

Lab number 6

Aim/Title: To study the implementation of static routing

Introduction

Static routing is a type of network routing where the routes to various network destinations are manually configured by the network administrator. It contrasts with dynamic routing, where routes are automatically learned by routers using routing protocols like OSPF or RIP. Static routes remain fixed unless manually changed, offering more control over network paths. This method is well-suited for smaller, simpler networks but becomes impractical in larger, dynamic environments where automatic route adjustments are needed. Despite its limitations, static routing provides a straightforward approach to network management with minimal overhead.

Key Concepts

1 Routing:

- Routing is the process of selecting paths in a network along which to send data packets. It occurs at the network layer (Layer 3) of the OSI model.
- Routers are responsible for forwarding packets based on destination IP addresses.

2 Static Routing:

- In static routing, routes are entered manually into the router's routing table. These routes do not change unless manually updated by the administrator.
- Each router needs to have a route for every network it can reach, either directly connected or through another router.

3 Static Route Configuration:

- A static route specifies:
- **Destination network:** The IP address of the network or host to be reached.
- **Subnet mask:** Defines the range of addresses within the destination network.
- **Next hop IP:** The IP address of the next router or gateway to which the packet should be forwarded.
- **Exit interface:** The router's interface that will forward the packet.

4 Advantages of Static Routing:

- **Simplicity:** Easy to configure and understand in small networks.
- **Security:** Since no routing updates are exchanged, it minimizes exposure to certain types of attacks.
- **Control:** Provides precise control over routing decisions, making it useful in specific network topologies.

5 Disadvantages of Static Routing:

- **Manual configuration:** Time-consuming for large networks and prone to human error.
- **No automatic updates:** If a route becomes unavailable (e.g., a network link fails), the router does not automatically reroute traffic through an alternative path.

- **Scalability issues:** Not practical for larger, complex networks because every route must be manually added and maintained.

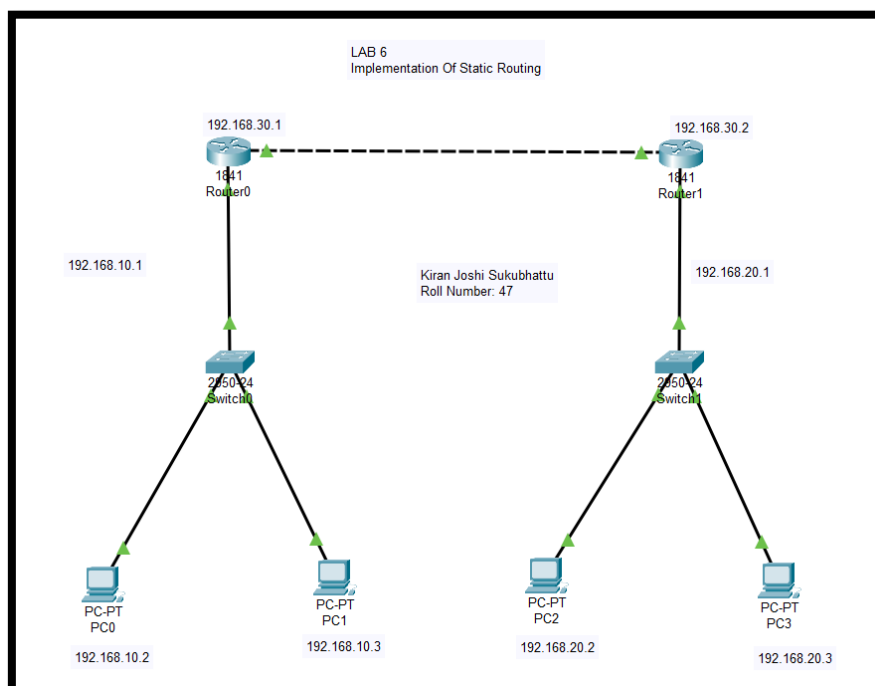
6 How Static Routing Works:

- When a router receives a packet, it checks its destination IP address.
- The router then searches its routing table for the best match to the destination.
- If a static route matches, the router forwards the packet to the next-hop address specified in the route.
- If no match is found, the router drops the packet unless a default route is configured.

Working steps:

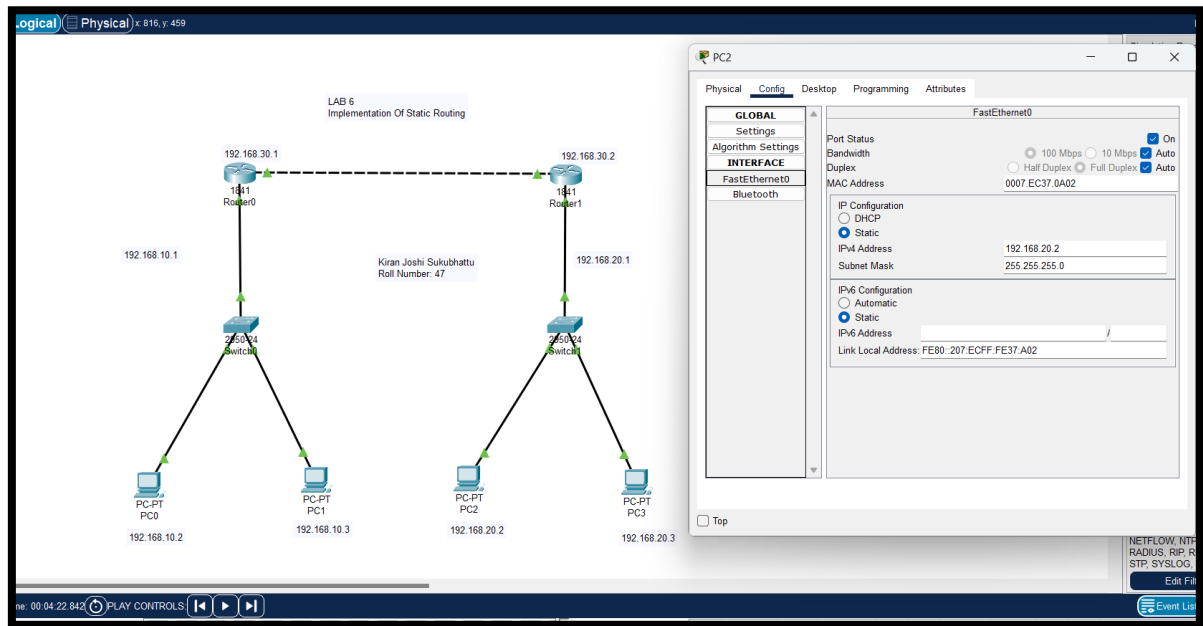
1 Network Devices Setup and Assigning IP Addresses:

- The network consists of two routers (Router0 and Router1), two switches (Switch0 and Switch1), and four PCs.
- Router0 is connected to Switch0, which is connected to PC0 (IP: 192.168.10.2) and PC1 (IP: 192.168.10.3).
- Router1 is connected to Switch1, which is connected to PC2 (IP: 192.168.20.2) and PC3 (IP: 192.168.20.3).
- Router0 Interface FastEthernet is assigned the IP 192.168.10.1 for the local network and 192.168.30.1 for the link to Router1.
- Router1 Interface FastEthernet is assigned the IP 192.168.20.1 for the local network and 192.168.30.2 for the link to Router0.
- PC0 and PC1 are configured with IPs 192.168.10.2 and 192.168.10.3, respectively, with the default gateway set to 192.168.10.1.
- PC2 and PC3 are configured with IPs 192.168.20.2 and 192.168.20.3, respectively, with the default gateway set to 192.168.20.1.



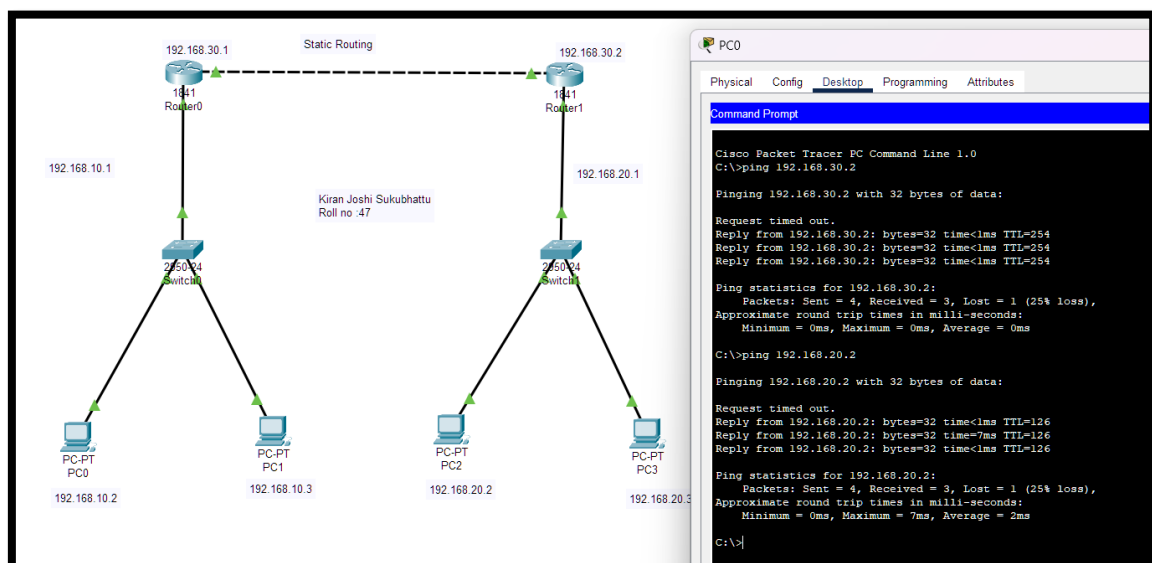
2 Configuring Static Routing:

- On Router0, add a static route to network 192.168.20.0/24 with the next hop set to 192.168.30.2 (the IP address of Router1).
- On Router1, add a static route to network 192.168.10.0/24 with the next hop set to 192.168.30.1 (the IP address of Router0).
- This ensures that both routers know how to route traffic to each other's connected networks.



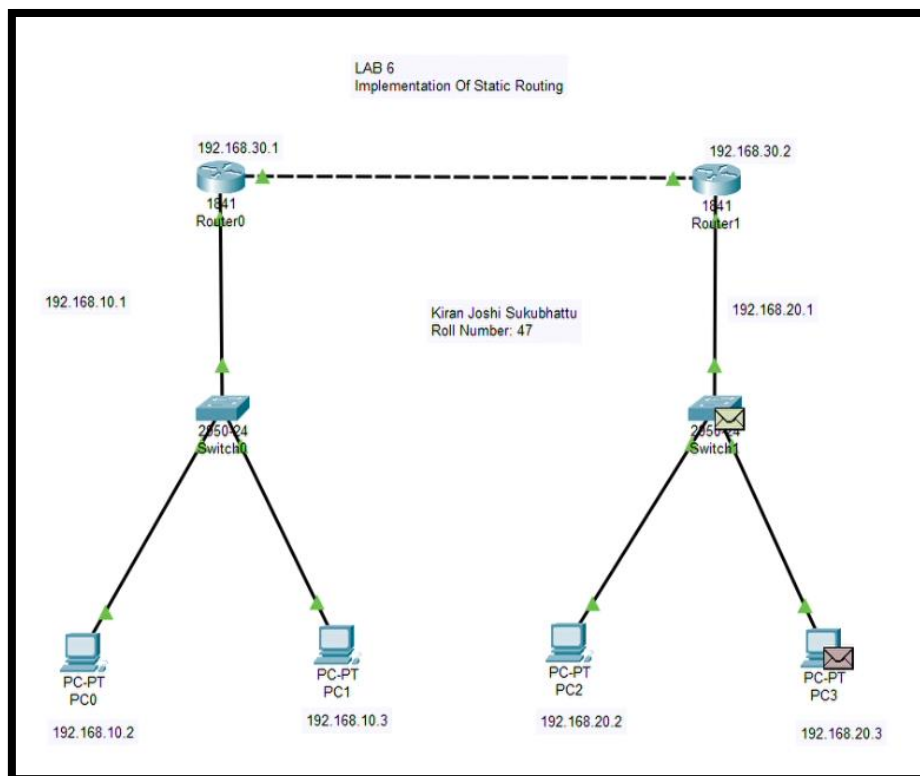
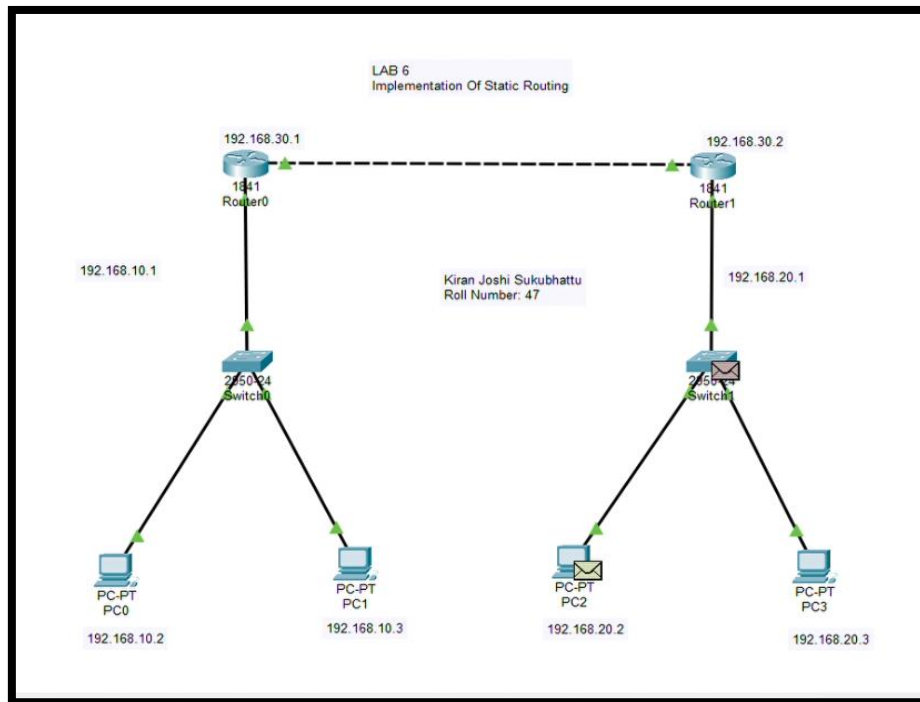
3 Testing the Configuration:

- Use the **ping** command on PC0 or PC1 to test the connectivity with PC2 or PC3.
- Successful pings confirm that the static routes are correctly configured, allowing communication between devices on different networks via the routers.



4 Observation in Simulation Mode:

- The simulation shows the data packets being transmitted between the PCs, routers, and switches.
- Notice how the static routes direct traffic between the two routers (via the 192.168.30.0/24 network) ensuring correct packet delivery



This completes the static routing setup, where traffic is manually routed between the two networks through their respective routers using predefined routes.

Conclusion:

This lab successfully demonstrated the principles and configuration of static routing. By manually entering routes into the routers, traffic was directed between two networks, allowing communication between devices on separate network segments. The successful pings confirm that the static routing configuration was correct and functional. Although static routing is useful for smaller networks due to its simplicity and control, it has clear limitations in terms of scalability and adaptability to changes in network topology. For larger networks, dynamic routing protocols like OSPF or RIP are generally more suitable due to their ability to automatically adjust to changes in the network.

Discussion:

The lab demonstrates the effectiveness of static routing in small networks, where its simplicity and control are beneficial. Static routing allows precise management of routes, which enhances security by eliminating dynamic updates. However, the manual configuration required makes it unsuitable for larger networks, as it becomes cumbersome and error-prone. Additionally, static routes do not adjust automatically to changes, making network recovery difficult without manual intervention. Despite these limitations, the experiment successfully established communication between separate networks, confirming that static routing can be reliable in controlled environments.