Computer Networking: Concepts

(CSE 3751)

Experiment 4

Aim:

Implementation and understanding the use of IPv4 Addressing, NAT with Cisco Packet Tracer

Objectives:

1. An overview on IPv4 addressing (Public, Private, Classful) and NAT (Network Address Translation).
2. Constructing and analysing the communication between two networks (of different classes).
3. Configuring and implementing NAT using a router to analyse the communication between PCs(in a private network) and a public server.

Exercises:

1. Mention the subnet mask and class of the following IPv4 addresses:
   a. 172.14.9.64
   b. 129.34.67.25
   c. 185.56.32.87
2. What are the commands used to determine the current IP address configurations on a Windows operating system? What is the difference between ipconfig and ifconfig commands?
3. If a class B network on the Internet has a subnet mask of 255.255.248.0, what is the maximum number of hosts per subnet?
4. List the situation where NAT is required.
5. Host A (on TCP/IPv4 network A) sends an IP datagram D to host B (also on TCP/IPv4 network B). Assume that no error occurred during the transmission of D. When D reaches B, what are the IP header field(s) that may be different from that of the original datagram D?

Name:_____ Regd. Number:_____

Aim of the Experiment:-

Implementation & understanding the case of IPv4 addressing, NAT with Cisco Packet Tracer.

Objectives:-

1. An overview on IPv4 addressing (Public, Private, Classful) and NAT

IPv4 addressing :-

IPv4 uses a 32-bit address space, allowing for about 4.3 billion unique address. These addresses are typically written in decimal format as four octates. (eg. 192.168.0.1)

Public IP address:-

These are unique & routable on the global Internet, assigned by IANA.

Private IP address:-

These are used within private n/w & are not routable on the global internet.

NAT:-

- It is an IP service commonly found on all private networks within organizations.
- It allows private IPv4 address to be translated into public IPv4 address.
- Allows devices in a private n/w to communicate with devices on a public n/w

Classful Address:-

- IP addresses are allocated according to the classes A-E.
- Doesn't support VLSM.
- More bandwidth
- Less efficient.

2. Constructing & analysing the communication b/w 2 n/ws (of different classes)

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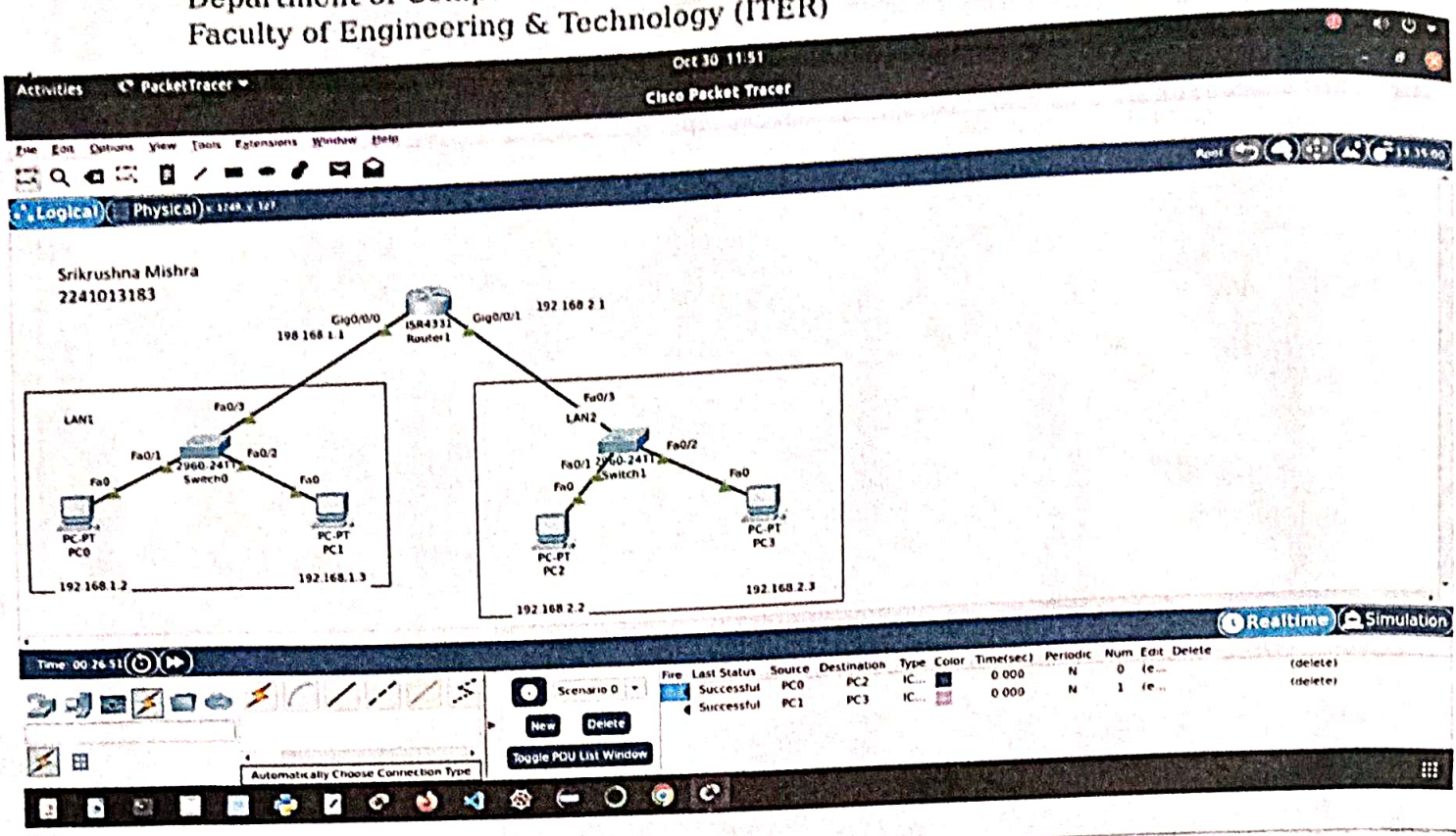
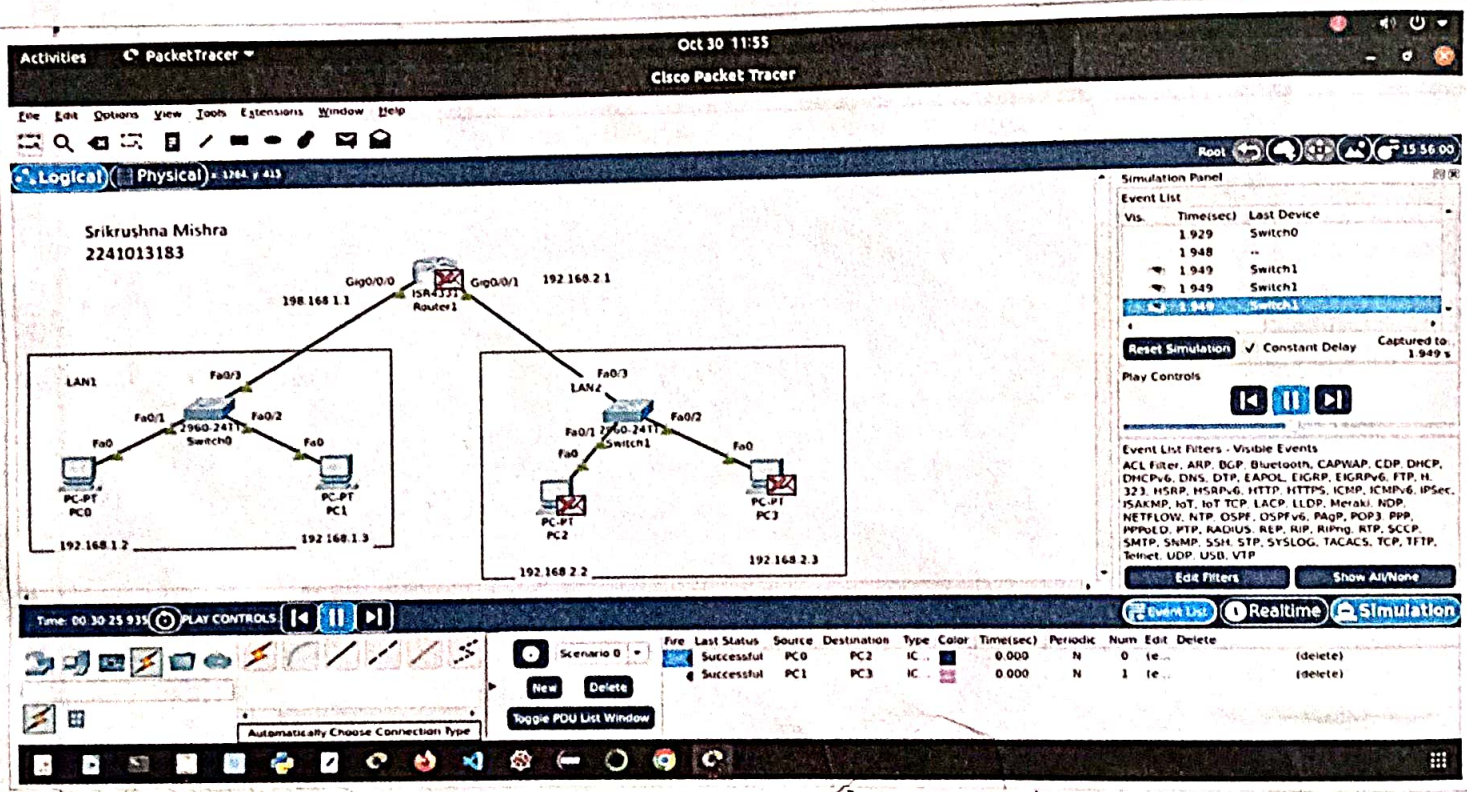




IP address of PCs:-

$PC_0 \rightarrow 192.168.1.2$

$PC_1 \rightarrow 192.168.1.3$

$PC_2 \rightarrow 192.168.2.2$

$PC_3 \rightarrow 192.168.2.3$

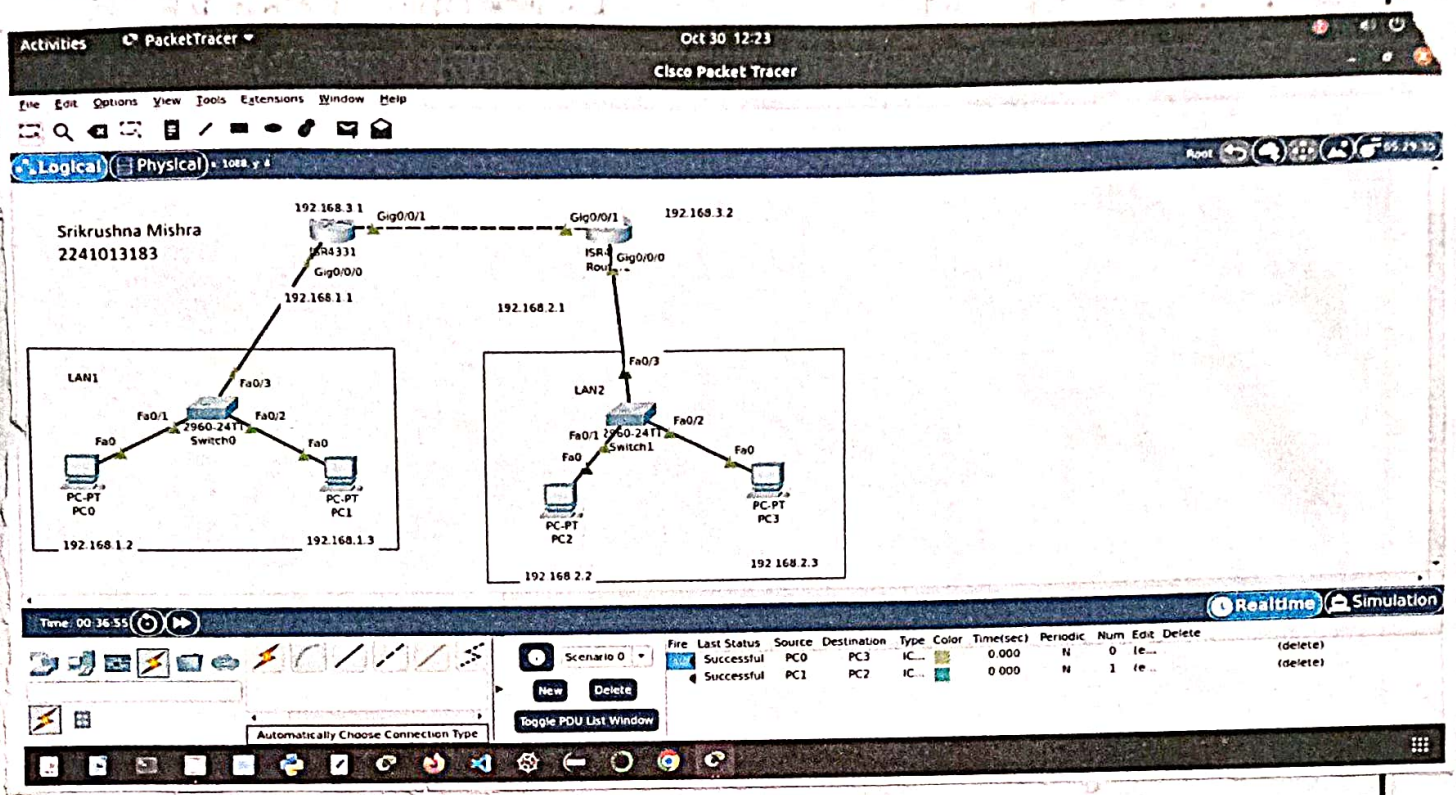
* Port Status = ON } both on gigabit ethernet 0/0/0 and 0/0/1
* Default gateway:-

PC_0, PC_1 } $\rightarrow 192.168.1.1$

PC_2, PC_3 } $\rightarrow 192.168.2.1$

Name:_____ Regd. Number:_____

* Gigabit ethernet 0/0/0 ⇒ 192.168.1.1
  Gigabit ethernet 0/0/1 ⇒ 192.168.2.1
* Source → Destination
  PC0 → PC2
  PC1 → PC3
  } ICMP message is successfully transmitted in both the cases.



→ Port status should be ON

→ Router 2:-
Gigabit Ethernet 0/0/0 ⇒ 192.168.2.1
Gigabit ethernet 0/0/1 ⇒ 192.168.3.2

→ Router 1:-
Gigabit ethernet 0/0/0 → 192.168.1.1.
Gigabit ethernet 0/0/1 → 192.168.3.1

* Normal Method :-

Router-1 (Static)
Network = 192.168.2.0
Mask = 255.255.255.0
Next Hop = 192.168.3.2
Add
N/w Address = 192.168.2.0/24 via 192.168.3.2

Router-2
N/w = 192.168.1.0
Mask = 255.255.255.0
Next Hop = 192.168.3.1
Add
N/w Address = 192.168.1.0/24 via 192.168.3.1

Name:_____ Regd. Number:_____

Source	Dest
PC0	PC_3
PC_1	PC_2

} ICMP message is successfully transmitted in both the cases.

* Command Line :-

Router (1) :- [class B]
Giga 0/0/0 = 128.10.1.1
Subnet Mask = 255.255.0.0
Giga 0/0/1 = 128.10.2.1

Router (2) :- [Class B]
Giga 0/0/0 = 128.10.1.2
Subnet Mask = 255.255.0.0
Giga 0/0/1 = 128.10.2.2

* Enter host name [Router 3] [port no]

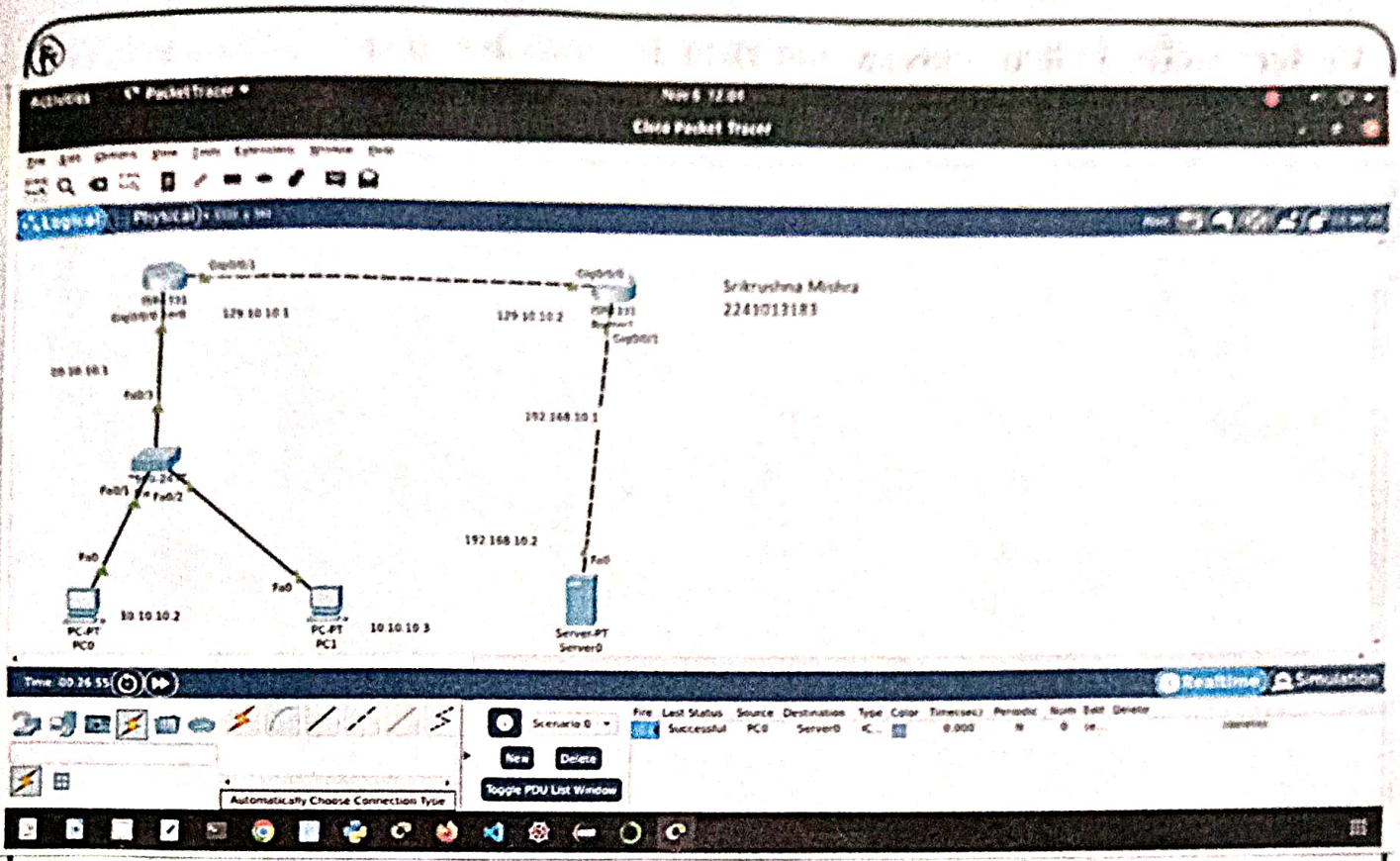
Router 3 :-

```
Router > enable
Router # }priviledge mode
Router # conft
Router (config) # interface GigabitEthernet 0/0/0
Router (config-if) #ip address 192.168.1.1 255.255.255.0
Router (config-if) #no shutdown
Router (config-if) #exit
Router (config-if) #interface GigabitEthernet 0/0/1
Router (config-if) #ip address 172.10.1.1 255.255.255.0
Router (config-if) # no shutdown
Router (config-if) #exit
```

Router-4 [host name :- Router 4]

```
Router > enable
Router # }priviledge mode
Router # conft
Router (config) # interface GigabitEthernet 0/0/0
Router (config-if) # 192.168.2.1 255.255.255.0
Router (config-if) #no shutdown
Router (config-if) #exit
Router (config-if) #interface GigabitEthernet 0/0/1
Router (config-if) # ip address 192.168.3.2 255.255.255.0
Router (config-if) # no shutdown  Router (config-if) #exit
```

Name:_____ Regd. Number:_____



IP address of PC :-

PC0 → 10.10.10.2

PC1 → 10.10.10.3

Server IP address :-

192.168.10.2

Router 0 :-

Giga 0/0/0 → 10.10.10.1

Giga 0/0/1 → 129.10.10.1

Router 1 :-

Giga 0/0/0 → 129.10.10.2

Giga 0/0/1 → 192.168.10.1

Server Dest

PC0 ⟶ Server } ICMP message

*Command Line Interface [CLI]

1) Router 0 :-

```
Router# enable
Router # conf t
Router(config)# int gig 0/0/0
Router(config-if)# ip address 10.10.10.1 255.0.0.0
Router(config-if)# no shutdown
Router(config-if)# exit
Router(config-if)# int gig 0/0/1
```

Name:_____ Regd. Number:_____

```
Router(config-if)#ip address 129.10.10.1  255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
```

2) Router-1 :-

```
Router>en
Router#conf t
Router(config-if)#int gig 0/0/1
Router(config-if)#ip address 192.168.10.1  255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#int gig 0/0/0
Router(config-if)#ip address 129.10.10.2  255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
```

(*) STATIC :-

1) Router-1 :-

```
Router(config)#ip route 10.0.0.0  255.0.0.0  129.10.0.1
Router(config)#exit
Router(config)#show ip route
```

Name:_____ Regd. Number:_____

2) Router - 0 :-

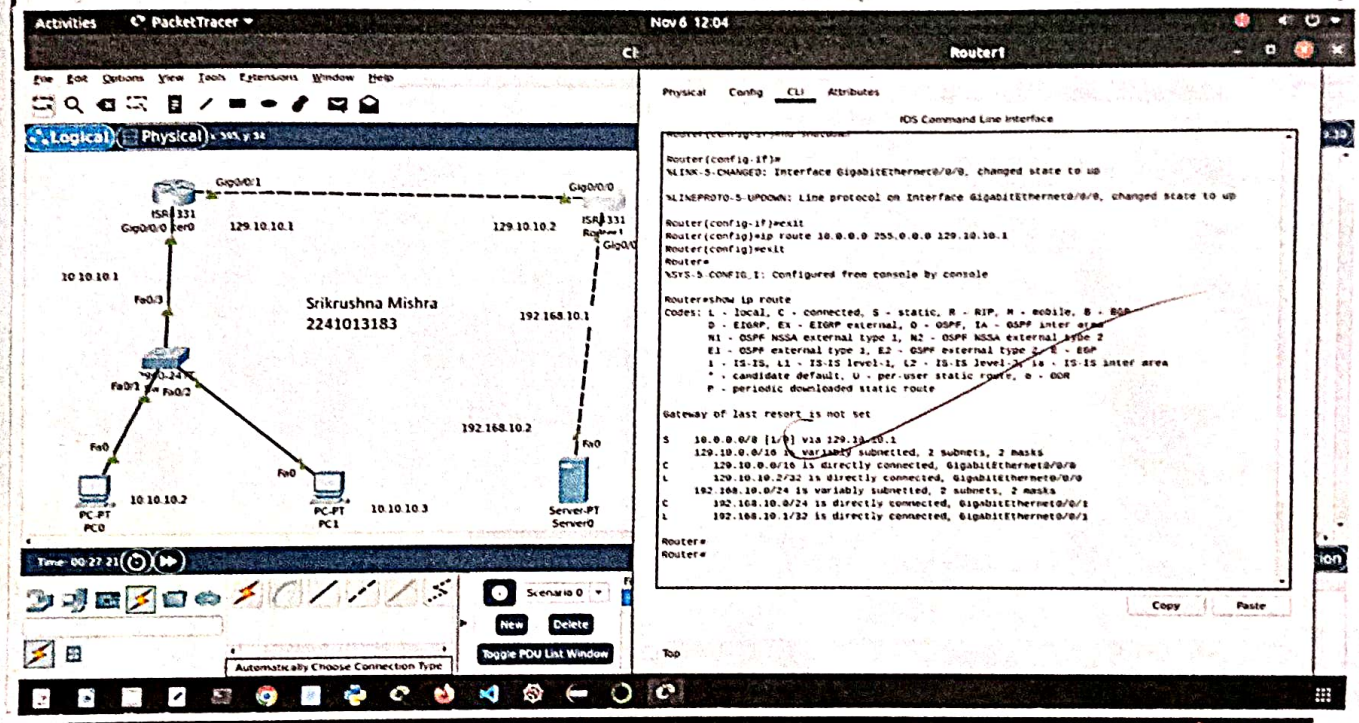
Router(config)# ip route 192.168.10.0 255.255.255.0 129.10.10.2

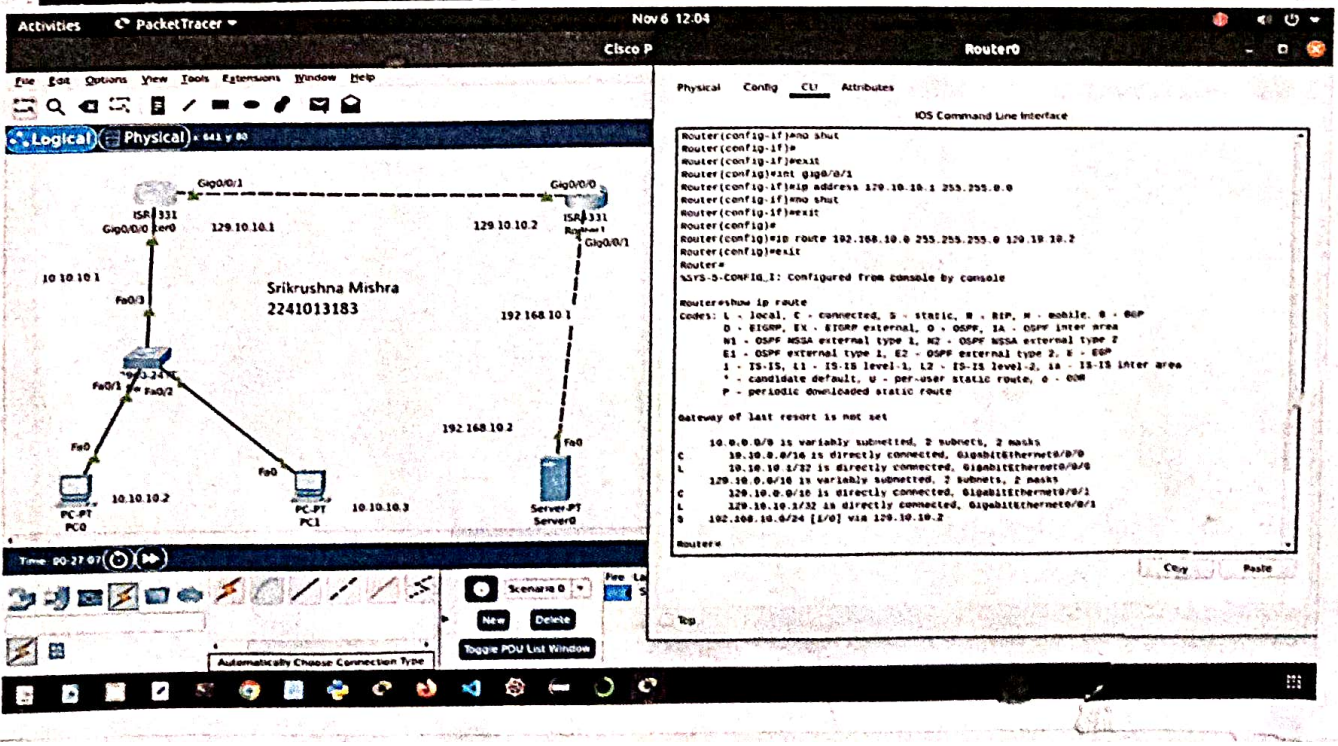
Router(config)#exit

Router# show ip route

* ICMP message :-

PC0 → Server 0 } 9t shoulal be successful.
PC1 → Server 1 }





Obj. 3

Configuring & implementing NAT using a router to analyse the communication b/w PCs (in a private n/w) and a public server.

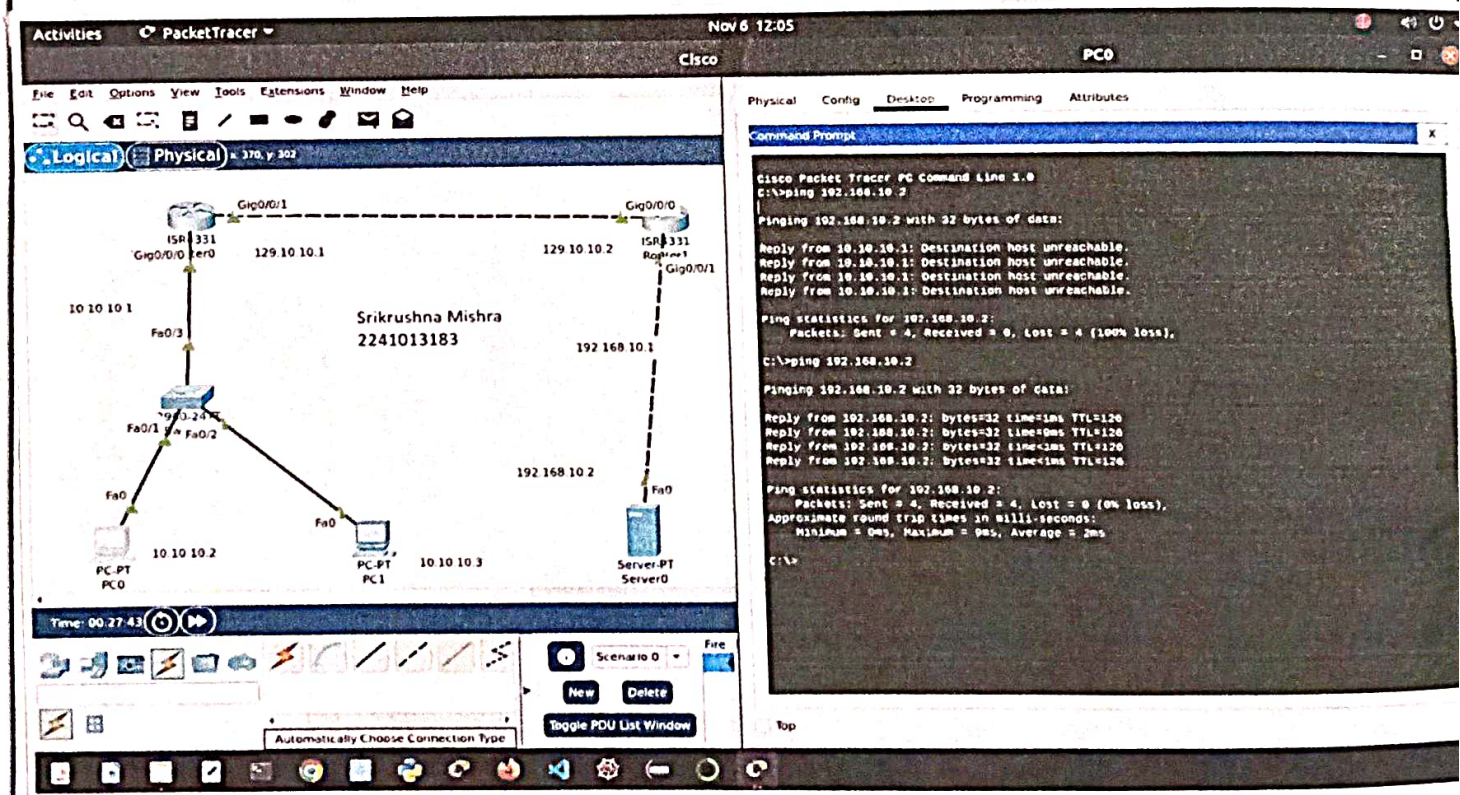
* CLI (Command Line Interface):-

```
Router >en
Router# conf t
Router(config)#ip nat inside source static 10.10.10.2 129.10.10.3
Router(config)#ip nat outside source static 10.10.10.3 129.10.10.4
Router(config)#int gig0/0/0
Router(config-if)#ip nat inside
Router(config-if)#exit
Router(config)# do sh ip nat translation
```

Details of Router

ICMP message

PC0 → Server0
PC1 → Server1
} Successful



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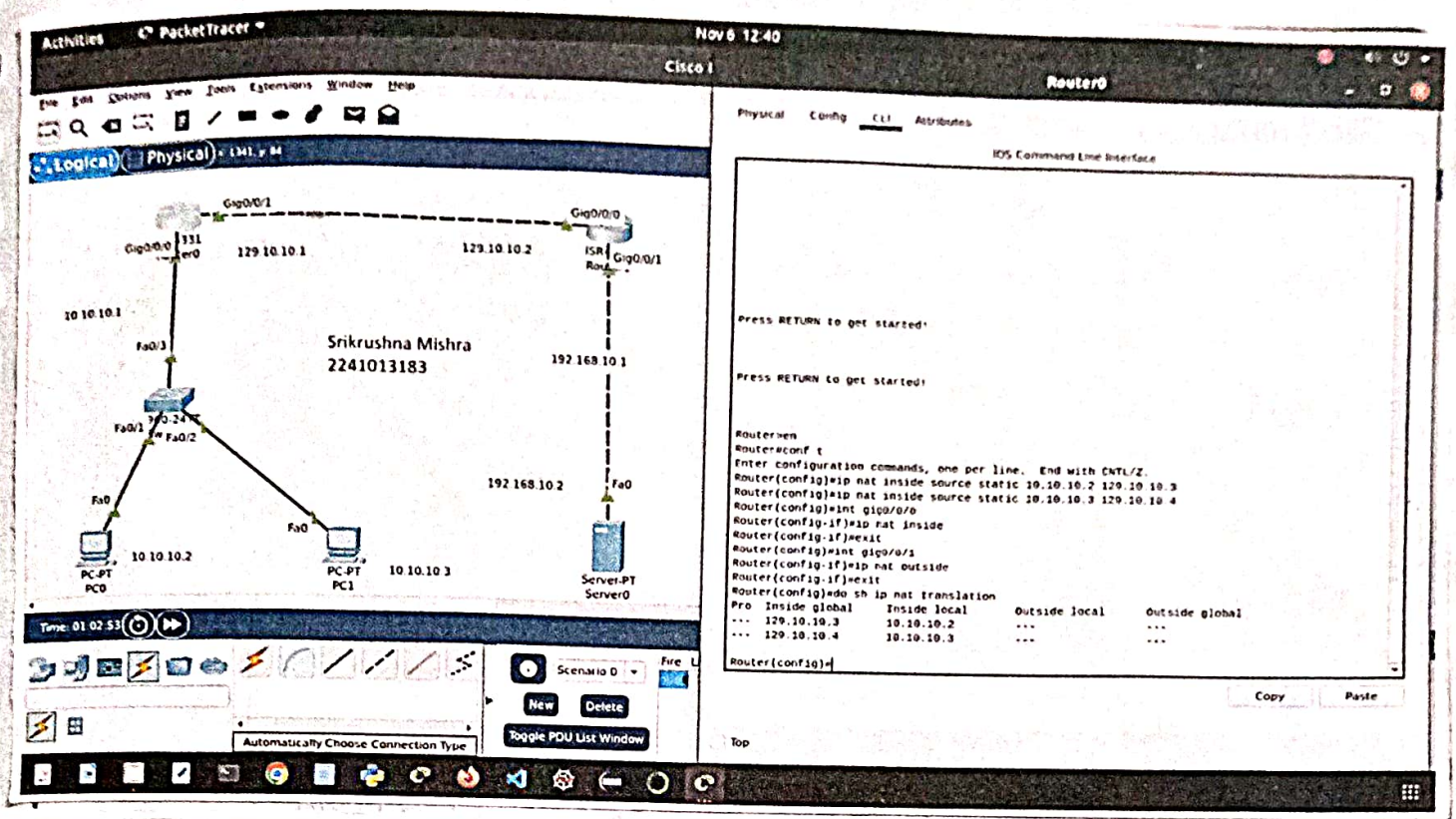

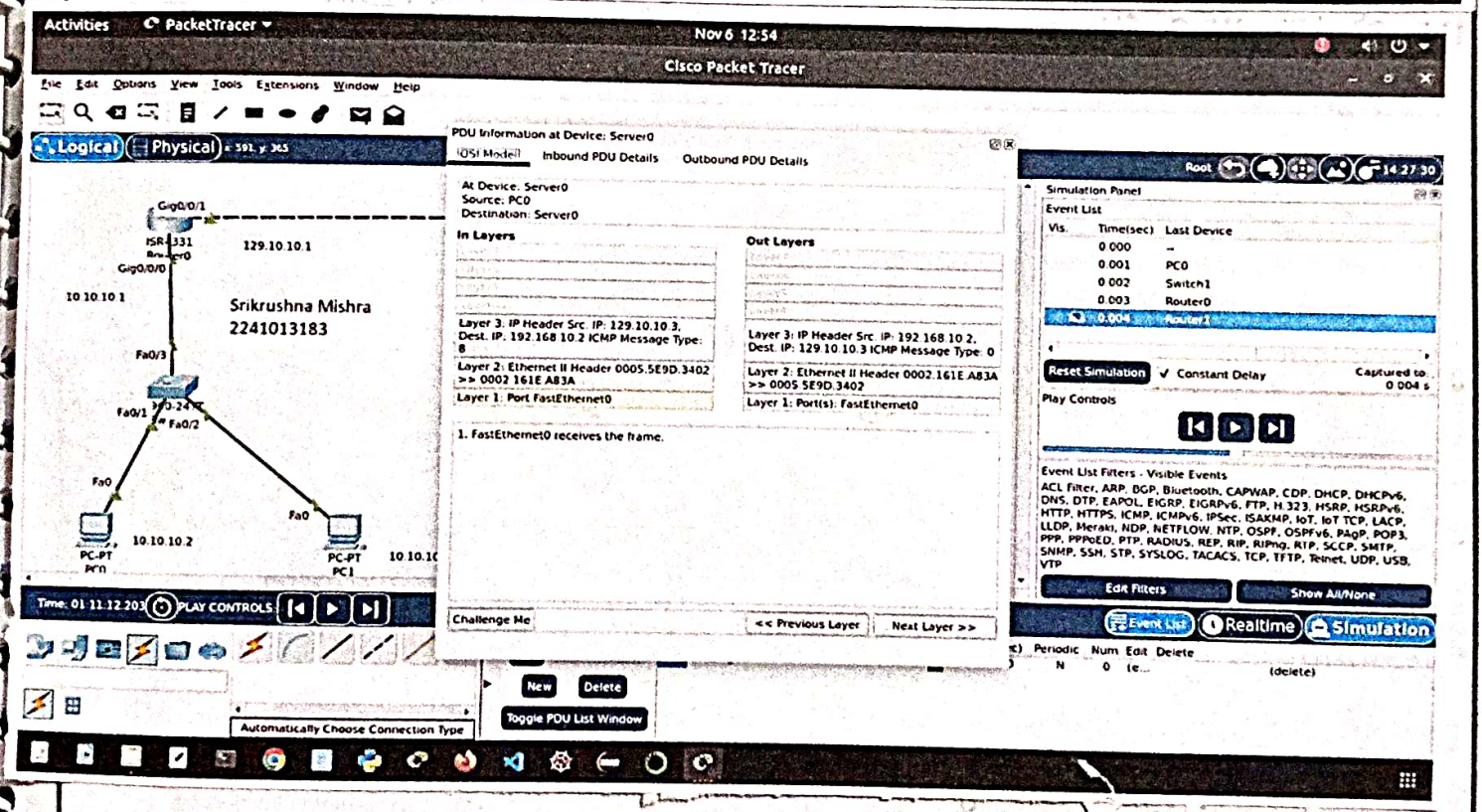

Name:_____ Regd. Number:_____

Conclusion :-

This experiment provided hands on experience with IPv4 addressing & NAT using CPT. And also IPv4 addressing. N/w communication establishing connectivity b/w different n/w classes using a router and NAT configuration, which shows the implementation of static dynamic & PAT to enable private n/w devices to communicate with external n/w.

Exercises

1. Mention the subnet mask and class of the following IPv4 addresses:
   a. 172.14.9.64
   b. 129.34.67.25
   c. 185.56.32.87

Ans a) 172.14.9.64
- Class B
- Subnet mask = 255.255.0.0

b) 129.34.67.25
- Class B
- Subnet mask = 255.255.0.0

c) 185.56.32.87
- Class B
- Subnet mask = 255.255.0.0

2) What are the commands used to determine the current IP address configurations on a Windows operating system? What is the difference b/w ipconfig and ifconfig commands?

ipconfig : primary command to check IP address configuration on a Windows OS

Usage:- cmd: ipconfig
To get detailed information (like DNS server, Subnet mask, Default gateway)
cmd: ipconfig/all

Difference:-

Aspect	ipconfig	ifconfig
OS	Windows	Unix/Linux & MAC OS
Purpose	Display & manage IP configuration	Displays & configures n/w interfaces
Common usage	View IP address, release DHCP leaks	Assign IP addresses

Name:_____ Regd. Number:_____

3) If a class B n/w on the internet has a subnet mask of 255.255.248.0, what is the maximum no. of hosts per subnet?

Ans- No. of hosts per subnet = $2^{\text{no. of host bit}} - 2$

Subnet mask = 255.255.248.0

11111111.11111111.11111000.00000000

~~21 bits for n/w~~ No. of n/w = 21 bits

No. of hosts = 11 bits

Maximum no. of host = $2^{11} = 2048$

Maximum no. of usable host = 2048 - 2 = 2046 (Ans)

4) List the situation where NAT is required.

Ans- i) Expanding IPv4 address usage
ii) Private to public n/w communication
iii) Enhancing n/w security
iv) Allows multiple devices to access the internet.
v) Connecting Overlapping IP n/w
vi) Load Balancing Across Servers.

5) Host A (on TCP/IPv4 network A) sends an IP datagram D to host B (also on TCP/IPv4 n/w B). Assume that no error occurred during the transmission of D. When D reaches B, what are the IP header field(s) that may be different from that of the original datagram D?

Ans- i) Time to live
ii) Header checksum } Always change
iii) Flags
iv) Fragment ~~off~~ offset } May change
v) Total length

4-12-24

Name:_____ Regd. Number:_____