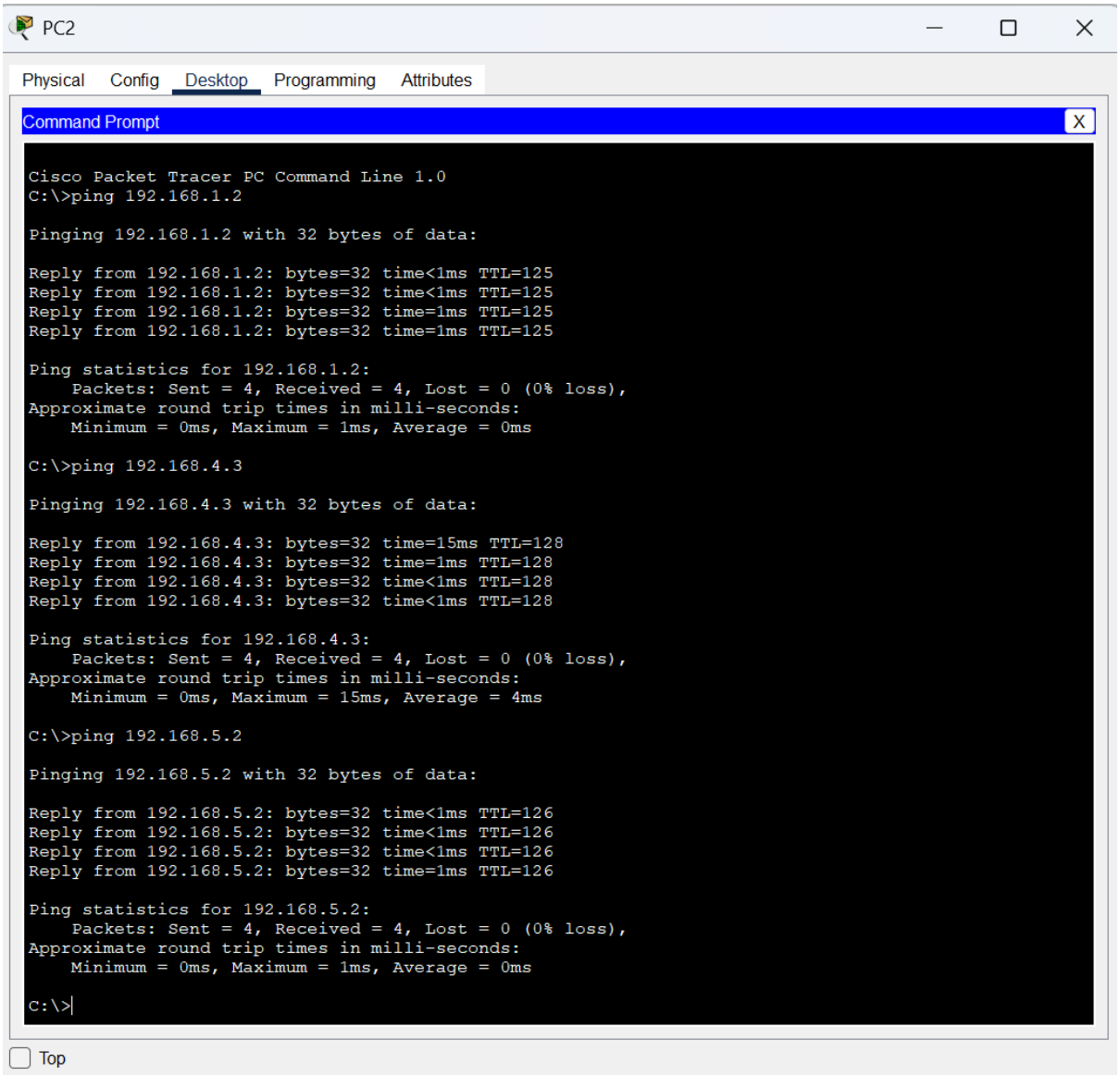


CONNECTIVITY TESTING



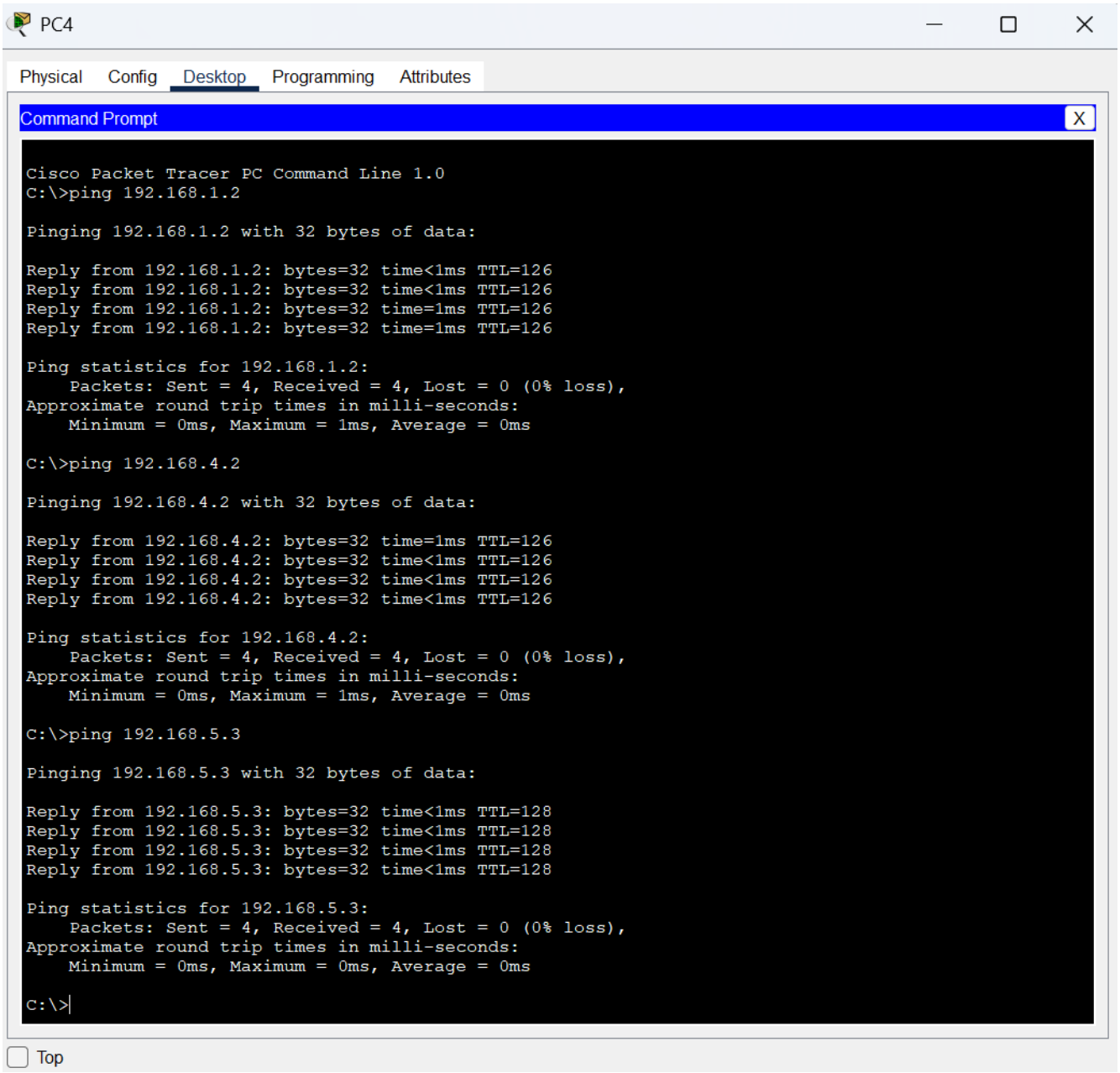
Connectivity Test from PC0

This screenshot shows a series of ping tests initiated from **PC0** (192.168.1.2). The tests were conducted to verify connectivity to a local device (**PC1** at 192.168.1.3), a remote device in the central network (**PC4** at 192.168.5.2), and a remote device in the far-right network (**PC2** at 192.168.4.2). The 0% packet loss in all tests confirms that the static routing on **Router0** is configured correctly, enabling successful communication from the leftmost LAN to all other parts of the network.



Connectivity Test from PC2

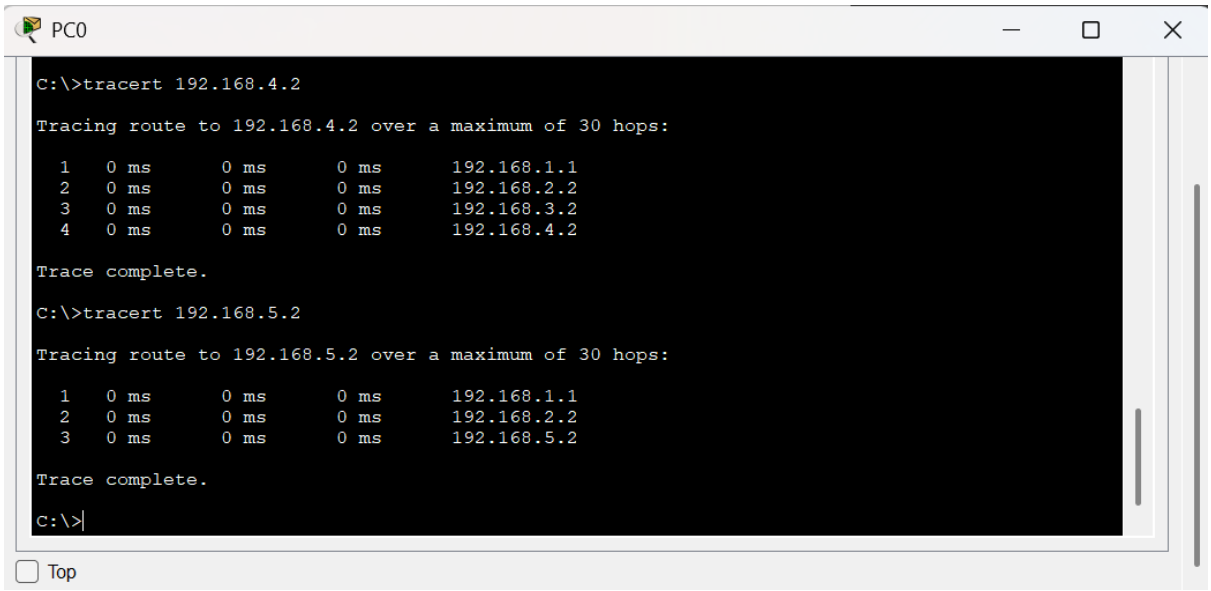
This screenshot documents the ping tests performed from **PC2** (192.168.4.2). Pings were successfully sent to a local device (**PC3** at 192.168.4.3), a remote device in the central network (**PC4** at 192.168.5.2), and a remote device in the far-left network (**PC0** at 192.168.1.2). The successful results demonstrate that the routing on **Router2** is correct and that bidirectional, end-to-end communication is fully established across the entire topology.



Connectivity Test from PC4

This screenshot displays the connectivity tests from **PC4** (192.168.5.2), the central-most PC. Pings to a local device (**PC5** at 192.168.5.3), a remote device on the left (**PC0** at 192.168.1.2), and a remote device on the right (**PC2** at 192.168.4.2) were all successful. This validates that the central router, **Router1**, is correctly routing traffic to both adjacent routers, confirming its pivotal role in the network's full functionality.

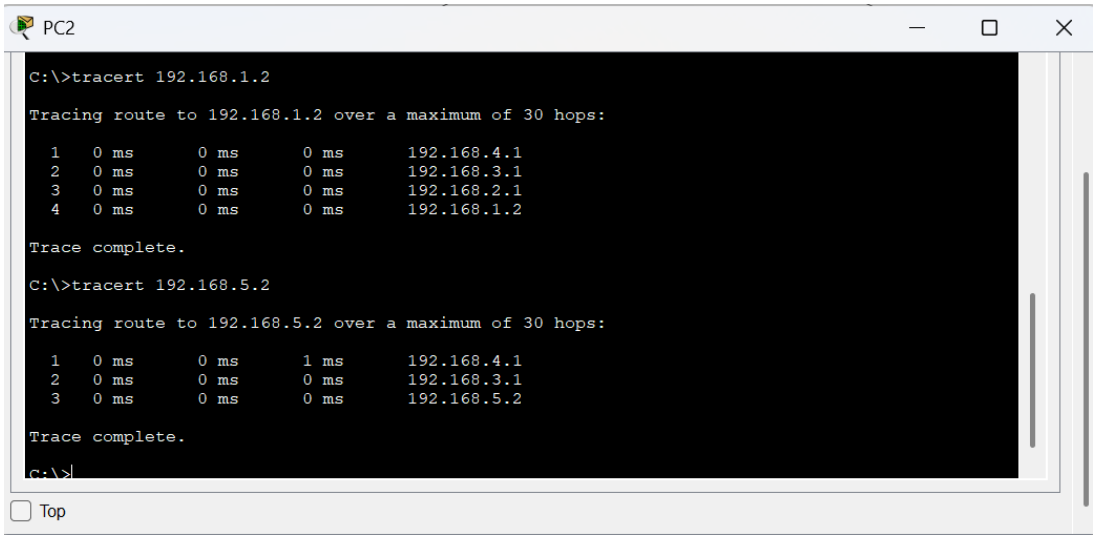
PACKET TRACEROUTE



Traceroute from PC0

This screenshot shows two traceroutes initiated from PC0 (192.168.1.2).

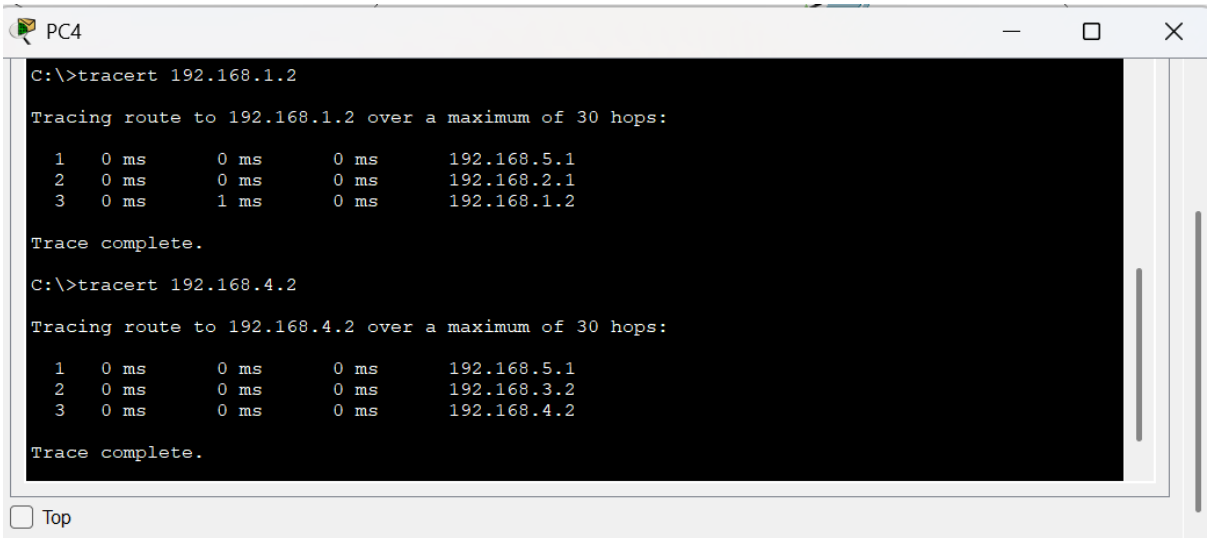
- The trace to PC2 (192.168.4.2) successfully maps the complete path across the network, hopping through Router0 (192.168.1.1), then Router1 (192.168.2.2), and finally Router2 (192.168.3.2) before reaching the destination.
- The trace to PC4 (192.168.5.2) correctly shows a shorter path through Router0 and Router1. These results confirm that the routing from the leftmost LAN is working perfectly.



Traceroute from PC2

This screenshot documents the return paths from PC2 (192.168.4.2).

- The trace to PC0 (192.168.1.2) shows the complete reverse path, hopping from Router2 (192.168.4.1) to Router1 (192.168.3.1) and then to Router0 (192.168.2.1).
- The trace to PC4 (192.168.5.2) shows the path to the central LAN via Router2 and Router1. This validates that routing is symmetrical and fully functional from the rightmost LAN.



Traceroute from PC4

This screenshot validates the routing from the central LAN, initiated from **PC4** (192.168.5.2).

- The traces to **PC0** (192.168.1.2) and **PC2** (192.168.4.2) both show Router1 (192.168.5.1) as the first hop.
- It then correctly forwards packets to either Router0 or Router2 depending on the destination. This confirms that the central router is making the correct routing decisions to reach both ends of the topology.

CONCLUSION

This practical successfully demonstrated the configuration and verification of static routing in a multi-network environment using Cisco Packet Tracer. The primary objective to establish full end-to-end connectivity between five interconnected networks was successfully achieved.

The process involved building a three-router topology, configuring static IP addresses on all end-devices and router interfaces, and manually defining the paths between non-directly connected networks using ip route commands. A key takeaway was the critical importance of specifying a correct, directly-connected next-hop address for each static route, as misconfigurations were identified and corrected to allow for proper packet forwarding.

Verification was performed methodically. The show ip route command confirmed that each router's routing table was correctly populated with paths to all five networks. Finally, successful ping and tracert tests from various PCs confirmed that the network was fully operational. The tracert command, in particular, provided a clear visualization of the hop-by-hop path that packets took, validating that the configured static routes were being used as intended.

In summary, this experiment provided hands-on experience in implementing and troubleshooting static routing, a fundamental concept in network administration