Lab 5 : Configuration of Static Routes and Default Routes

Objectives :

- To establish communication between disparate local area networks (LANs) by manually defining paths across an internetwork of at least two routers.
- To observe how the router processes a static route by looking up the next-hop IP address in the routing table.

Theory :

Routing refers to the process of selecting an appropriate path for data packets to travel from a source device to a destination device across interconnected networks. Routers play a crucial role in this process. Similar to how a postal system forwards mail, a router receives incoming packets, inspects the destination IP address, and consults its routing table to determine the most suitable interface or next-hop router for packet delivery.

Static Routing :

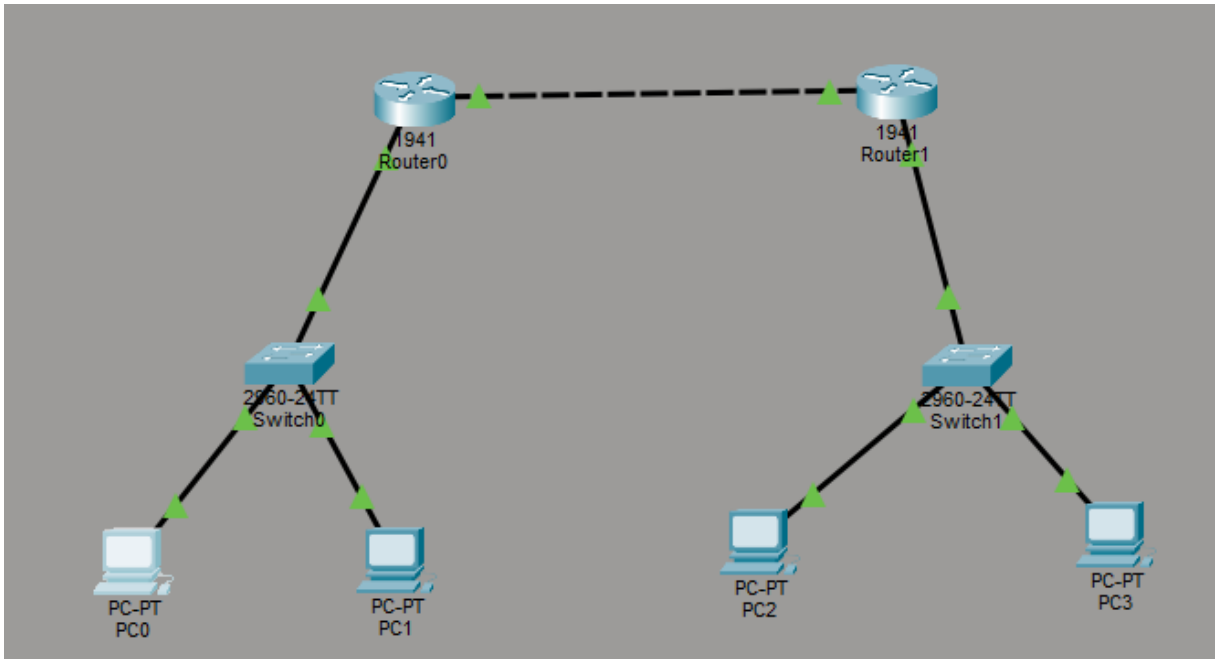
Definition: Static routing is a routing technique in which network administrators manually configure routes in a router's routing table. These routes remain fixed and do not adapt automatically to changes in the network topology. If a network link fails or a new network is added, the administrator must manually update the routing information.

The Routing Command: In Cisco devices, the syntax is: Router(config)# ip route < destination network > < subnet mask > < next hop ip >

Key Characteristics:

- Resource Efficiency: Static routing does not involve the exchange of routing updates between routers. As a result, it consumes no additional network bandwidth and requires minimal CPU and memory resources.
- Security: Since routing information is not advertised to other routers, the risk of route manipulation or injection by unauthorized devices is significantly reduced.
- **Administrative Control:** Network paths are fully controlled by the administrator, making static routing ideal for small or stable networks.

Network Topology :



Configuration :

For PCs : Each host device was manually assigned an IPv4 address, subnet mask, and default gateway to ensure proper communication within its respective LAN and with external networks.

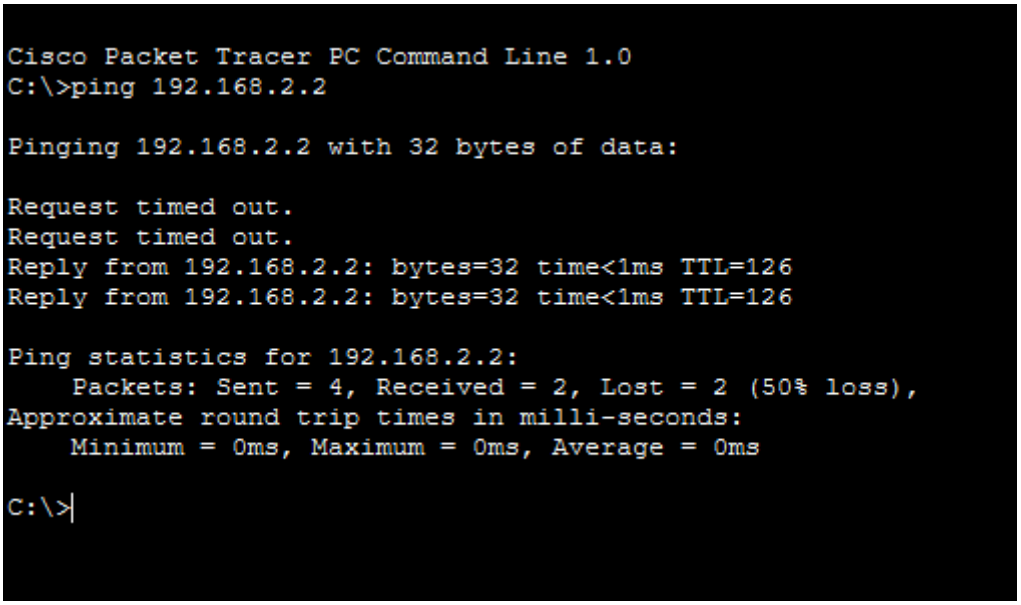
Device	IPv4 address	Subnet Mask	Default Gateway
PC0	192.168.1.2	255.255.255.0	192.168.1.1
PC1	192.168.1.3	255.255.255.0	192.168.1.1
PC2	192.168.2.2	255.255.255.0	192.168.2.1
PC3	192.168.2.3	255.255.255.0	192.168.2.1

For Routers : The routers were configured with static routes to enable communication between the two LANs. Each router was assigned IP addresses on its interfaces and provided with the appropriate next-hop information.

Device	IPv4 address	Subnet Mask	Next Hop	Ethernet Cable	Default Gateway
Router 1	192.168.2.0	255.255.255.0	10.0.0.2	gig 0/0	10.0.0.1
				gig 0/1	192.168.1.1
Router 2	192.168.1.0	255.255.255.0	10.0.0.1	gig 0/0	10.0.0.2
				gig 0/1	192.168.2.1

Observation:

Initially, communication between hosts in different LANs was unsuccessful due to the absence of routing information. After configuring static routes on both routers, the routing tables were updated accordingly. Successful ping tests confirmed that packets were correctly forwarded between the two networks, although a small amount of initial packet loss was observed during the first attempt.



Dynamic Routing :

Definition: A default route is a special type of static route that is used when a router does not have a specific entry for a destination network in its routing table. Instead of discarding the packet, the router forwards it to a predefined next-hop address.

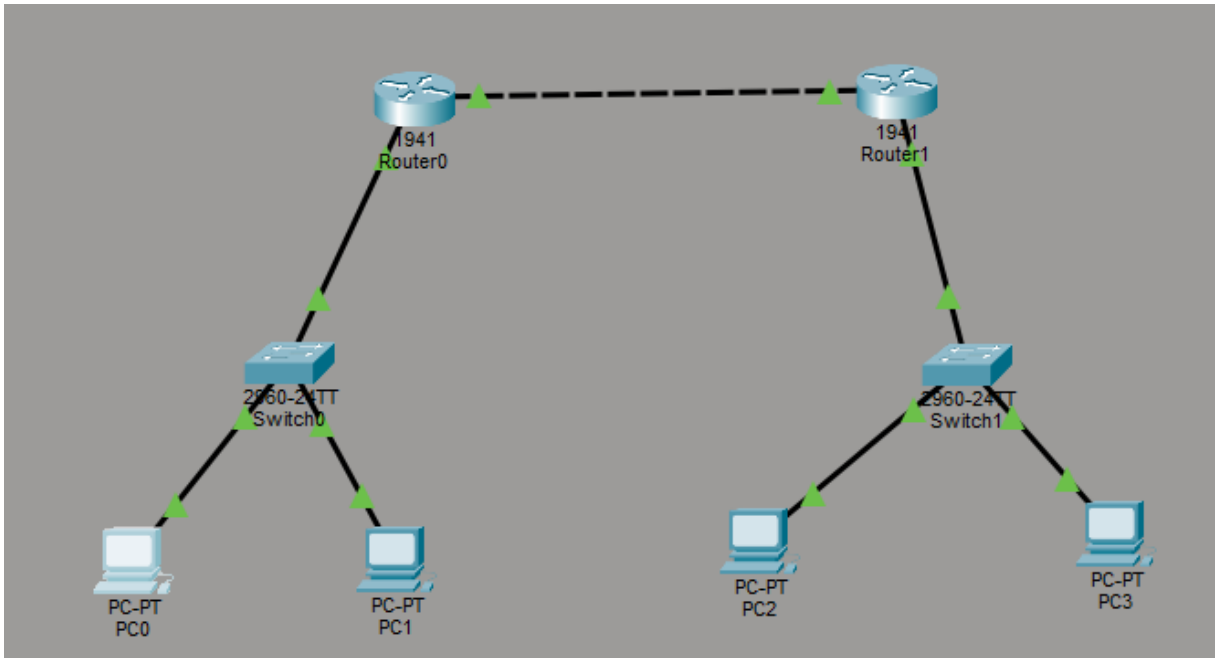
The "Quad-Zero" Route: The default route is represented by 0.0.0.0 0.0.0.0.

Syntax : ip route 0.0.0.0 0.0.0.0 < next hop ip >

Usage:

Default routing is widely used on edge routers or routers with a single exit path, such as those connected to an Internet Service Provider (ISP). Instead of maintaining a large routing table with numerous network entries, the router relies on a single default route to forward all unknown traffic.

Network Topology :



Configuration :

For PCs: The PC configuration remained unchanged from the static routing setup.

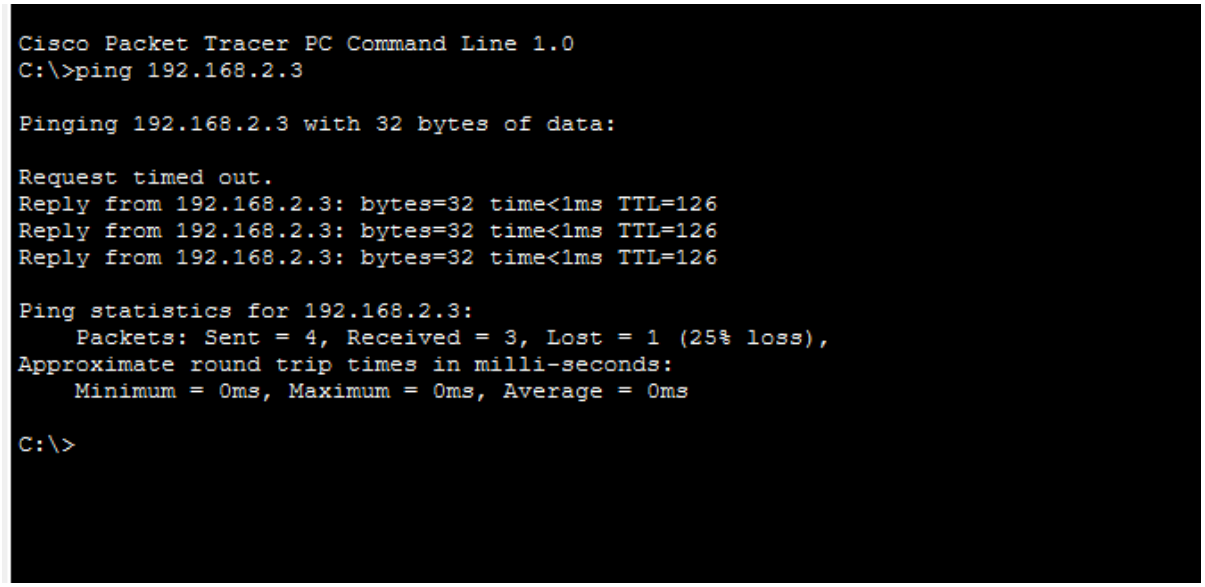
Device	IPv4 address	Subnet Mask	Default Gateway
PC0	192.168.1.2	255.255.255.0	192.168.1.1
PC1	192.168.1.3	255.255.255.0	192.168.1.1
PC2	192.168.2.2	255.255.255.0	192.168.2.1
PC3	192.168.2.3	255.255.255.0	192.168.2.1

For Routers :

Device	Destination Network	Subnet Mask	Next Hop
Router 1	0.0.0.0	0.0.0.0	10.0.0.2
Router 2	0.0.0.0	0.0.0.0	10.0.0.1

Observation :

After implementing the default routes on both routers, all packets destined for unknown networks were successfully forwarded to the respective next-hop routers. Ping tests between hosts across different LANs confirmed reliable connectivity, with minor packet loss occurring only during the initial transmission phase.



Result :

Static Routing:

The configuration of static routes enabled successful communication between the 192.168.1.0 and 192.168.2.0 networks. Connectivity was verified through ping tests, demonstrating that the routers correctly forwarded packets based on manually configured routing entries.

Default Routing:

The implementation of the quad-zero default route ensured that all unspecified traffic was routed efficiently through the designated next-hop routers. This approach simplified the routing configuration while maintaining reliable network connectivity.

Discussion :

In this lab, static routing was implemented by manually configuring each router and end device. Prior to route configuration, devices located in different LANs were unable to communicate due to the absence of routing information. Once the static routes were established, the routers successfully exchanged traffic between networks, confirming correct route selection and packet forwarding.

Static routing proved to be bandwidth-efficient, as no routing updates were exchanged between routers. However, it also highlighted the limitation that any change in network topology would require manual reconfiguration.

Default routing was then implemented as a simplified alternative. The configuration process was straightforward and required fewer commands. Although minor packet loss was observed during the initial ping attempts, all subsequent packets were transmitted successfully, demonstrating the reliability of default routing in simple network scenarios.

Conclusion :

This lab successfully demonstrated the practical implementation of static and dynamic routes using Cisco Packet Tracer.