AICTE - CISCO VIRTUAL INTERNSHIP

PROJECT REPORT - 2024

Sri Eshwar
College of Engineering
An Autonomous Institution
Affiliated to Anna University, Chennai

NETPATH ILLUMINATOR

Submitted by

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Domain: **NETWORKING**

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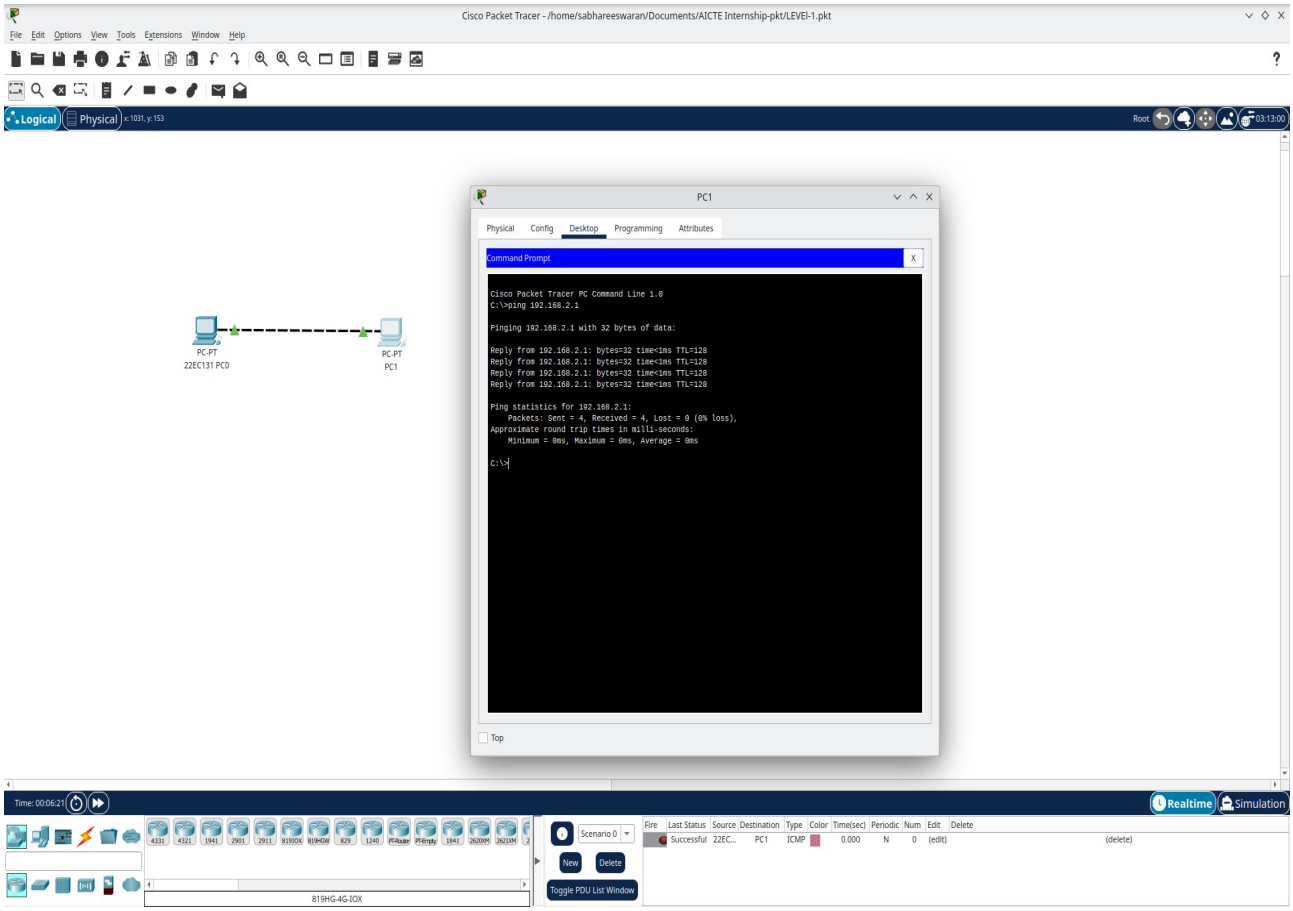
LEVEL-1

The objective is to establish a connection between two PCs and assign specific IP addresses to them. The main task is to examine the communication process using the "ping" command. Additionally, we will explore the purpose of Address Resolution Protocol (ARP) and understand why both MAC and IP addresses are necessary. We will also learn about ARP tables and how to view them.



The commands to execute are:

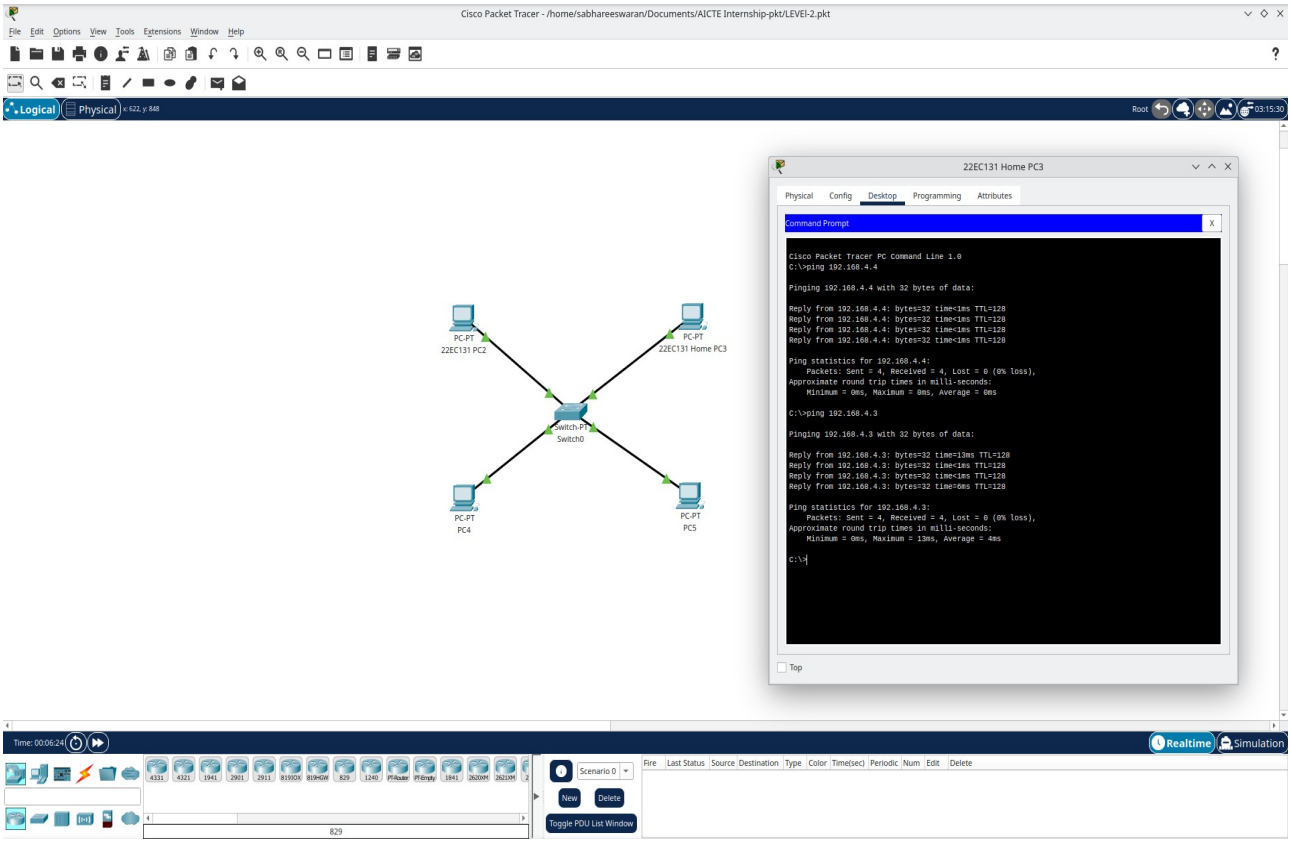
- ping 192.168.2.1
- ping 192.168.2.2
- arp-a
- arp-d

Description:

- **MAC Address:** Each device has an unique identifier for communications at the data link layer.
- **IP Address:** It is used for identifying devices and routing traffic at the network layer.

LEVEL-2

The goal is to connect computers via a switch, assign unique IP addresses, and verify connectivity with "ping" tests. We'll explore the switch's MAC table and functions like learning, flooding, and forwarding, using the "show mac address-table" command. Additionally, we'll study VLANs and aging timers in network management.



The commands to execute are:

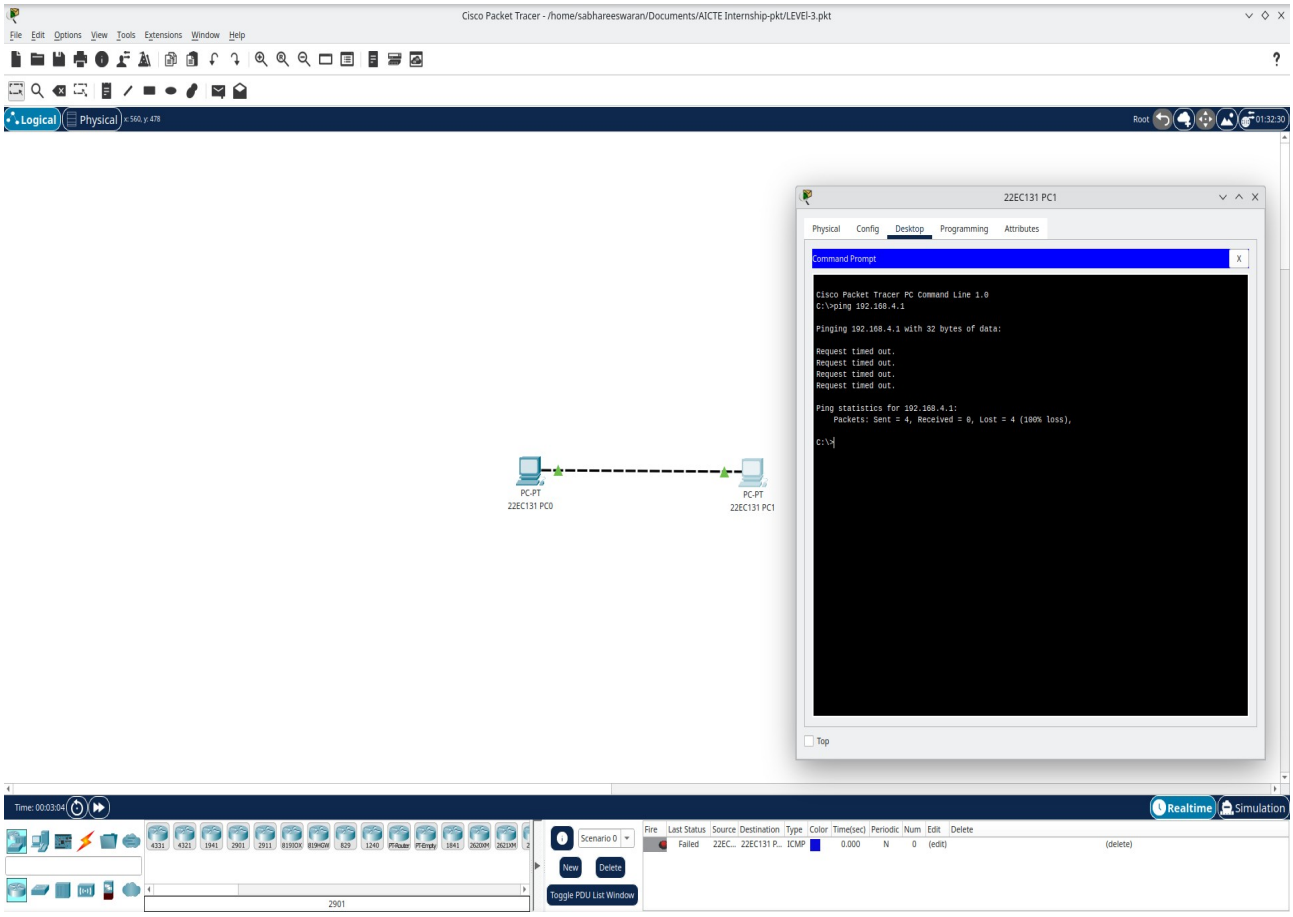
- ping 192.168.4.4
- ping 192.168.4.3
- ping 192.168.4.2
- ping 192.168.4.1
- show mac address-table

Description:

We can able to communicate with multiple devices when they are connected to a Switch in a same network.The subnet address should be same and node address only to be changed, that makes the difference of devices connected to a same network. Each end device is connected to a seperate port in a switch.

LEVEL-3

In this scenario, two computers are directly connected and assigned different IP addresses with separate subnets. Inspite of direct connection, ping operations will fail due to the lack of ARP resolution. ARP maps IP addresses to MAC addresses. Since the computers are on different subnets, they are not in the same broadcast domain, preventing ARP messages from reaching each other. This can be solved using routers, which operate at Layer 3 of the OSI model. Routers facilitate communication between different subnets by performing routing functions, including ARP resolution, allowing successful packet forwarding and communication between devices on separate subnets



The Commans to execute are

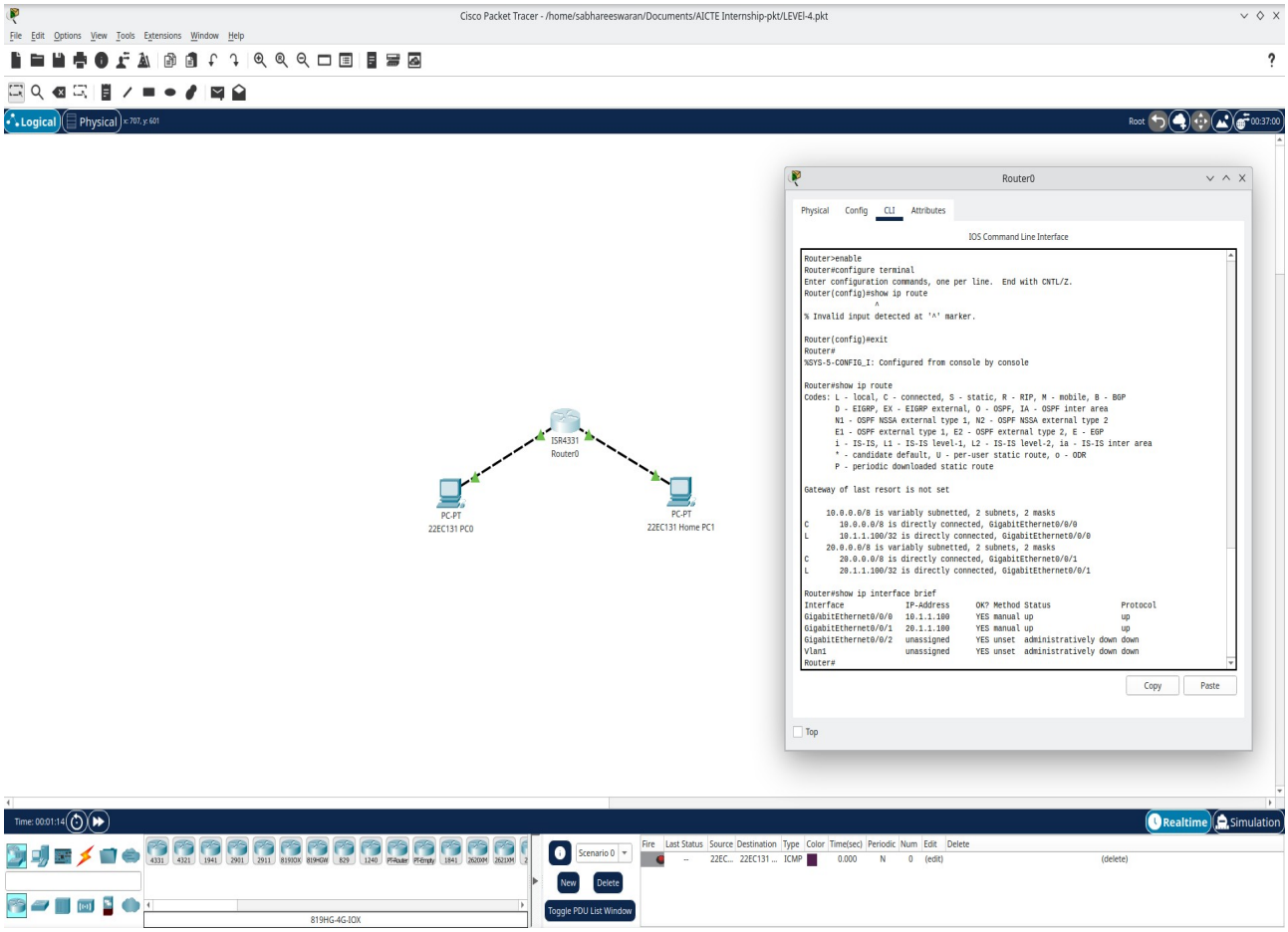
- ping 192.168.4.1
- ping 10.1.1.1

Description:

The two commuters cannot communicate to each other as they are connected with different IP addresses. To solve this issue, they can connected using Routers which can connect two networks.

LEVEL-4

In this level, the goal is to connect two computers using a router, each with different IP addresses, and perform a ping test between them. We'll also examine the routing table and entries using commands like "show ip route" and "show ip int brief" to understand routing. The concept of a default gateway is crucial, as it refers to the router's IP address serving as the exit point for local network traffic to other networks. When a device needs to communicate outside its subnet, it forwards packets to the default gateway, which routes them to external networks. This enables communication beyond the local network.



The commands to execute are:

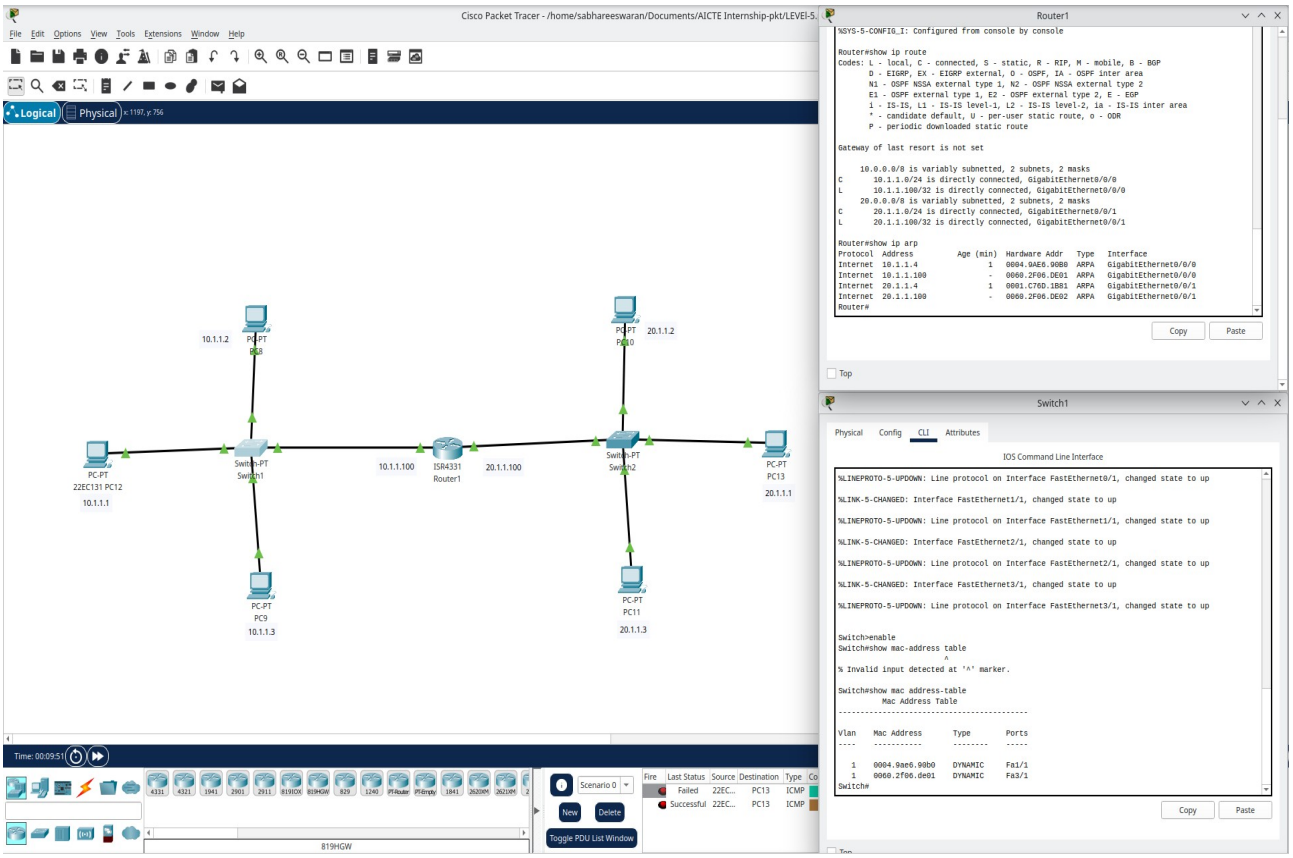
- show ip route
- show ip interface brief

Description:

Two different end devices of different subnets are connected with router. Using these command, We can able to get ip addresses of the end devices connected to the respective router and also the get detailed information on the specific connection.

LEVEL-5

The objective is to connect multiple computers using two networks, a router, and a switch, enabling communication between the networks. This involves connecting computers to the switch, which connects to the router. We'll initiate ping commands to test inter-network communication and examine the router's routing table for network routes and the ARP table for IP-to-MAC address mappings. We'll also explore the switch's MAC table, which stores MAC addresses and associated ports, to understand how it forwards frames. By examining these tables, we'll gain insights into routing, switching operations, address resolution, and traffic management between the networks.



The commands to execute:

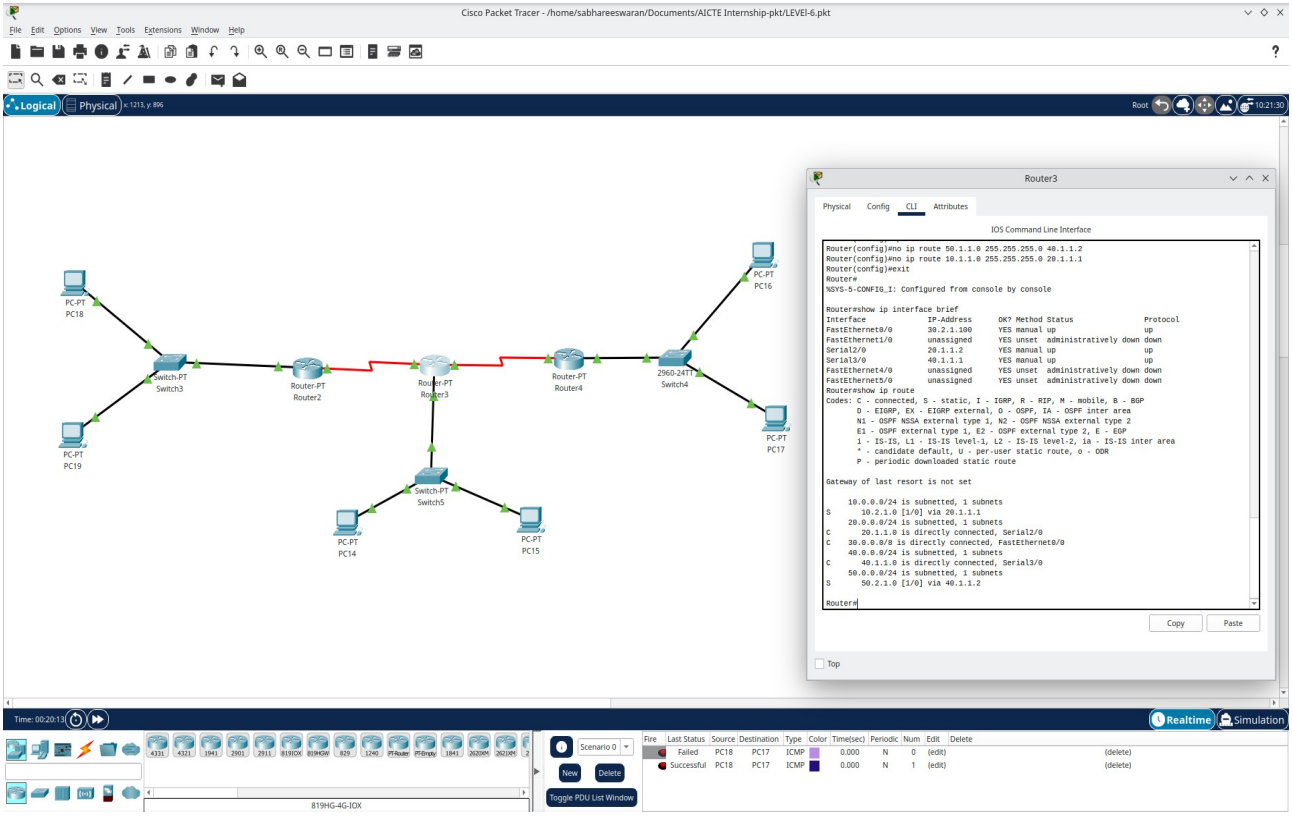
- show ip route
- show ip interface brief
- show mac address-table
- show ip arp

Description:

The 3 PC’s are connected with switch. Likewise, we made 2 seperate networks. These two mnetworks are connected with router for communication. In switch, we can able to see mac address table of end devices(PC’s). Using ‘show ip arp’ we can able to get arp table. Using ip route and ip interface brief, we can able to view the detailed information.

LEVEL-6

The objective is to connect different networks using routers by configuring static routes. We'll use router commands to set up and verify static routes with the "show ip route" command. Static routes are manually defined to specify network destinations and next-hop routers. We'll explore the routing information base (RIB), which contains routing data, including static and dynamic routes. Understanding the RIB helps in comprehending how routers determine the best path for forwarding packets. By configuring static routes and examining the RIB, we gain insights into packet forwarding and establishing network connectivity between different networks.



The commands to execute:

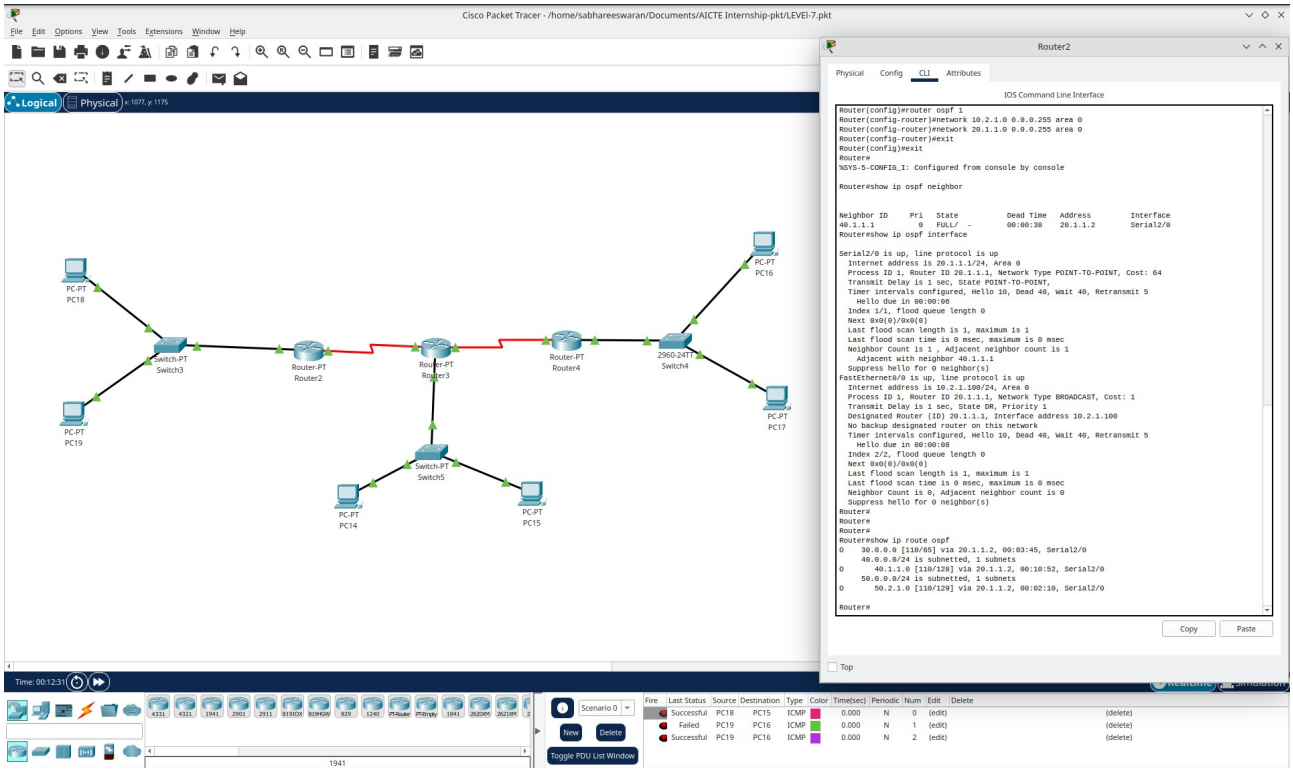
- show ip route
- show ip interface brief

Description:

The 3 networks were constructed and they are of the same as they have 2 PC's , a switch and a router in a single network. The three networks can be connected using the routers. The routers connected for routing to the destination end devices which can be of different network. It follows static routing as it follows the same path as provided.

LEVEL-7

The goal is to connect multiple networks using routers by configuring OSPF (Open Shortest Path First) as the dynamic routing protocol. We'll set up OSPF on each router and use OSPF-specific commands to understand its operation, including neighbor relationships, interface states, and the OSPF routing table. The "show ip route" command will reveal the IP route table with OSPF-learned routes and their next hops. By configuring OSPF, analyzing show commands, and reviewing the IP route and interface tables, we'll gain insights into OSPF's role in dynamic routing and efficient packet forwarding within a network.



The Command to execute:

- show ip route
- show ip interface brief

The command to configure:

- enable
- configure terminal
- interface "portname"
- ip address "ip address" "subnet"
- no shutdown
- exit

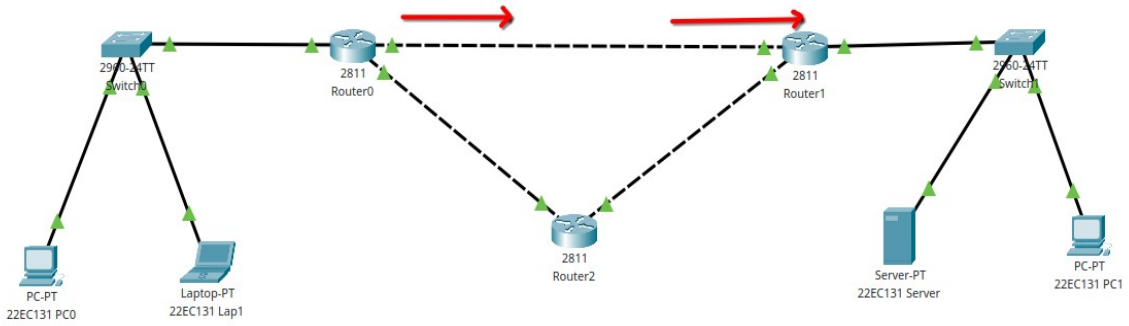
Description:

The 3 networks were constructed and they are of the same as they have 2 PC's , a switch and a router in a single network. The three networks can be connected using the routers. The routers connected for routing to the destination end devices which can be of different network. It follows dynamic routing as it selects path while transfering packets through OSPF.

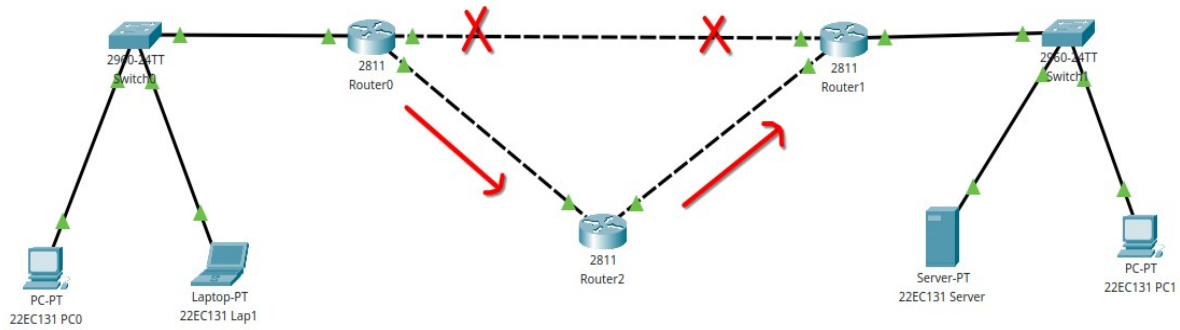
LEVEL-8

To establish network connectivity between multiple networks using routers by configuring OSPF (Open Shortest Path First) on each router. In this level, one needs to have Primary and Backup path (with one extra hop or one can even configure higher cost) to reach the server. With these two paths, one needs to capture the packets to reach to the server and observe the packet flow. Then one needs to shutdown the link Fa0/1 at R1 so that Primary path goes down. Then observe in the packet path. How OSPF dynamically reroutes packets after convergence.

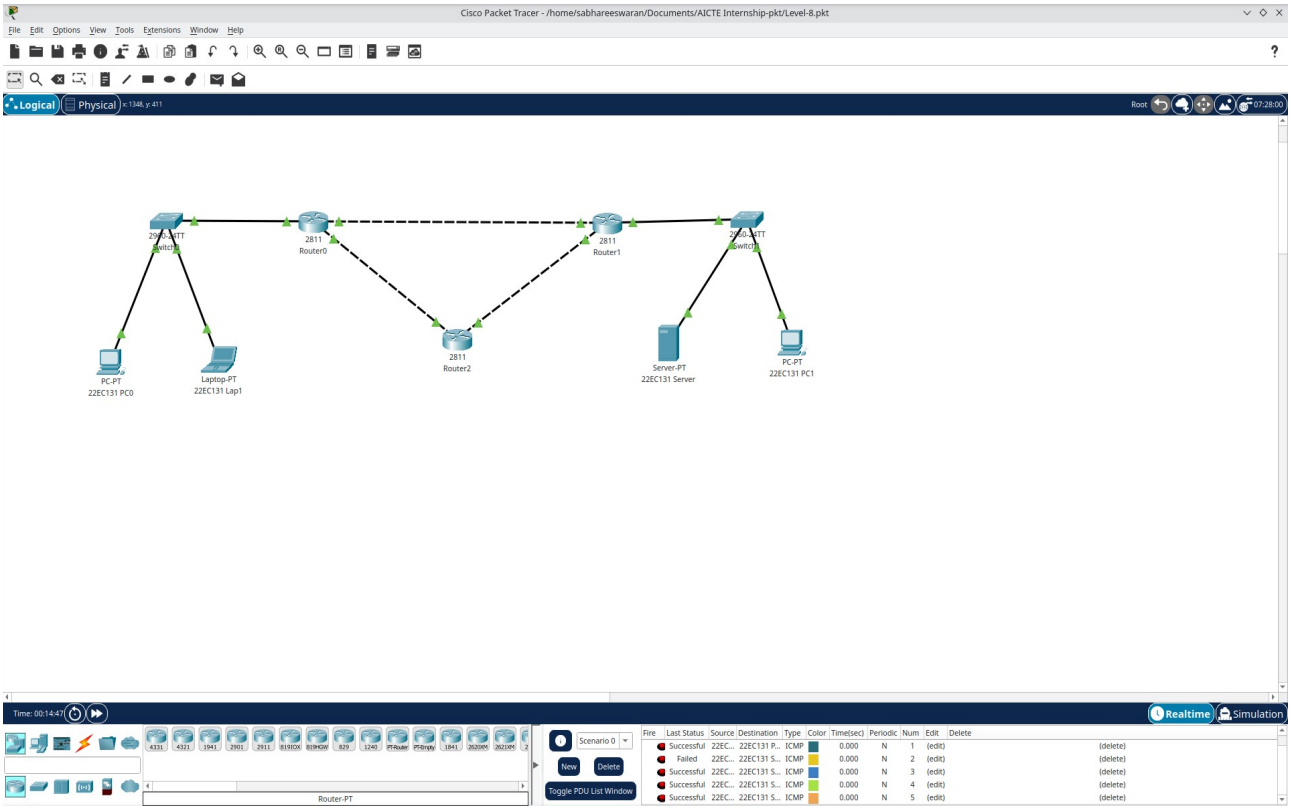
When all routers are enabled it select the efficient path by OSPF.



When the path from Router 0 to Router 1 is off and all routers are enabled.



When the packet transfer is successful.



Description:

The 2 networks were constructed. One network has one PC, one laptop and a switch. a single network. Other network has one server and one PC connected with a switch. To connect these network, the routers were used. We were placing three routers. The routers connected for routing to the destination end devices which can be of different network. It follows dynamic routing as it selects path while transfering packets through OSPF. When all the routers were on and the packets are transferred through the path Router0 → Router1, When the path of Router0→ Router1 is shutdown then it chooses the path of Router0 → Router2 →Router3 path through OSPF.

ASSESSMENT CRITERIA:

1. Explain the distinction between MAC learning and IP networking.

MAC learning is used for transfering the message through the destination. The source MAC address is stored in the Switch(Layer 2) device. Then it transfers to the destination MAC address.

Ip networking is used to route packets to different networks which operates at Layer 3 devices. Routers determine the best path for the packet transfer based on the destination IP address and routing tables.

2. Differences between Layer 2 and Layer 3 networks.

Layer 2 (Data Link Layer) works with MAC addresses and it is responsible for node-to-node communication within the same network segment. Devices like switches will operate here.

Layer 3 (Network Layer) works with IP addresses and it is responsible for packet forwarding across different networks.

3. Explain the function of subnetting and the workings of the Address Resolution Protocol (ARP).

Subnetting is used to divide a larger network into smaller network by reducing broadcast domains and enabling better allocation of IP addresses while ARP allows to communicate within the same network and to find the MAC address associated with the target IP address.

4. Explain the role of a default gateway, the process required for packets to move between subnets, and the initial steps for troubleshooting connectivity issues.

Default gateway is a router interface which provides the path for local network devices to communicate with the other network devices and for troubleshooting the connectivity, we use the command “ping ipaddress” IP address should be the destination IP address to check the connectivity for packet transfer.

5. Should be able to differentiate between a router and a switch in more practical manner.

Routers operates at Layer 3 uses IP addresses as it able to transfer packets from one network to other network like WAN.

Switches operates at Layer 2 uses MAC addresses as it able to transfer packets from one network to other network like LAN.

6. Should be able to articulate the purpose of static routing and the method by which network connectivity is established across different networks.

Static routing defines a fixed path for routing of packets and Using Routing table we can able to transfer packets through a specific path which ensures network connectivity.

7. What does Routing Information Base (RIB) mean?

RIB is a database of routing information maintained by routers which contains all the routes. It is used to determine the best path for forwarding packets.

8. One should be able to define what a routing protocol is, the differences between static and dynamic routing protocols, and provide an example of a dynamic routing protocol.

Routing Protocol: Routing Protocol defines how routers communicate with each other to distribute routing information.

Static routing is manually configured by the user and doesn't change unless it is updated whereas Dynamic routing is where the routes are automatically updated based on network topology.

Example of Dynamic routing is OSPF(Open Shortest Path First).

9. Explain how the ping function works? Additionally, elaborate on the significance of the ICMP protocol? Develop a ping program using C/C++. Implementing a basic ping program involves using sockets to send ICMP (Internet Control Message Protocol) echo requests and handle ICMP echo replies.

Ping uses ICMP protocol to send requests and waits for reply from the destination and it checks connectivity. ICMP used for error messages and operational queries like ping.

10. Explain the basic flow of packet from PC to a web server located outside the campus.

The packet is sent from the PC using MAC address and the router uses routing which helps to connect to Web browser based on the routing table and it reaches destination.

GITHUB LINK:

https://github.com/sabharees/AICTE_Cisco_networking_intern