Experiment-1

Aim → Study on network elements, IP address, subnet mask & network simulators.

Objectives →

1) An overview on network elements

a) Switch → Forwards data based on MAC address (Layer 2)

b) Hub → Broadcast data to all devices (Layer 1)

c) Routers → Routes data between new using IP address (Layer 3)

d) Bridge → Connects two network segments (Layer 2)

e) Repeater → Amplifies signals to extends network range (Layer 1)

f) Access Point → Connects wireless devices to a wired network. (Layer 2)

2) An overview on different classes of IP addressing subnet mask and gateway.

- Classes of IP addresses →

i) Class A : IP Range → 0.0.0.0 to 127.255.255.255

Subnet mask : 255.0.0.0

ii) Class B: IP Range → 120.0.0.0 to 191.255.255.255

Subnet mask : 255.255.0.0

iii) Class C : IP Range → 192.0.0.0 to 233.255.255.255

Subnet mask : 255.255.255.0

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- Subnet Mask → A 32 bit number that separates the network and and host portions of an IP address.
- Gateway → Devices that allows a communication between different networks.

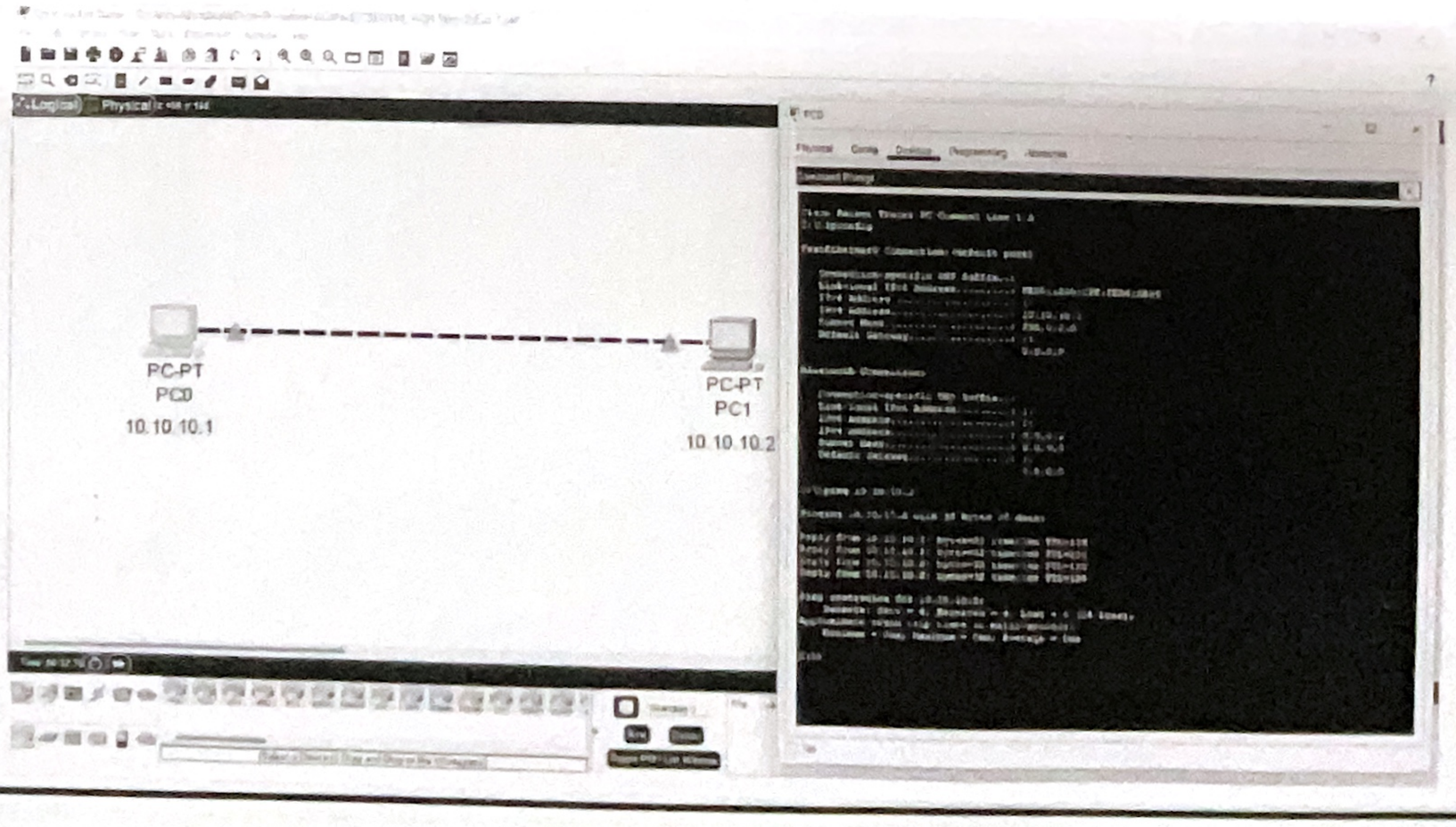
3) Introduction to Cisco Packet Tracer (CPT) tool to configure a network.

A network simulation tool developed to design, configure & troubleshoot network. It allows to create virtual network, simulate data flow and test network configuration.

4) Making connection between two host PCs (end devices) and analysing the communication using ping command.

a) Connection of 2 host PCs and assigning ~~them~~ both of them a separate IP address.

Observation →



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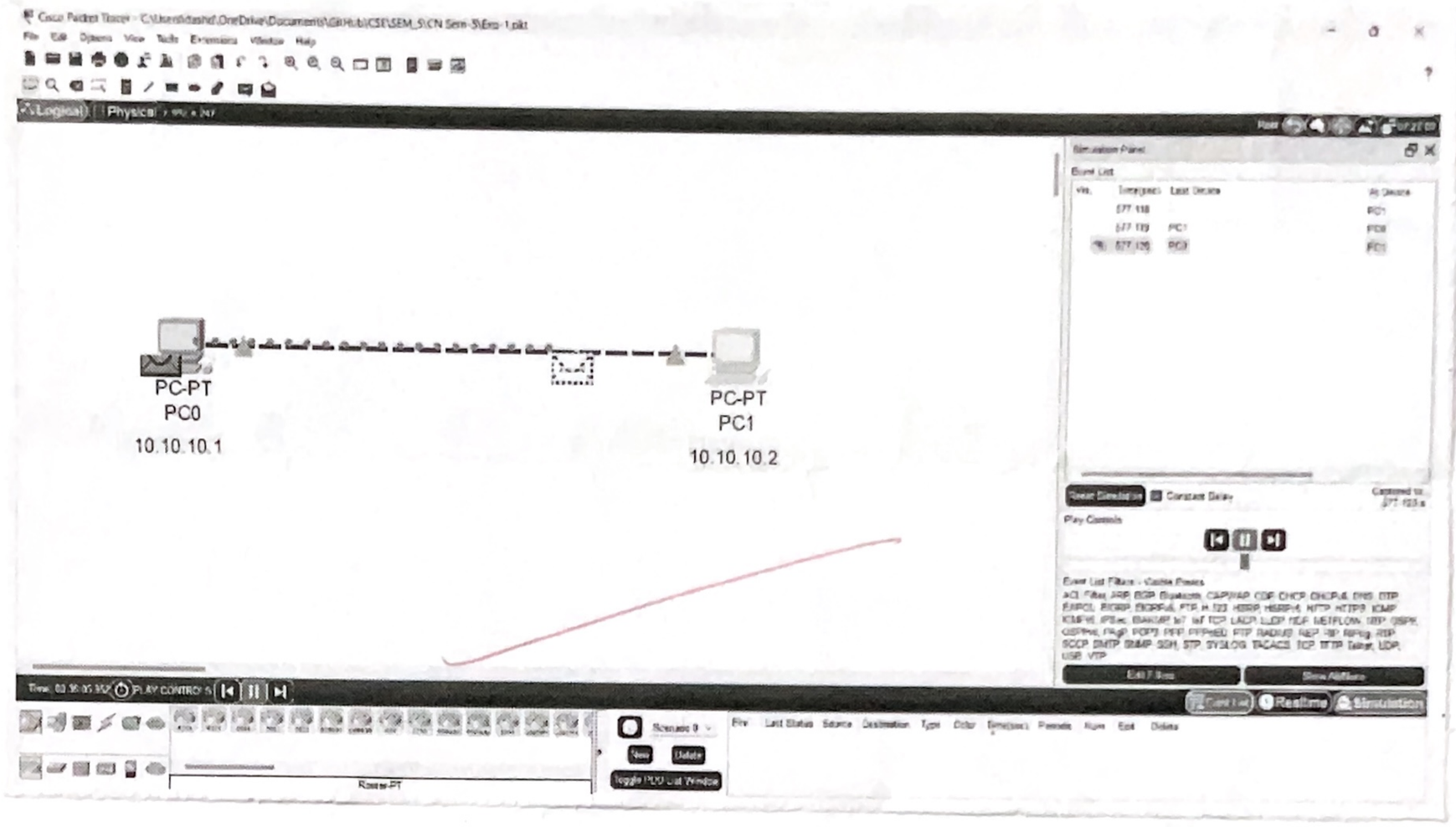
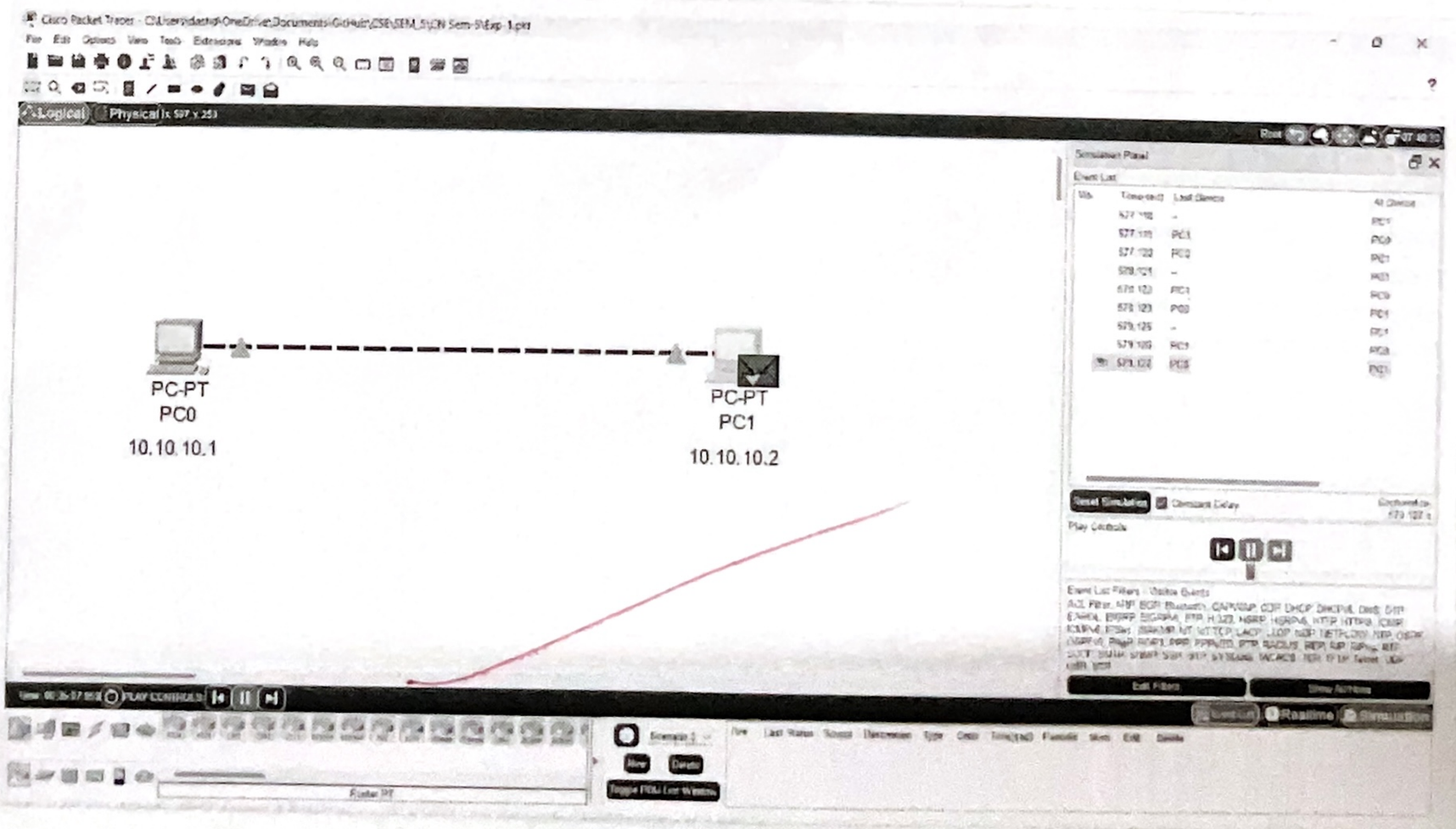
b) Trasfer of message from Host 1 to Host 2 →

Observation →



c) Message has been sent and recieved successfully.

Observation →



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Conclusion → Here, two host PC is connected directly using crossover cable. After assigning IP address in same subnet. We used ping command ~~ping~~ to test communication. The experiment demonstrate peer-to-peer communication over a direct link.

Hence, direct PC-to-PC communication is possible without intermediatary device, provided proper IP configuration and cable-type (Crossover).

Exercises →

1) Differentiate layer 2 and layer 3 switches.

Ans→ i) Layer 2 switch (Data Link Layer) →

a) Function → Operates at the data link layer (Layer 2) of the OSI model. It primarily handles switching of data within the same network using MAC address.

b) Forwarding: Uses MAC addresses to forward packets.

c) Broadcast Domain: Typically, all ports on the switch are in the same broadcast domain (unless VLANs are configured).

d) Routing Capability → Does not route between different networks or subnets, its used for communication within a local network.

e) Typical use → Connecting devices within same VLAN or network ~~agent~~ segment (e.g., within a single building or office)

ii) Layer 3 switch (Network Layer) →

a) Function → Operates at both the Data Link Layer & the Network layer. It can switch data like a layer 2 switch, but it also routes between different network or subnets using IP address.

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b) Forwarding → Uses IP addresses for packet forwarding, similar to a router.

c) Broadcast Domain → Each port can be in a different broadcast domain (supports VLANs & routing between them).

d) Routing Capability → Can perform routing functions between different subnets & networks (e.g., inter-VLAN routing).

e) Typical Use → Larger networks that need both high-speed switching & routing between subnets (e.g., in enterprise environments)

2) Compare and ~~const~~ contrast IPv4 and IPv6 addresses. What are the default subnet mask for class A, class B and class C IP address?

Ans →

Feature	IPv4	IPv6
Address Length	32-bit (4 octets)	128 bit (16 octets)
Address Format	Dotted decimal (e.g. 192.168.1.1)	Hexadecimal with colons (e.g. 2001:0db8:85a3::8a2e:0370:7334)
Address space	~4.3 billion addresses	~340 undecillion addresses
Subnetting	Uses Subnet mask	Uses prefix lengths
Broadcasting	Supports broadcast	No broadcast, uses multicast
Security	No built-in security (Optional, via IPSec)	Built-in support for IPSec

Default Subnet Mask for IPv4 Classes:

i) Class A:

a) IP Range → 0.0.0.0 to 127.255.255.255

b) Default subnet mask → 255.0.0.0 (or /8 CIDR notation)

c) Network / Host bits → 8 bits for network, 24 bits for host

ii) Class B:

a) IP Range → 128.00.0 to 191.255.255.255

b) Default Subnet Mask: 255.255.0.0 (or /16 CIDR notation)

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c) Network / Host Bits : 16 bits for network, 16 bits for host

iii) Class C →

a) IP Range → 192.0.0.0 to 223.255.255.255

b) Default Subnet Mask : 255.255.255.0 (or /24 CIDR notation)

c) Network / Host Bits → 24 bits for network, 8 bits for host

3) Which of the classes does the following IP address belong to?

a) 10.10.10.1

Ans→ a) First Octet: 10

b) Class : A

b) 172.16.4.3

Ans→ a) First octet : 172

b) Class : B

c) 192.168.1.20

Ans→ a) First Octet: 192

b) Class : C

4) What are the key features of Cisco Packet Tracer?

Ans→ i) Network Simulation → Create and stimulate virtual networks using a user-friendly interface.

ii) Multi-User Collaboration → Users can work together on the same network project in real time.

iii) Device Configuration → Simulates various Cisco devices (routers, switches, firewalls) & supports configuration of routing, switch., security protocols, and more.

iv) Support for IOT → Includes Internet of Technology device simulation & network programming features.

v) Cross Platform → Available on multiple platforms, including windows, macOS, Linux and mobile devices.

vi) Scenario-Based Learning → Includes predefined labs & learning scenarios to practice networking skills.

vii) Visual Network Topology → Offers a visual interface for creating and managing complex network topologies.

viii) Support for Cisco commands → Users can interact with devices using Cisco CLI commands

ix) Simulation Mode → Enables the analysis of network packets & protocols at different OSI layers.

x) Flexible Learning → Ideal for networking courses, certification prep (like CCNA) and hands-on practice.

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5) Explain the two workspaces and two modes of operation in Packet Tracer.

Ans → a) Workspaces →

i) Logical Workspaces → This is the primary workspace where users create and connect devices virtually. It allows you to design and visualise the network topology, including routers, switches, PCs, etc. You can arrange and connect devices, assign IP addresses & configure protocols.

ii) Physical Workspace → This workspace gives a more realistic view of the network by showing the physical layout of devices in a specific environment, such as a building or a city. It provides a spatial perspective, helping users understand how devices are connected in real world scenarios, including rack views of devices, cable distances and device placement.

b) Modes of operation →

i) Real Time Mode → In this mode, network devices function as they would in a live environment. When you send data or configure devices, the effects take place immediately. It stimulates real-time communication, where you can see traffic & device responses right away.

ii) Simulation Mode → It allows you to pause the network activity and analyze how data flows through the network. You can control the timing of packet movements and inspect protocols step by step. This mode is useful for debugging, testing network behaviour & understanding packet transmission in detail.

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