PROJECT REPORT: ARP LAN Simulation using Cisco Packet Tracer

Aim

This project's primary goal is to use Cisco Packet Tracer to design and implement a basic Local Area Network (LAN) and show how the Address Resolution Protocol (ARP) works. This entails setting up several PCs, connecting them with a switch, allocating IP addresses, and monitoring how ARP converts IP addresses to MAC addresses when communicating between devices..

Problem Statement

Devices in a LAN environment communicate with one another at various OSI model layers. MAC addresses are necessary for the actual delivery of data at Layer 2, even though users and applications use IP addresses (Layer 3). The Address Resolution Protocol (ARP) maps IP addresses to their corresponding MAC addresses in order to close this gap. Devices couldn't locate the right destination MAC address for an IP without ARP, which would result in unsuccessful communications.

This project shows how real-time ARP requests and responses happen when two computers in the same subnet try to connect.

Scope

The following ideas are practically understood through this simulation: • ARP request and reply packets created during initial PC-to-PC communication.

- How IP-to-MAC address mappings are added to ARP tables (or caches).
  By understanding these concepts, students and professionals can gain hands-on experience with one of the core mechanisms that enable IP networking.
- The connection between a LAN's Layer 3 (Network) and Layer 2 (Data Link) addressing.
- Students and professionals can get practical experience with one of the fundamental mechanisms that make IP networking possible by comprehending these ideas.

Required Components

Software Tools Used:

• Cisco Packet Tracer – A network simulation tool used to design and test the LAN setup.
• GitHub – For maintaining version control and storing documentation of the project.
• Screen Recorder Tools (Snipping Tool + WO Mic) – For capturing screenshots and recording steps.

Virtual Hardware Used in Packet Tracer:

• 4 PCs (PC-PT) representing network hosts.
• 1 Cisco 2960 Switch (8-port) to interconnect all the PCs.
• Copper Straight-Through LAN Cables to connect each PC to the switch.

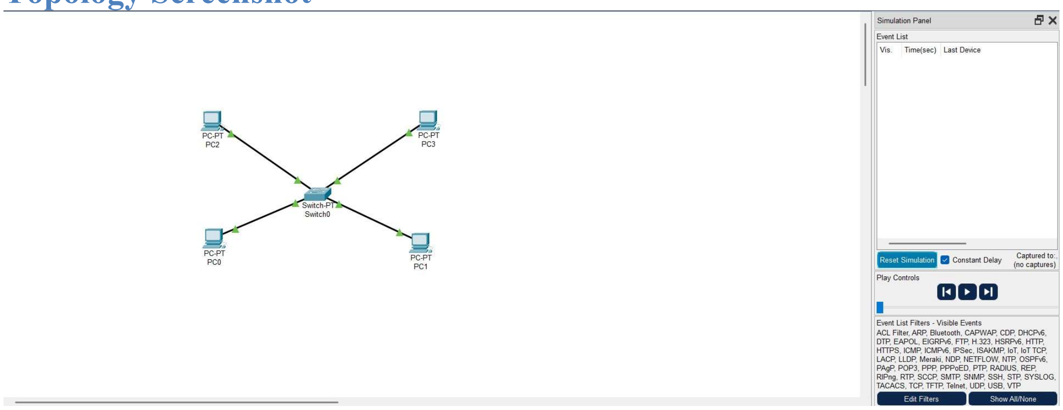
Network Design and IP Addressing

A simple LAN is designed where four PCs are connected to a single switch. Each PC is assigned an IP address within the same subnet so that they can communicate without a router.

The IP address configuration is as follows:
• PC1: 192.168.1.1 / 255.255.255.0
• PC2: 192.168.1.2 / 255.255.255.0
• PC3: 192.168.1.3 / 255.255.255.0
• PC4: 192.168.1.4 / 255.255.255.0

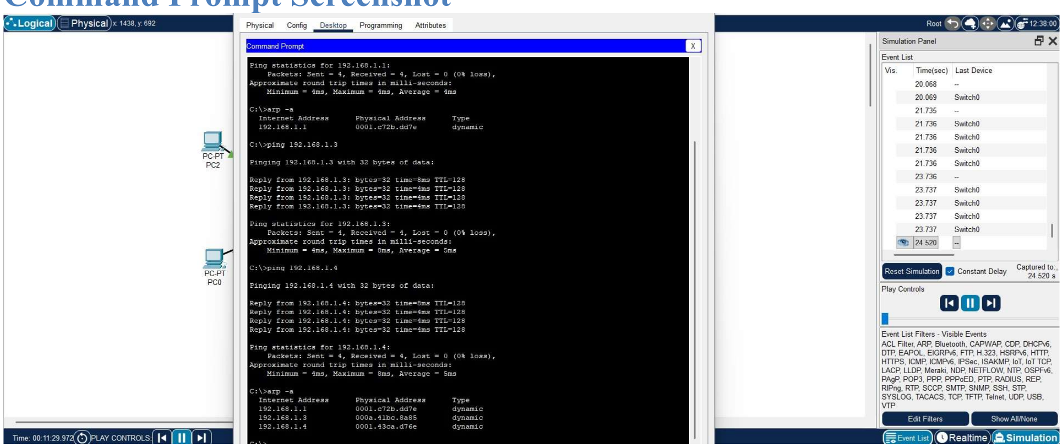
All devices are part of the 192.168.1.0/24 subnet.

Topology Screenshot



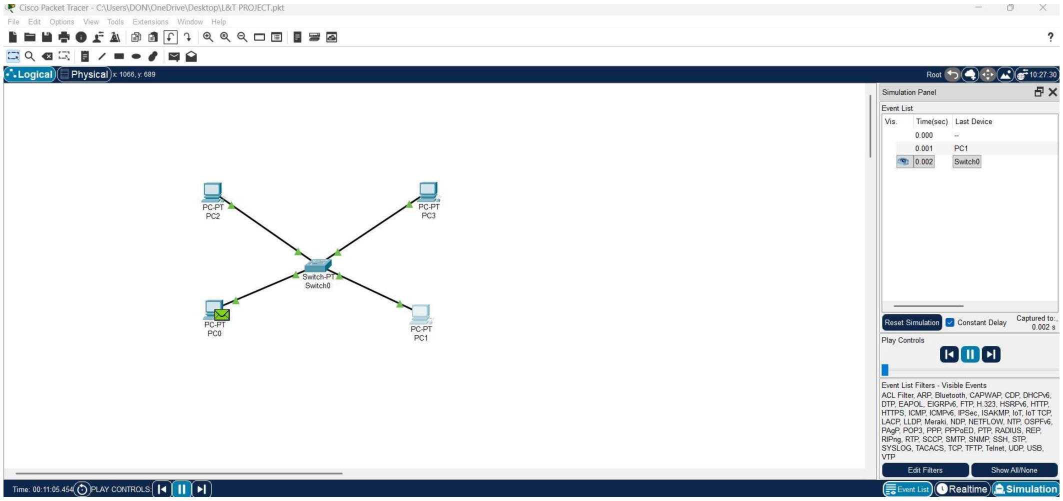
The above topology shows all four PCs connected to a single Cisco 2960 Switch using copper straight-through cables. Each connection has been verified to ensure the link lights turn green, indicating active connectivity.

Command Prompt Screenshot



This screenshot shows the use of the command prompt in Packet Tracer to verify ARP entries. Commands like 'arp -a' and 'ping' have been executed to demonstrate ARP table population and successful communication.

Simulation Screenshot



The simulation panel displays ARP packets being transmitted from one PC to another and the switch learning the MAC addresses of the connected devices. The eye icon in the simulation window indicates captured packets showing the ARP request and reply process.

Working and Step-by-Step Demonstration

1. IP Configuration:
Using the Desktop > IP Configuration menu, each PC was manually given its unique IP address.
2. Initial ARP Table Check:
The ARP cache of PC1 was checked using 'arp -a'. Since no communication had occurred yet, the ARP table was empty.

3. Initiating Communication:
PC1 pinged PC3 using the 'ping 192.168.1.3' command. Since PC1 had no MAC address for PC3 in its ARP table, it generated an ARP request broadcast asking, “Who has 192.168.1.3?”

4. Receiving ARP Reply:
PC3 responded with its MAC address, allowing PC1 to populate its ARP table and send the actual ICMP echo request packets.

5. ARP Table Verification:
The 'arp -a' command on PC1 now displayed the MAC addresses of PC3 (and other PCs that communicated).

6. Switch MAC Learning:
During this process, the switch learned the MAC addresses associated with each port, which can be verified in its MAC table.

Conclusion

In this project, a simple LAN consisting of four PCs and a switch was successfully created in Cisco Packet Tracer. The Address Resolution Protocol (ARP) mechanism was demonstrated, showing how devices in the same subnet discover each other's MAC addresses to enable communication. The ARP tables confirmed that IP-to-MAC address mapping occurred correctly, and the switch was able to learn MAC addresses for efficient frame forwarding. This exercise provides a strong foundation for understanding real-world network communication at Layer 2 and Layer 3.

Team Members

Harikrishna Ramesh (2362514)

Gregory Manoj (2362513)

Don Manuel Francy (2362510)

Joshuva Chacko (2362516)

Joel Titto (2362516)