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Experiment 1

Aim:

Study on network elements, IP address, Subnet mask and network simulator(s)

Objectives:

1. An overview on network elements (i.e. switch, hub, router, bridge, repeater, access point).
2. An overview on different classes of IP addressing, subnet mask and gateway.
3. Introduction to Cisco Packet Tracer (CPT) tool to configure a network.
4. Making connection between two host PCs (end devices) and analysing the communication using ping command.

Exercises:

1. Differentiate layer 2 and layer 3 switches.
2. Compare and contrast IPv4 and IPv6 addresses. What are the default subnet mask for class A, class B and class C IP address?
3. Which of the classes does the following IP address belong to?
    a. 10.10.10.1
    b. 172.16.4.3
    c. 192.168.1.20
4. What are the key features of Cisco Packet Tracer?
5. Explain the two workspaces and two modes of operation in Packet Tracer.

* Aim of the experiment:-

Study on network elements, IP address, subnet mask and network simulator(s).

* objective :-

An overview on network elements (i.e. switch, hub, router, bridge, repeater, access point).

=> Switch :-

A network switch or switching hub is a computer networking device that connects network signals.

=> Hub :-

(i) A device that extends the reach of a network by regenerating the electrical signals.

(ii) It also receives data on one port and then sends it out to all other active ports.

=> Router :-

(i) A network layer device that forwards data packets between networks.

(ii) Routers use IP addresses to forward traffic to other networks.

=> Bridge:-

(i) It is a layer 2 device that connects two or more Local Area Networks (LAN) to form a single, larger LAN.

(ii) It operates at the data link layer of the OSI model, filtering and forwarding data packets based on their MAC addresses.

=> Repeater:-

(i) A device that regenerates weak signals to extend the distance a signal can travel.

(ii) It receives a signal & retransmits it at a higher level and/or higher power, or on to the other side of an structure.

=> ACCess point:-

(i) A hardware device that allows wireless devices to connect to a wired network, such as the internet by transmitting and receiving data over wi-fi.

(ii) It converts wired signals into wireless ones, extending the range and capacity of a network, and allowing multiple devices to connect simultaneously without cables.

* objective-2:-

An overview on different classes of IP addressing subnet mask & gateway.

=> classes of IP addressing:-

The 32-bit of IP address is divided into five sub-classes :-

(i) class A

(ii) class B

(iii) class C

(iv) class D

(v) class E

=> structure of classful Addressing:-

Class	Leading Bits	NET ID Bits	HOST ID Bits	Number of Networks	Addresses per Network	Starting Address	Ending Address
class A	0	8	24	2^7	2^{24}	0.0.0.0	127.255.255.255
class B	10	16	16	2^{14}	2^{16}	128.0.0.0	191.255.255.255
class C	110	24	8	2^{21}	2^8	192.0.0.0	223.255.255.255
class D	1110	NOT Defined	NOT Defined	NOT Defined	NOT Defined	224.0.0.0	239.255.255.255
class E	1111	NOT Defined	NOT Defined	NOT Defined	NOT Defined	240.0.0.0	255.255.255.255

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=> classful Addressing:

The class of IP address is used to determine the bits used for network ID and host ID and the number of total networks and hosts possible in that particular class.

	Byte 1	Byte 2	Byte 3	Byte 4
Class A	Network ID	HOST ID		
Class B	Network ID		HOST ID	
Class C	Network ID			HOST ID
Class D	Multicast Address			
Class E	Reserved			

=> Subnet mask:

(i) A 32-bit number that acts like a filter for an IP address, dividing it into a network portion and a host portion.

(ii) It tells devices on the network which part of an IP address identifies the network and which part identifies a specific host within that network.

=> Gate way:-

(i) A gateway is a hardware device that acts as a "gate" between two networks.

(ii) A gateway may contain devices such as protocol translators, impedance matching devices, rate converters, fault isolators or signal translators as necessary to provide system interoperability.

* Objective 3:-

Introduction to cisco packet Tracer (CPT) tool to configure a network.

(i) Network simulation software:-

Cisco packet Tracer is a powerful simulation tool developed by cisco, mainly used for designing, configuring and testing computer networks without needing physical hardware.

(ii) Hands-on Learning platform:-

It provides a virtual environment where students & professionals can practice configuring routers, switches, PCs, servers, firewalls & IOT devices.

(iii) Drag and Drop Interface:

The tool uses a simple graphical interface where users can drag and drop network devices, connect them with cables and configure them using command-line Interfaces.

(iv) Packet Flow visualization:

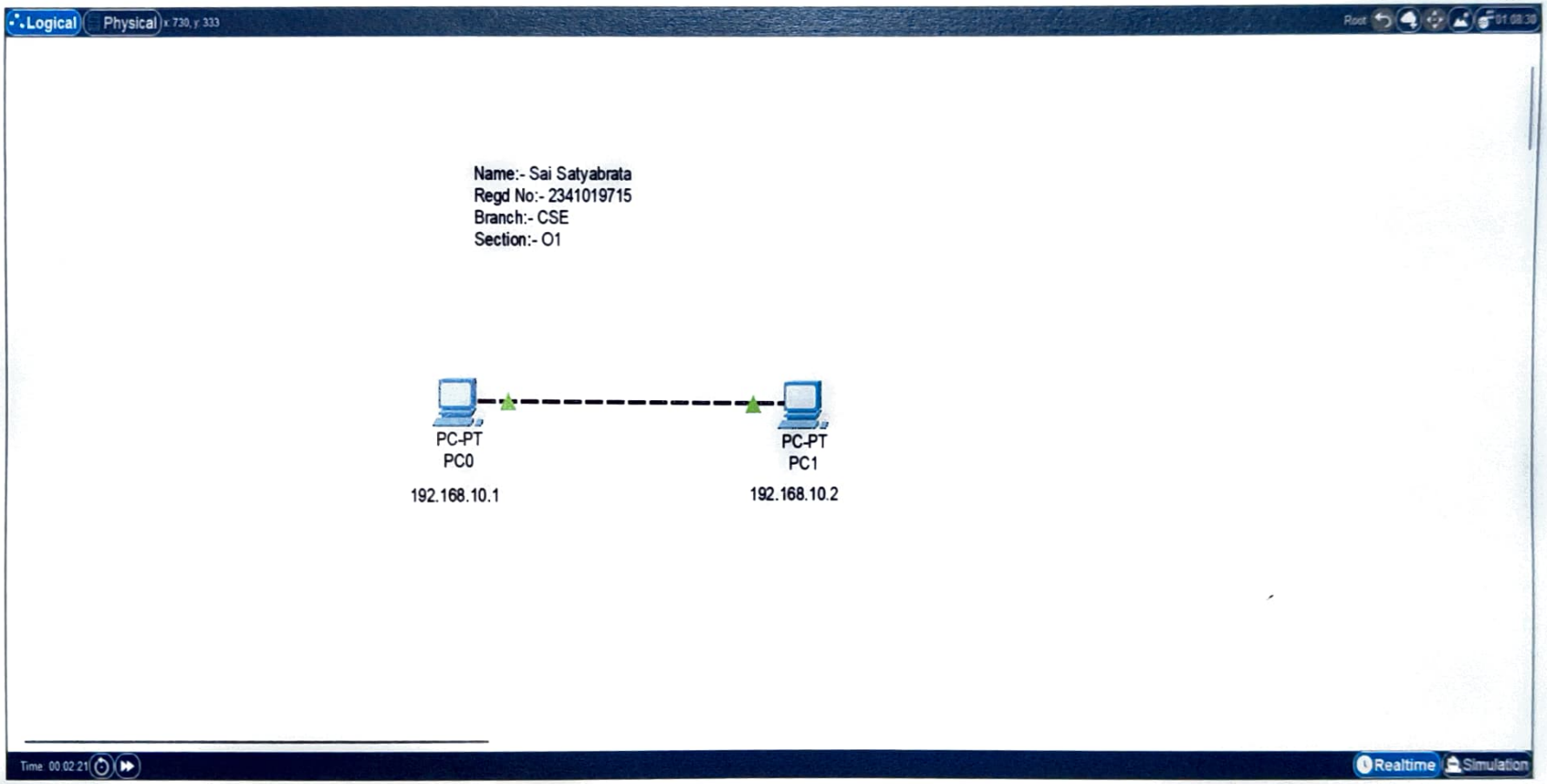
The ability to visualize data packet movement across the network, helping to understand how communication works in step-by-step manner.

(v) Protocols and services:

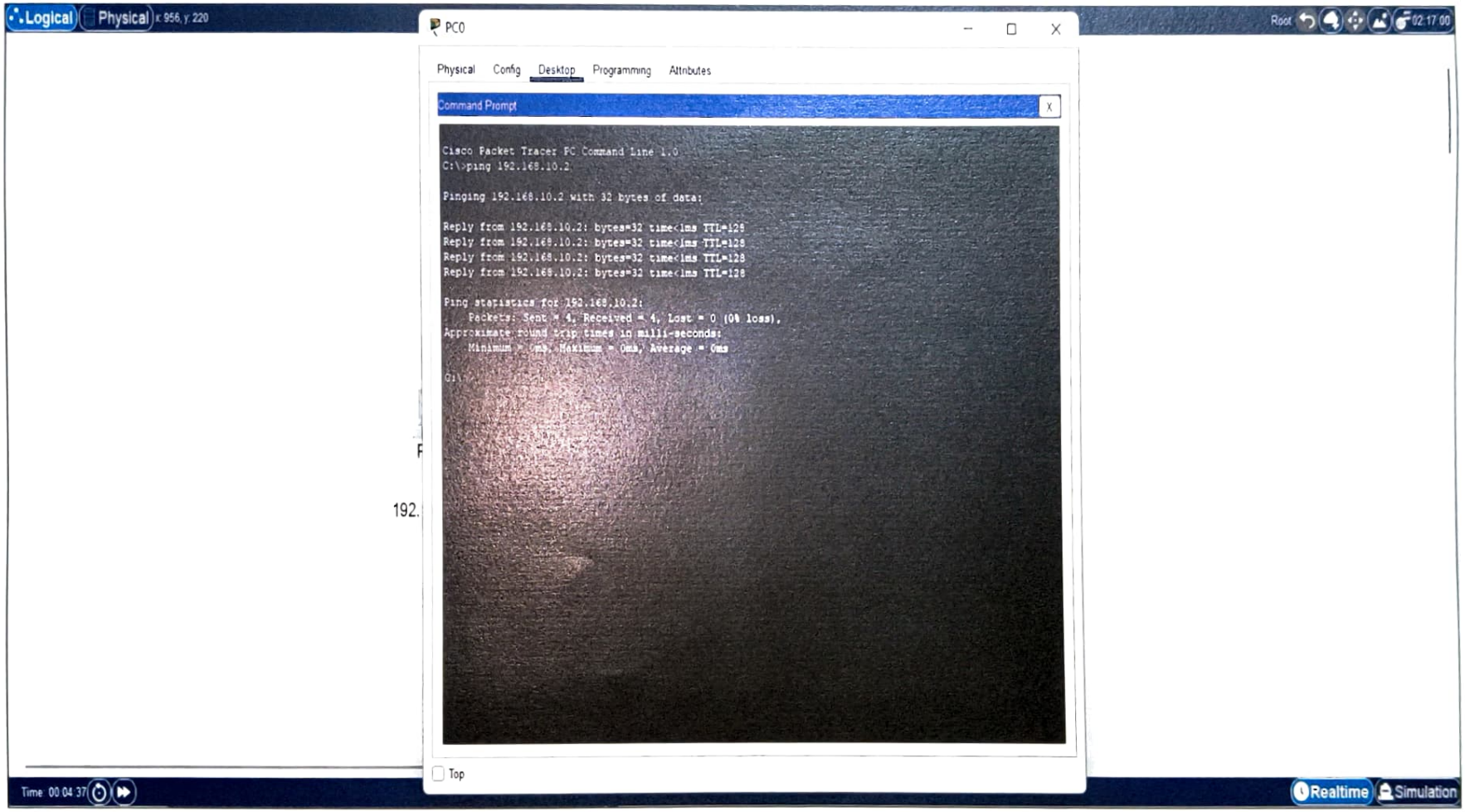
Packet Tracer allows simulation of many networking protocols and services. (e.g. IP addressing, DHCP, DNS, Routing, VLANs, OSPF, EIGRP, RIP), enabling real-world networking practice.

❖Objective-4:-

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



❖ Ping between the 2pcs:-



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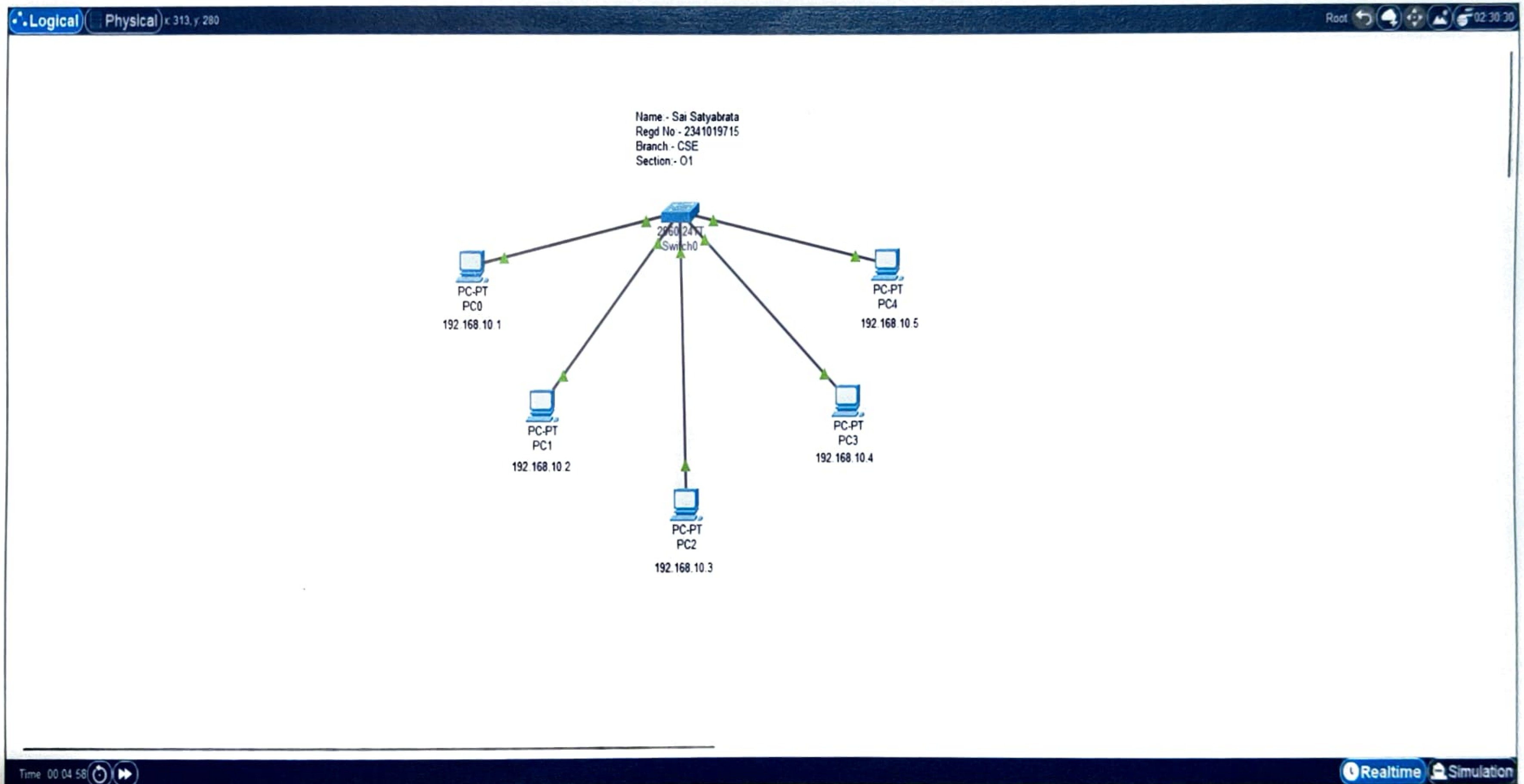
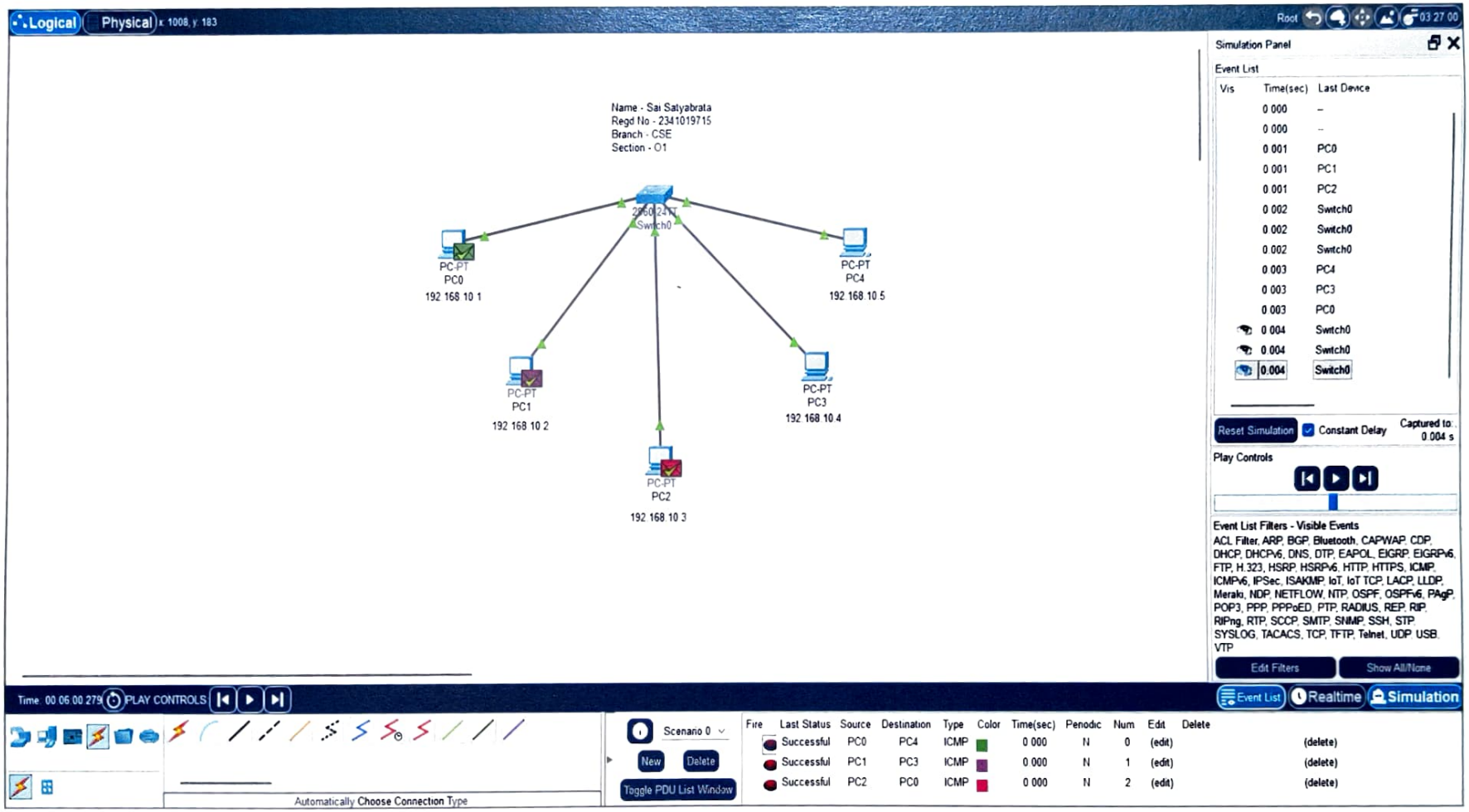
❖ Configuring a Network using switch:-

I. <u>Realtime:-</u>

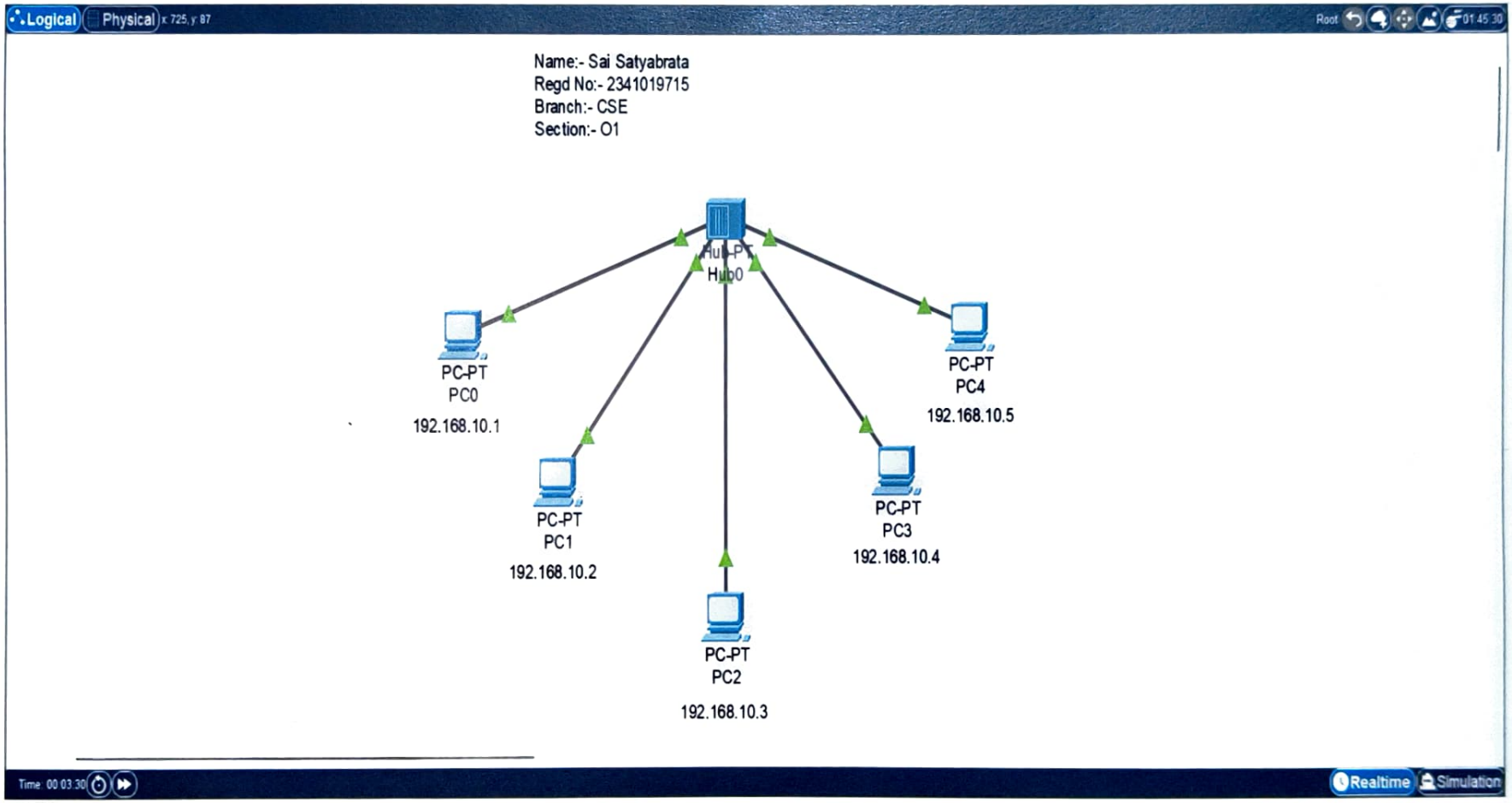


II. Simulation:-

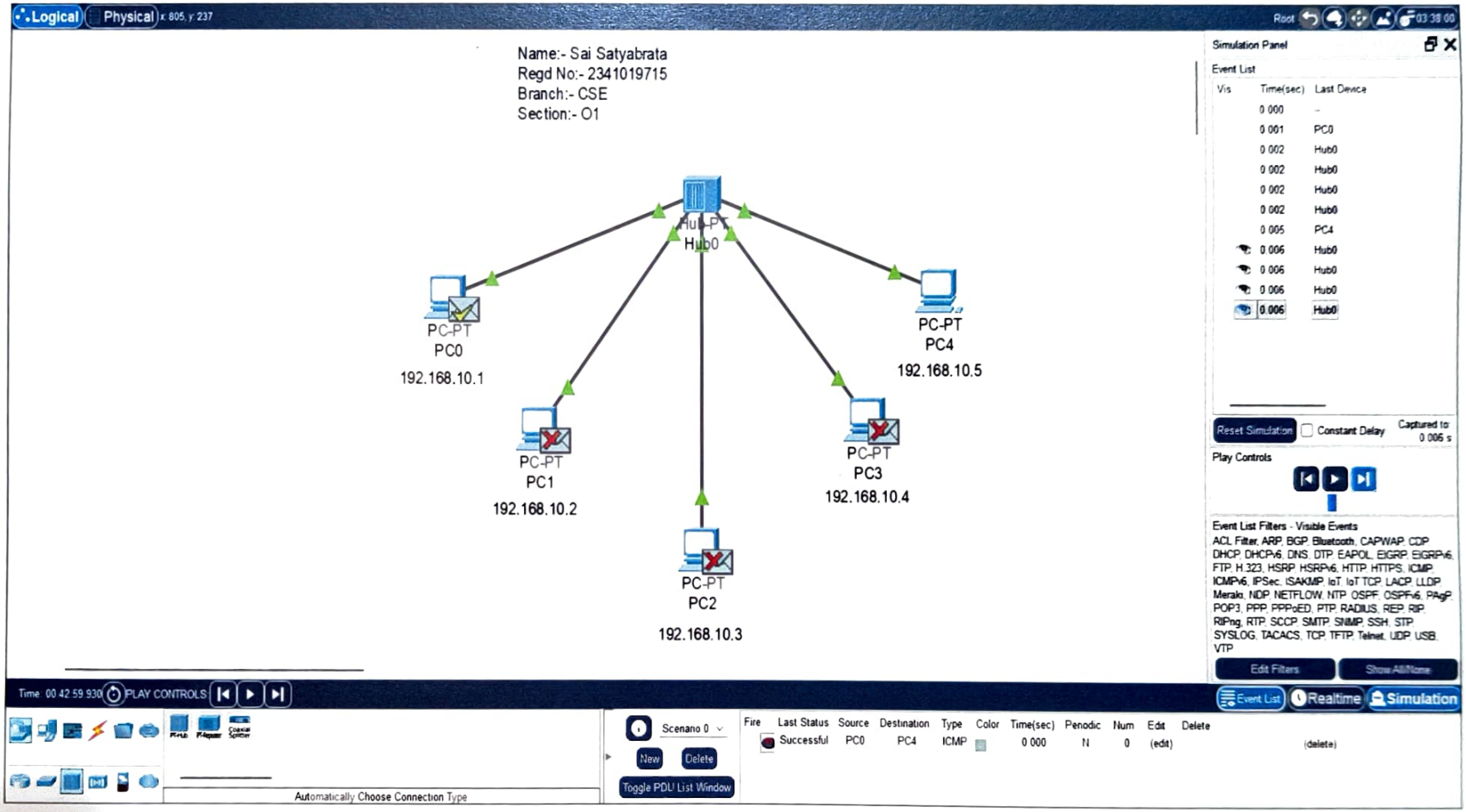


❖Configuring a Network using Hub:-

I. Realtime:-



II. Simulation:-



* Analysis:-

=> IP configuration:-

PC0 - IP:- 192.168.10.1 ; Mask: 255.255.255.0

PC1 - IP:- 192.168.10.2 ; Mask: 255.255.255.0

=> Ping Result:-

Successful ICMP echo Reply indicates proper configuration and communication.

=> Simulation mode Analysis:-

ARP request generated by PC0 to learn MAC of PC1.

ICMP Echo Request travels PC0 → switch → PC1:-

ICMP Echo Reply travels PC1 → switch → PC0:-

* Conclusion:-

"The experiment has been successfully demonstrated".

(i) Function of networking devices (hub, switch, router etc).

(ii) IPV4 addressing and subnet masks.

(iii) use of cisco packet Tracer to design a network.

(iv) Successful communication between PCs using ping.

(v) The experiment has been performed successfully in both Realtime and simulation.

Name:_____ Regd. Number:_____

* Exercise:-

1) Differentiate Layer-2 and Layer-3 switches:-

(i) L2 switch works at Data Link layer, forwards frames using MAC addresses.

(ii) L3 switch works at Network layer, forwards packets using IP addresses and supports routing.

2) Compare IPV4 and IPV6, and default subnet masks.

-> IPV4:-

32-bit, dotted decimal, 4.3 billion addresses.

-> IPV6:-

128-bit, hexadecimal, very large address space, no NAT required.

-> Subnet mask:-

Class A = 255.0.0.0,

Class B = 255.255.0.0,

Class C = 255.255.255.0

3) Class of given IPS:-

(i) 10.10.10.1 — class A

(ii) 172.16.4.3 — class B

(iii) 192.168.1.20 — class C

4) key features of cisco packet Tracer:

(i) Device Library
(ii) CLI access
(iii) Realtime & simulation modes
(iv) Protocol support
(v) IOT Simulation
(vi) Packet Inspection

5) Two workspace & two modes in packet Tracer:

=> workspace:-

Logical & physical

=> modes:-

Realtime & simulation