Computer Networking: Concepts

(CSE 3751)

Experiment 2

Aim:

Implementation of basic Ethernet using Cisco Packet Tracer to understand and make IP, TCP and UDP Header Analysis

Objectives:

1. An overview on headers (i.e. Ethernet, IP, TCP & UDP), ICMP. FTP and TFTP.
2. Configuration of an Ethernet using the network devices in Cisco Packet Tracer.
3. Simulating the Ethernet by transmitting ICMP. FTP and TFTP messages between two end devices.
4. Understanding and analysing different fields of IP, TCP and UDP headers after simulation.

Exercises:

1. Given the value available in "fragment offset" field of IP header is 100. what is the number of bytes ahead of this fragment?
2. An IP packet has arrived with the first 8 bits as 01000010. What is the version and the header length?
3. A TCP header in hexadecimal format is given as below.

   05320017 00000001 00000000 500207ff 00000000

   a. What is the source port number?

   b. What is the destination port number?

   c. What is the length of the header?

   d. What is the window size?
4. Given a UDP header in hexadecimal format 06 32 00 0D 00 1C E2 17. Find the following:
   a. Source port number.
   b. Destination port number.
   c. Length of user datagram.
   d. Length of the data.

Experiment - 2

Aim :-
Implementation of basic Ethernet using Cisco Packet Tracer to understand & make IP, TCP and UDP Header Analysis

Objectives :-

1. An overview on headers (i.e. Ethernet, IP, TCP & UDP), ICMP, FTP and TFTP.

Ethernet :-
→ A widly used technology for wired local Area networks.
→ Used frames to encapsulate data, containging MAC addresses for source & destination.
→ Supports speed 10 MBPS to 100GBPS

IP :-
→ Internet protocol responsible for addressing and routing packets of data across networks.
→ It's basically two types :- IPv4 (32-bit address)
IPv6 (128-bit addresses)

TCP :-
→ TCP stands for transmission control protocol
→ TCP ensures reliable, ordered and error checked delivery of data b/w applications

UDP :-
→ UDP stands for User Datagram Protocol
→ The purpose of UDP to allows low-latency, connectionless communication.
→ Common uses of UDP is streaming media and online gaming

ICMP:-
→ ICMP stands for Internet Control Message Protocol.
→ Operates at the network layer, primarily for control messages
→ Used for Troubleshooting and monitoring network connectivity

FTP:-
→ FTP stands for File Transfer Protocol.
→ Supports authentication and can operate in active or passive modes.
→ Uses for uploading and downloading files from web servers.

TFTP:-
→ TFTP stands for Trivial File Transfer Protocol
→ Purpose is a simpler version of FTP for transfering files with minimal overhead.
→ Commonly used for booting devices over a network and transfering ~~files with minimal overhead~~ configuration files.
~~→ Commonly used booting devices over a network and~~

2 Configuration of an Ethernet using the network devices in Cisco Packet Tracer.

N/w Setup:-
* Place 2 end devices (PCs), a switch and a router on the work space in Cisco Packet Tracer
* Connect the PCs to switch using ethernet cables
* Configure the router interface with IP addresses to allow commu^n across n/w

IP address Configuration:-
* Assign IP address to each PC & configure the default gateway.

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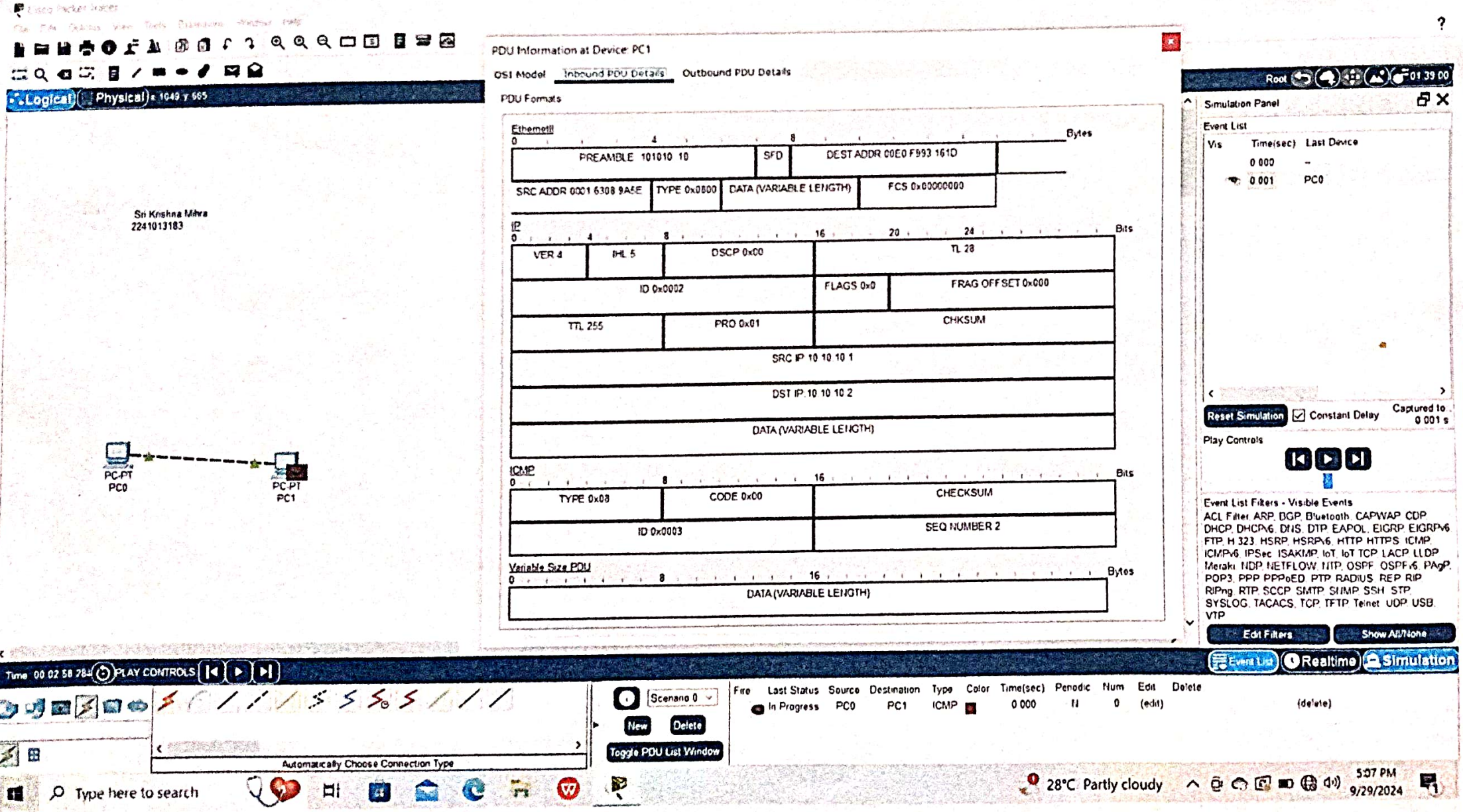
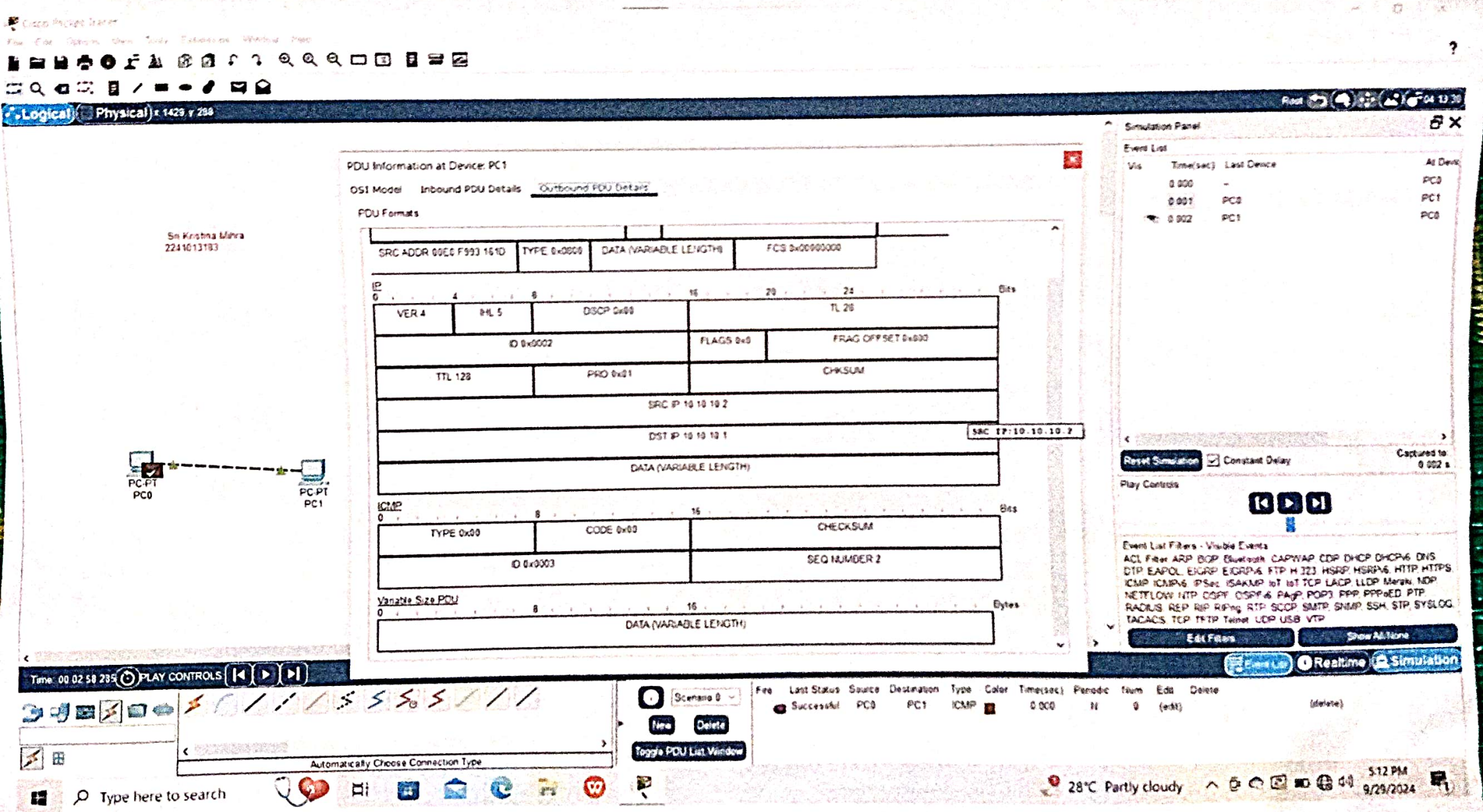
ICMP:-

(a) First an inbound message is transfered from one PC to another PC and the message is successfully transmitted

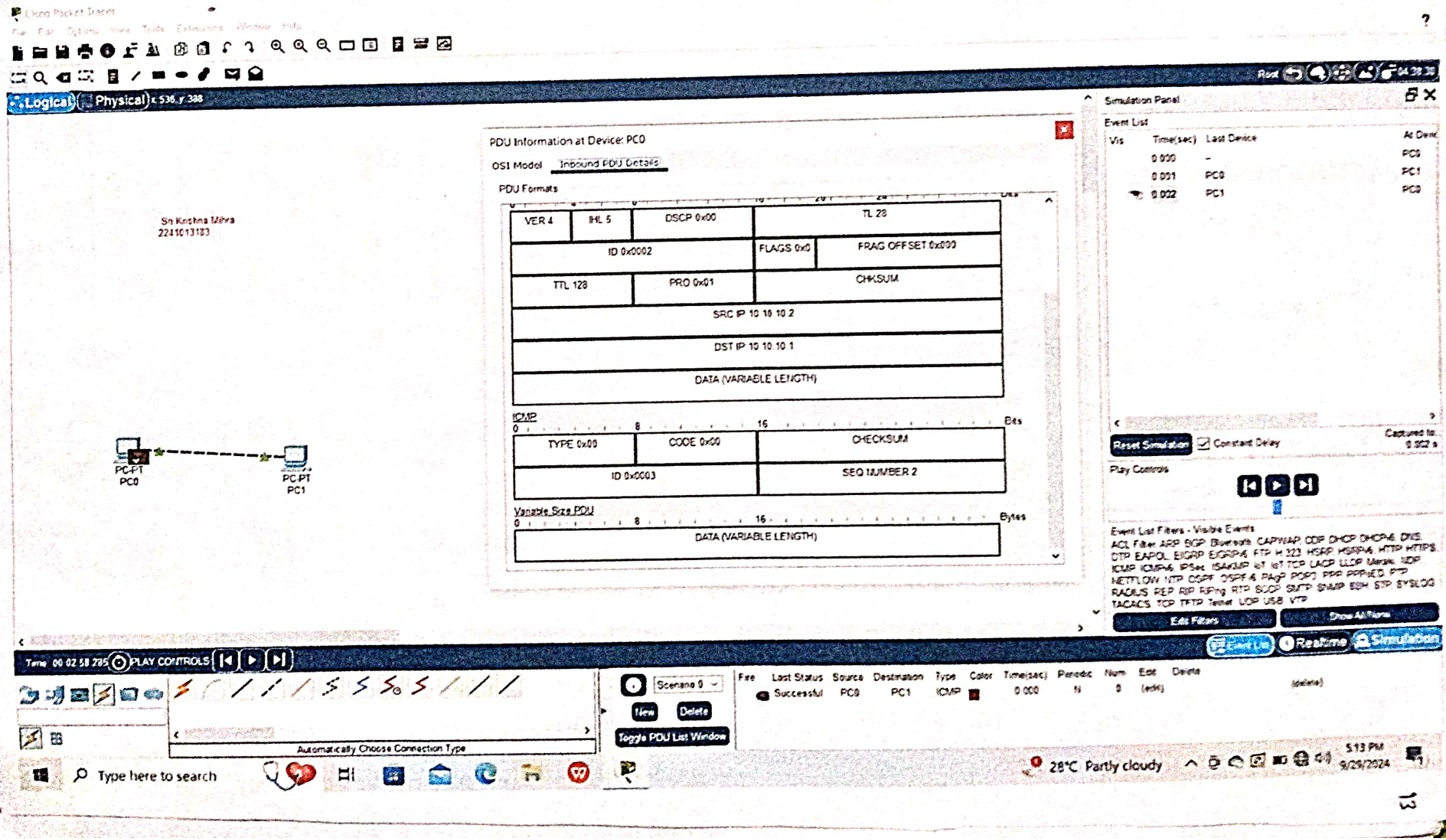
∴ Here is the inbound PDU details of successfully transmitted message [PC0 - PC 1]



(b) Secondly; an outbound PDU details information of PC1 is also shown:-



(c) then; by next simulation the message is again sent back from PC1 to PC0 (source) & only the Inbound PDU details information is being shown :-



3. Simulating the Ethernet by transmitting ICMP, FTP & TFTP message between two end devices.

→ ICMP stands for Internet Control Message Protocol is primarily used for network diagnostics and error reporting

→ FTP stands for File Transfer Protocol used to transfer files between a client & a server over a TCP/IP network.

→ TFTP stands for Trivial File Transfer Protocol, is a simplified version of FTP, designed for transfering files without authentications

→ Configuring ethernet using Cisco Packet Tracer allows users to simulate a real coorld networking environment by transmitting ICMP, FTP and TFTP messages between end devices.

FTP(TCP):-

A complex PDU message is sent from one end to another end. Here one PC to another server is connected between each other and complex PDU message is transfered blw them and we can see the three-way acknowledgement process here.

(a) In here we can see, the message is successfully transmitted from server to PC. Here the sequence number = 0

Acknowledgement no = 1

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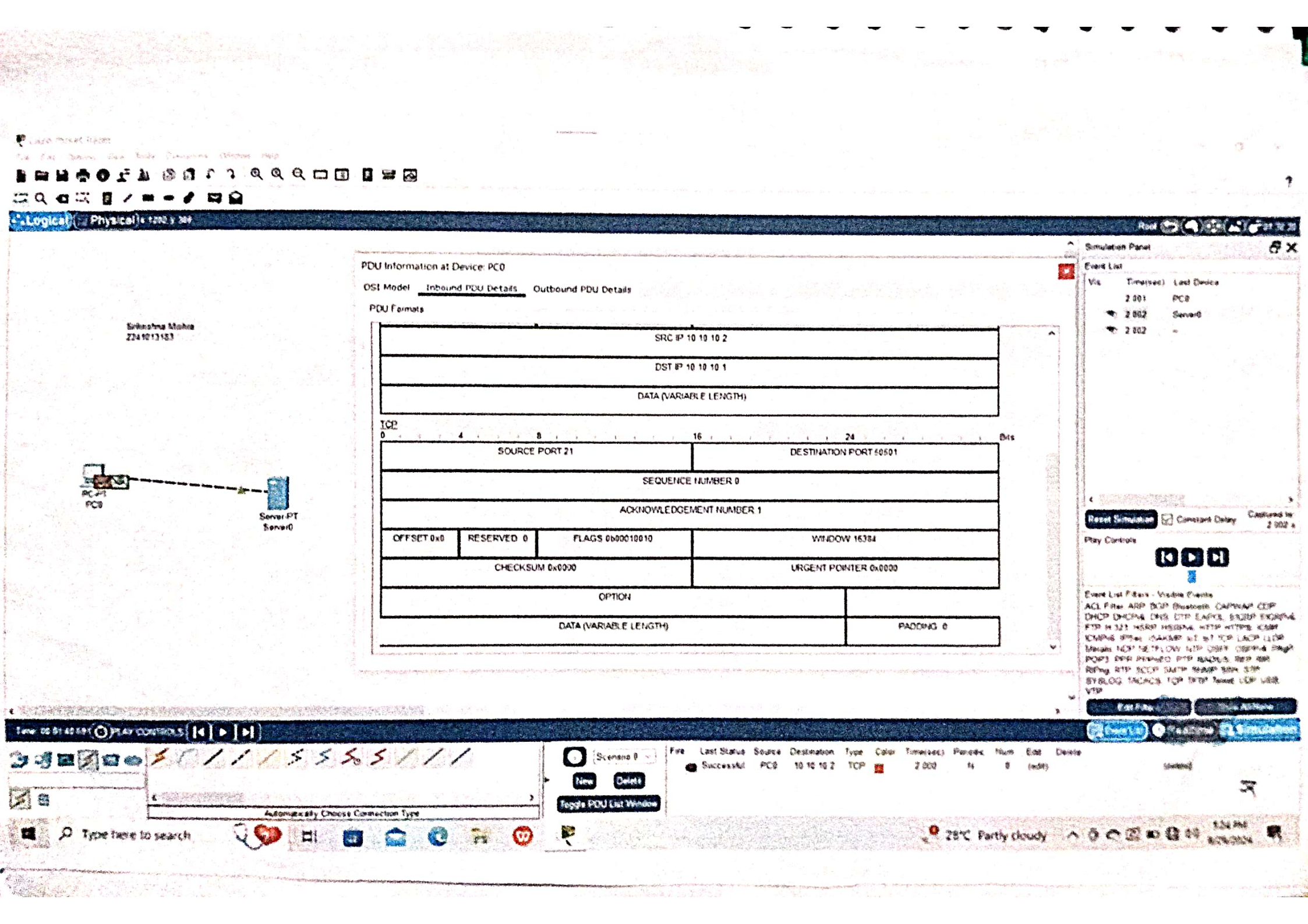
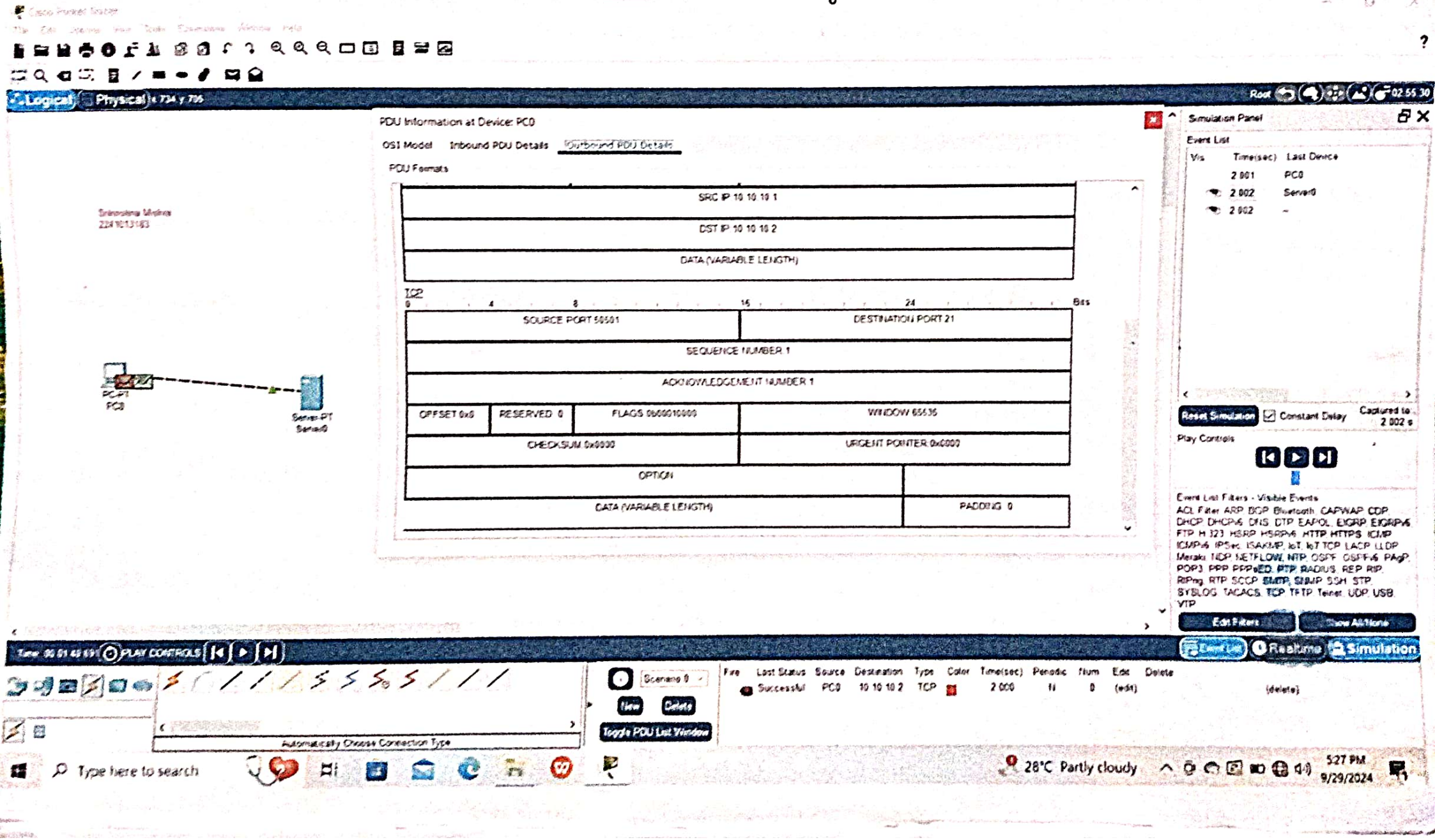

Logical
Physical
PDU Information at Device: PC0
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
SRC IP 10.10.10.2
DST IP 10.10.10.1
DATA (VARIABLE LENGTH)
TCP
0
4
8
16
24
Bits
SOURCE PORT 21
DESTINATION PORT 50501
SEQUENCE NUMBER 0
ACKNOWLEDGEMENT NUMBER 1
OFFSET 0x0
RESERVED 0
FLAGS 0b000010010
WINDOW 16384
CHECKSUM 0x0000
URGENT POINTER 0x0000
OPTION
DATA (VARIABLE LENGTH)
PADDING 0
PC-PT
PC0
Server-PT
Server0
Simulation Panel
Event List
Reset Simulation
Constant Delay
Play Controls
Scenario 0
New
Delete
Toggle PDU List Window
Automatically Choose Connection Type
Type here to search
28°C Partly cloudy

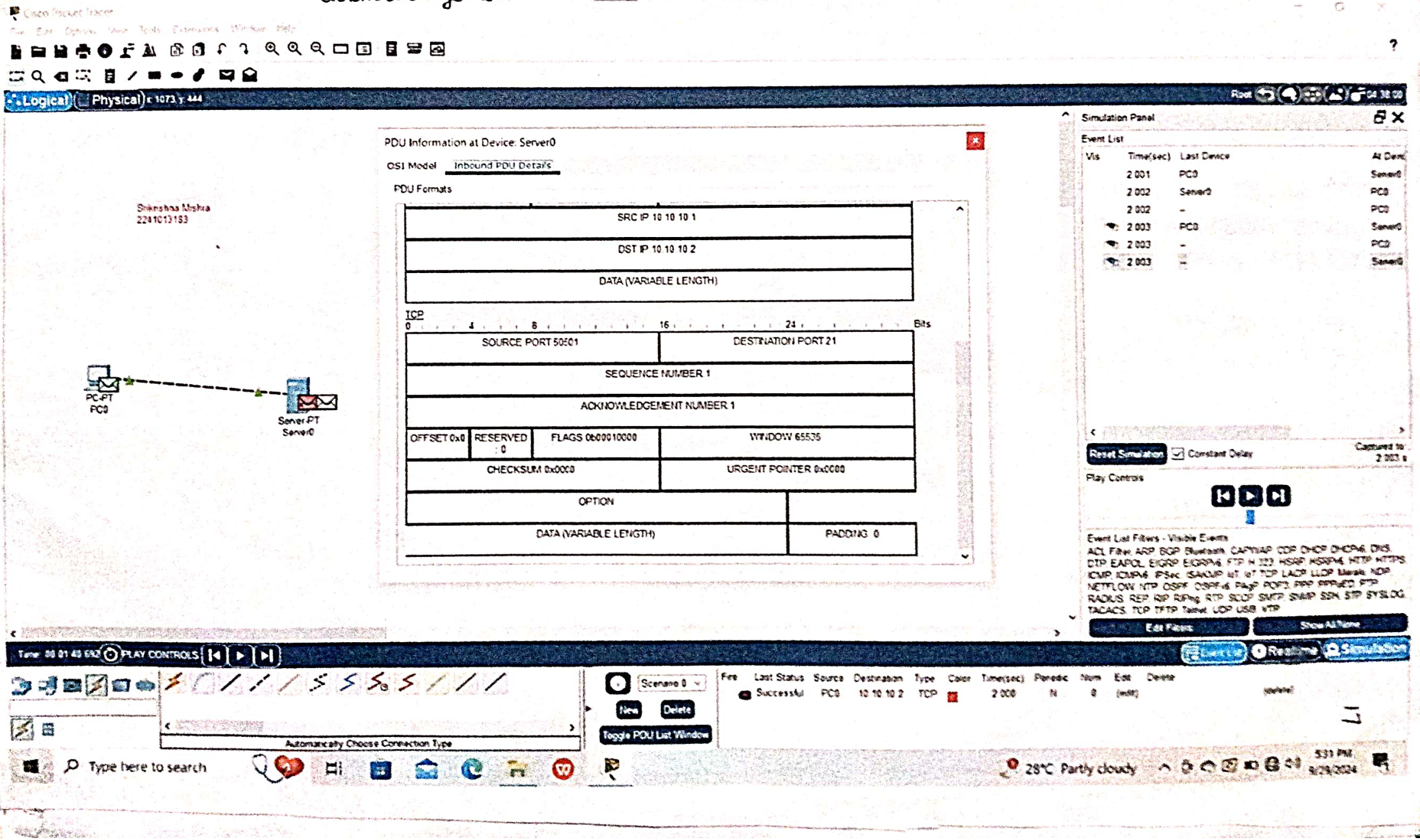
2 (b) In this FTP (TCP) model, we can the outband message when message is sent from server to PC. and the complex PDU message is sent. Here sequence no = 1
Acknowledgement = 1



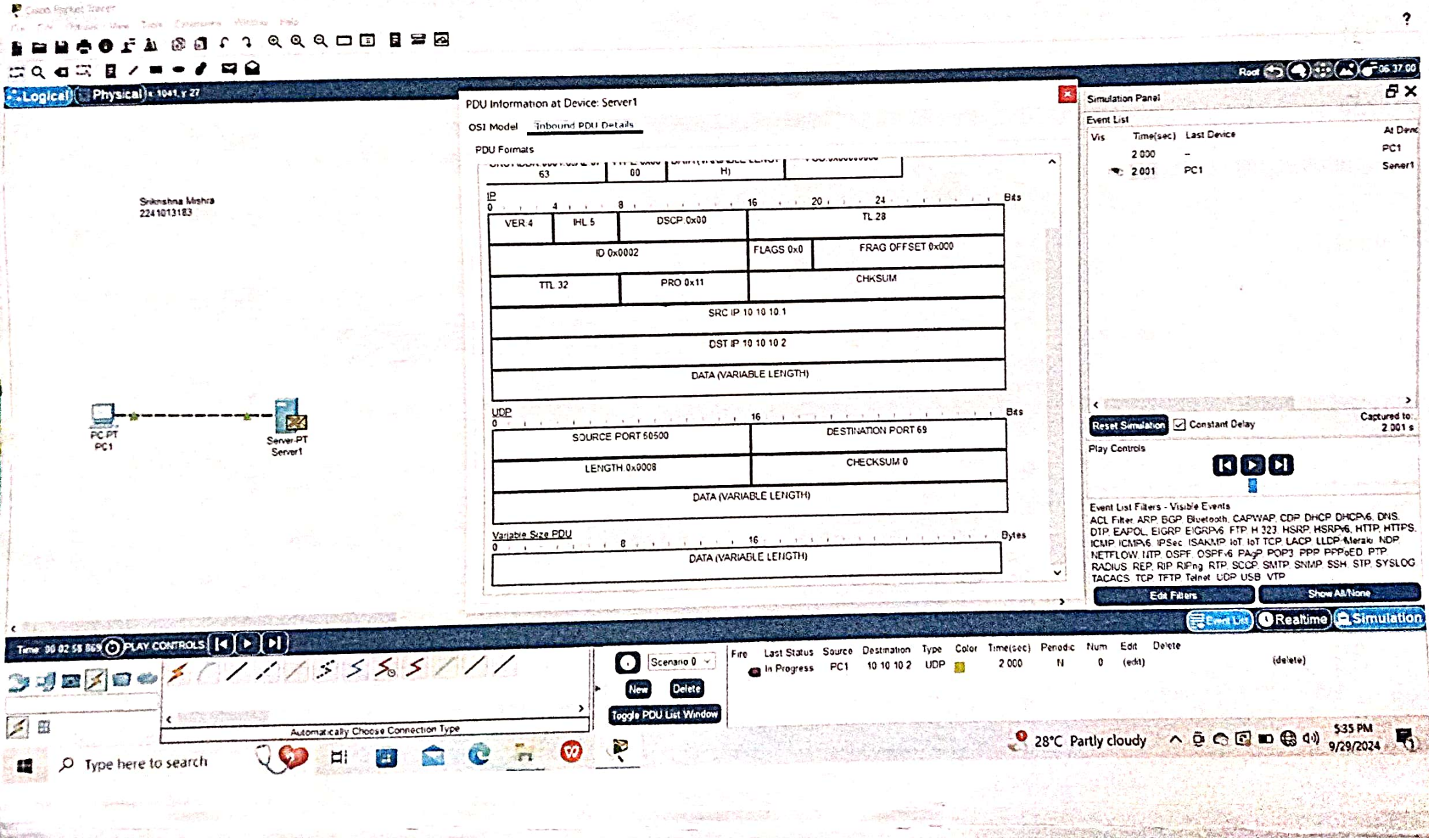
(c) And now; the message is sent back from PC to server successfully & with this 3-way handshaking process is also completed.

Here sequence no = 1

acknowledgement = 1



UDP:- On UDP, an complex PDU message is successfully sent from one end to another end. But the message can't be return back as there is no 3-way acknowledgement process or 3way handshaking process.
(TFTP)
∞ Acknowledgement is not there.
Here, only Inbound PDU details is shown.



4) Understanding & analysis different fields of IP, TCP & UDP headers after simulation.

After simulating data transmission using these protocols.

→ Packet Inspection :- Use packet tracer simulation mode or wireshark to capture packets. This allows you to view the headers in real time.

→ For IP headers; check the source & destination IP addresses to verify routing & connectivity.

→ For TCP headers, analyze the sentence & acknowledgement numbers to understand the flow of data & ensure reliable delivery.

→ For protocol identification use the protocol field in the IP header to determine the data using TCP or UDP, which impacts how data is managed and transmitted

→ This knowledge is foundational for anyone working in networking and network administration.

Conclusion :-

Implementing basic ethernet using Cisco Packet Tracer provides practical experience in configuring network devices & understanding communication protocols. This hands on approach enables detailed analysis of IP, TCP & UDP headers, enhancing knowledge of data transmission and error handling

Exercises:

1) Given the value available in "fragment offset" field of IP header is 100. What is number of bytes ahead of this fragment?

Ans:- Given, IP header = 100

Offset is measured in 8 byte blocks

So, Bytes = 100 × 8 = 800 bytes

2) An IP packet has arrived with the first 8 bit as 01000010. What is the version & the header length?

Ans:- Given, IP packets: 0100 0010

Here, the 1st 4 bits represent the corresponds to version 4 (0100) that IP version IPv4.

→ For header length: 0100 represent the header length in 32-bit words.

0010 = 2

Header length = 2 × 4 = 8 bytes

3) A TCP header in hexadecimal format is given as below

05320017 00000001 00000000 500207ff 00000000

a) What is the source port number?

Ans:- The first 16-bits (4-hexadecimal) digits are:

$0532 = 2\times16^0 + 3\times16^1 + 5\times16^2 + 0\times16^3$

$= 2 + 48 + 1280 = 1330$

b) What is the destination port number?

Ans- $0017 = 7\times16^0 + 1\times16^1 + 0\times16^2 + 0\times16^3$

$= 7 + 16 = 23$

(c) What is the length of the header?

Ans:- Here, Header = 5002

1st hex digit = 5 = 0101

Header length = 5×4 = 20 bytes

(d) What is the window size?

Ans:- Window size found in the next 16-bits after header length.

07ff = $f \times 16^0 + f \times 16^1 + 7 \times 16^2 + 0 \times 16^3$

= $15 + 15 \times 16 + 7 \times 256 + 0$

= $15 + 240 + 1792 = 2047$

4) Given a UDP header in hexadecimal format 06 32 00 0D 00 1C E2 17. Find the following:

a) Source Port number.

The 1st 16 bit digits are = 0632

0632 = $2 \times 16^0 + 3 \times 16^1 + 6 \times 16^2 + 0 \times 16^3 = 2 + 48 + 1536 = 1586$

b) Destination Port number.

Next 16-bit after source port are = 000D

000D = $D \times 16^0 + 0 \times 16^1 + 0 \times 16^2 + 0 \times 16^3 = 13$

c) Length of user datagram

The next 16-bits are 001C

001C = $C \times 16^0 + 1 \times 16^1 + 0 \times 16^2 + 0 \times 16^3 = 12 + 16 = 28$

d) Length of the data

Length of data = Total Length − Header Length

For UDP header length = 8 bytes

Total length of UDP = 28 bytes

Length of data = 28 bytes − 8 bytes = 20 bytes