NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCE
Computer Network Lab (CL3001)
Lab Session 02

Objective:

- To understand IP addressing
- To identify IP address classes, their default subnet mask, network address & host address.
- Introduction to Cisco Packet Tracer & basic networking devices.

IP Address:

An IP address class is a categorical division of internet protocol addresses in IPv4-based routing. Separate IP classes are used for different types of networks. Some are used for public internet-accessible IPs and subnets, that is, those networks behind a router (as in classes A, Band C).
The subnet mask for a default, unsubnetted class A, B or C network has 1s for each bit that is used for network ID or subnet ID, and 0s for the host ID bits. Of course, we just said we aren't subnetting, so there are no subnet ID bits.

IP Address Classes

Class A	1 – 127	(Network 127 is reserved for loopback and internal testing) Leading bit pattern	0	00000000.00000000.00000000.00000000 Network . Host . Host . Host
Class B	128 – 191	Leading bit pattern	10	10000000.00000000.00000000.00000000 Network . Network . Host . Host
Class C	192 – 223	Leading bit pattern	110	11000000.00000000.00000000.00000000 Network . Network . Network . Host
Class D	224 – 239	(Reserved for multicast)		
Class E	240 – 255	(Reserved for experimental, used for research)		

Private Address Space

Class A	10.0.0.0 to 10.255.255.255
Class B	172.16.0.0 to 172.31.255.255
Class C	192.168.0.0 to 192.168.255.255

Default Subnet Masks

Class A	255.0.0.0
Class B	255.255.0.0
Class C	255.255.255.0

Address Class Identification

Address	Class
10.250.1.1	A
150.10.15.0	B
192.14.2.0	
148.17.9.1	
193.42.1.1	
126.8.156.0	
220.200.23.1	
230.230.45.58	
177.100.18.4	
119.18.45.0	
249.240.80.78	
199.155.77.56	
117.89.56.45	
215.45.45.0	
199.200.15.0	
95.0.21.90	
33.0.0.0	
158.98.80.0	
219.21.56.0	

Network & Host Identification

Circle the network portion of these addresses:

177.100.18.4

119.18.45.0

209.240.80.78

199.155.77.56

117.89.56.45

215.45.45.0

192.200.15.0

95.0.21.90

33.0.0.0

158.98.80.0

217.21.56.0

10.250.1.1

150.10.15.0

192.14.2.0

148.17.9.1

193.42.1.1

126.8.156.0

220.200.23.1

Circle the host portion of these addresses:

10.15.123.50

171.2.199.31

198.125.87.177

223.250.200.222

17.45.222.45

126.201.54.231

191.41.35.112

155.25.169.227

192.15.155.2

123.102.45.254

148.17.9.155

100.25.1.1

195.0.21.98

25.250.135.46

171.102.77.77

55.250.5.5

218.155.230.14

10.250.1.1

Network Addresses

Using the IP address and subnet mask shown write out the network address:

188.10.18.2
255.255.0.0 — 188 . 10 . 0 . 0

10.10.48.80
255.255.255.0 — 10 . 10 . 48 . 0

192.149.24.191
255.255.255.0 _____

150.203.23.19
255.255.0.0 _____

10.10.10.10
255.0.0.0 _____

186.13.23.110
255.255.255.0 _____

223.69.230.250
255.255.0.0 _____

200.120.135.15
255.255.255.0 _____

Host Addresses

Using the IP address and subnet mask shown write out the host address:

188.10.18.2 255.255.0.0	0 . 0 . 18 . 2
10.10.48.80 255.255.255.0	0 . 0 . 0 . 80
222.49.49.11 255.255.255.0	
128.23.230.19 255.255.0.0	
10.10.10.10 255.0.0.0	
200.113.123.11 255.255.255.0	
223.169.23.20 255.255.0.0	
203.20.35.215 255.255.255.0	

Default Subnet Masks

Write the correct default subnet mask for each of the following addresses:

177.100.18.4	255 . 255 . 0 . 0
119.18.45.0	255 . 0 . 0 . 0
191.249.234.191	
223.23.223.109	
10.10.250.1	
126.123.23.1	
223.69.230.250	
192.12.35.105	
77.251.200.51	
189.210.50.1	

INTRODUCTION TO Cisco Packet Tracer

Packet Tracer – Creating a New Topology

What is Packet Tracer? Packet Tracer is a protocol simulator developed by Dennis Frezzo and his team at Cisco Systems. Packet Tracer (PT) is a powerful and dynamic tool that displays the various protocols used in networking, in either Real Time or Simulation mode. This includes layer 2 protocols such as Ethernet and PPP, layer 3 protocols such as IP, ICMP, and ARP, and layer 4 protocols such as TCP and UDP. Routing protocols can also be traced.

Purpose: The purpose of this lab is to become familiar with building topologies in Packet Tracer.

Requisite knowledge: This lab assumes some understanding of the Ethernet protocol. At this point we have not discussed other protocols, but will use Packet Tracer in later labs to discuss those as well.

Step 1: Start Packet Tracer

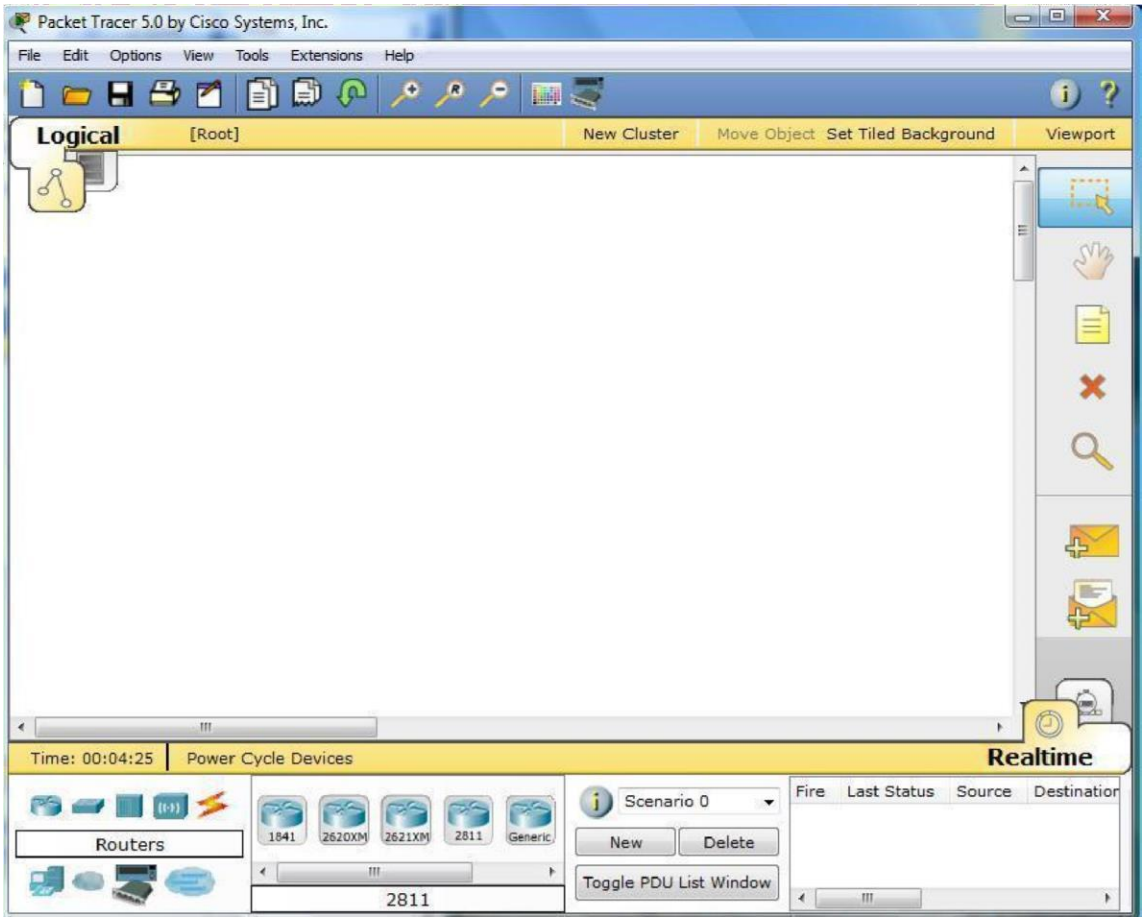

Fig 1: Cisco Packet Tracer Interface

Step 2: Choosing Devices and Connections

We will begin building our network topology by selecting devices and the media in which to connect them. Several types of devices and network connections can be used. For this lab we will keep it simple by using **End Devices**, **Switches**, **Hubs**, & **Connections**.
Single click on each group of devices and connections to display the various choices. The devices you see may differ slightly.

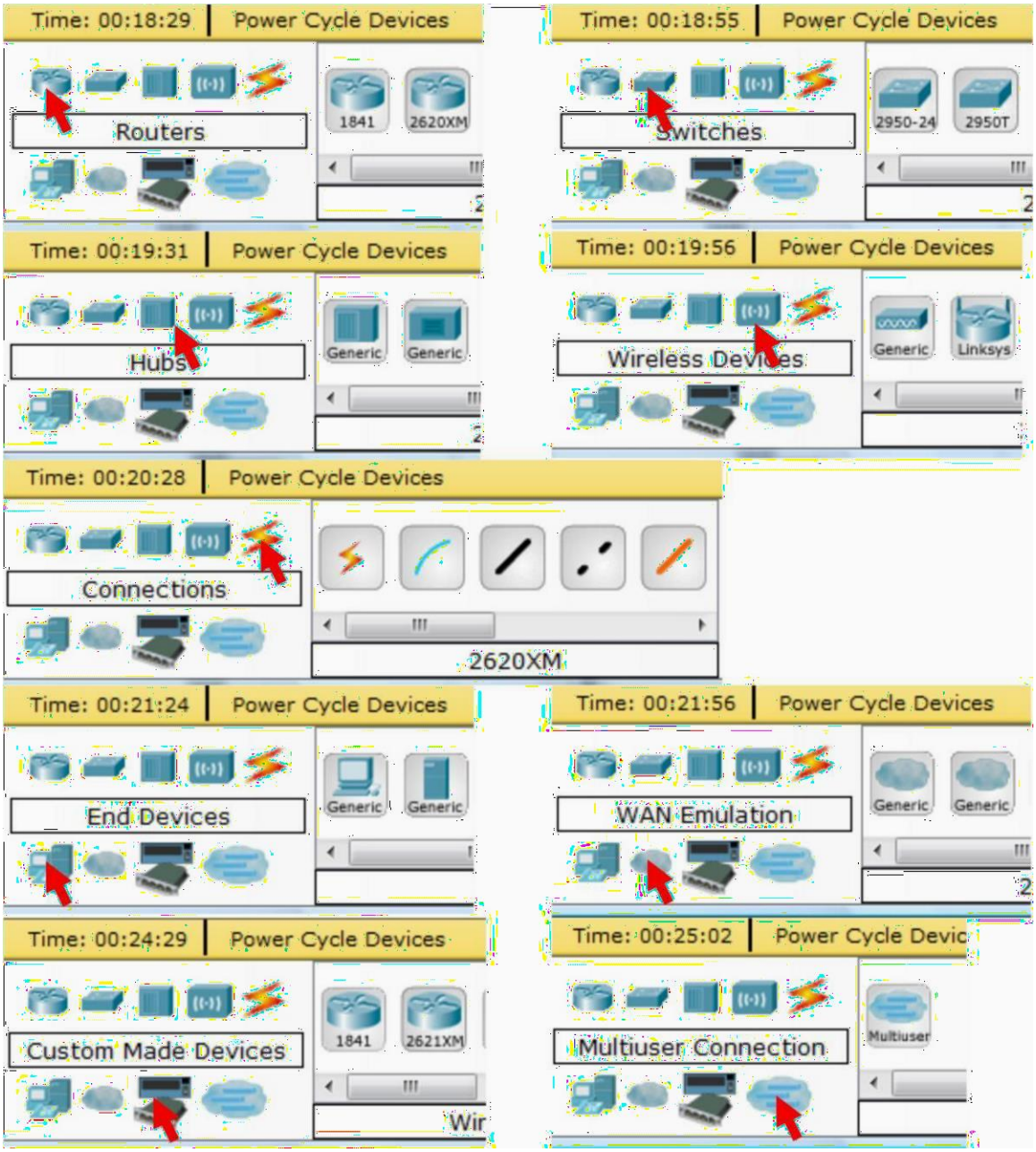

Fig 2: Various Devices Options in Packet Tracer

Step 3: Building the Topology – Adding Host

Single click on the **End Devices**.

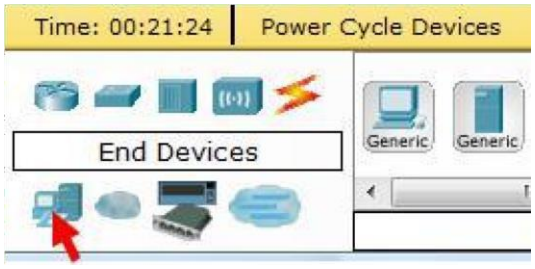

Fig 3a: End Devices Options in Packet Tracer

Single click on the **Generic** host.

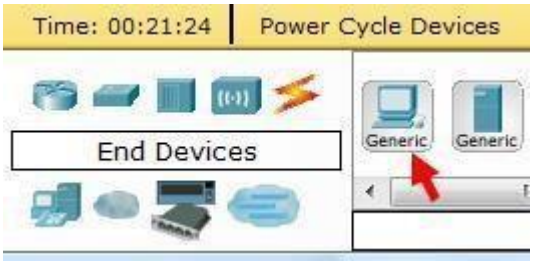

Fig 3b: Select PC Options in Packet Tracer

Move the cursor into topology area. You will notice it turns into a plus "+" sign.

+

Single click in the topology area and it copies the device.

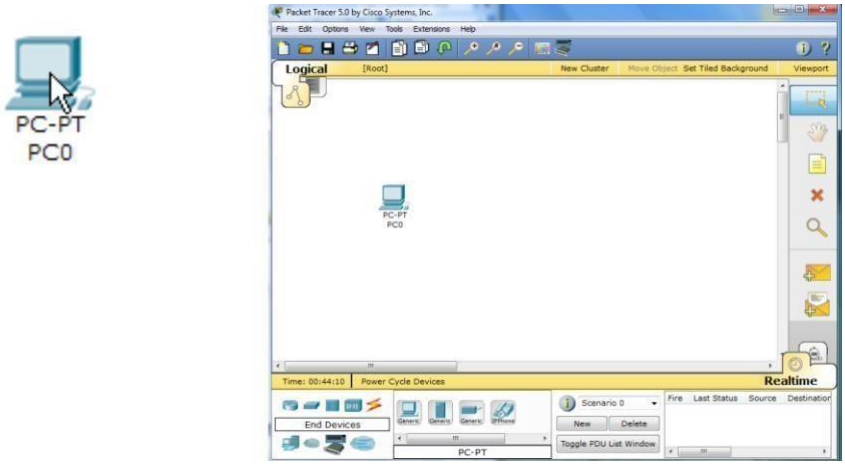

Fig 3c: Placing PC in Packet Tracer work area

Add three more hosts.

Step 4: Building the Topology – Connecting the Hosts to Hubs and Switches

Adding a Hub

Select a hub, by clicking once on Hubs and once on a Generic hub.

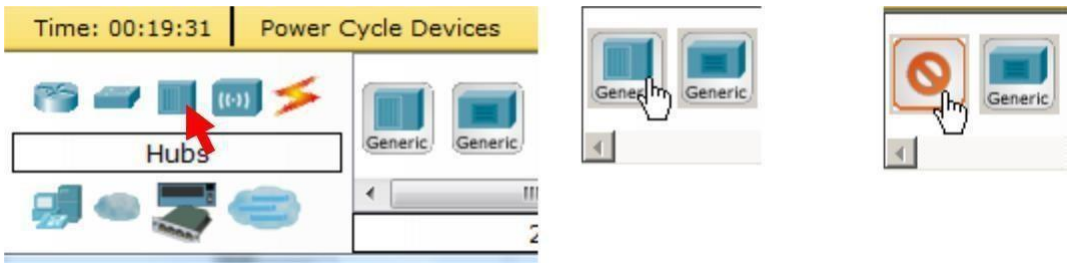

Fig 4a: Selecting Hub in Packet Tracer

Add the hub by moving the plus sign "+" below PC0 and PC1 and click once.

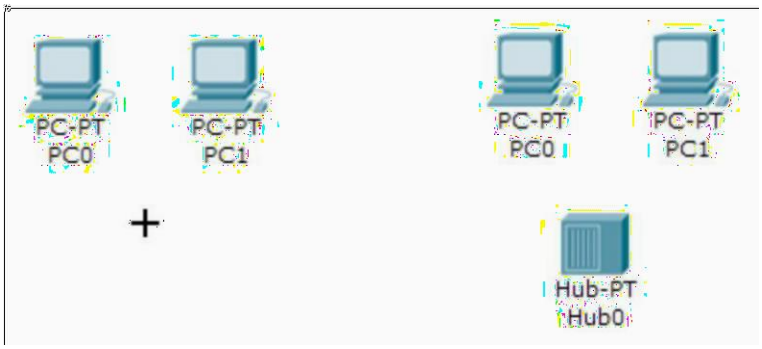

Fig 4b: Placing Hub & PC in Packet Tracer

Connect PC0 to Hub0 by first choosing **Connections.**

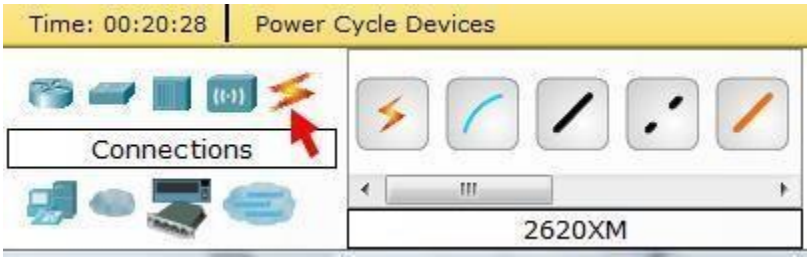

Fig 4c: Selecting wire in Packet Tracer

Click once on the **Copper Straight-through** cable.

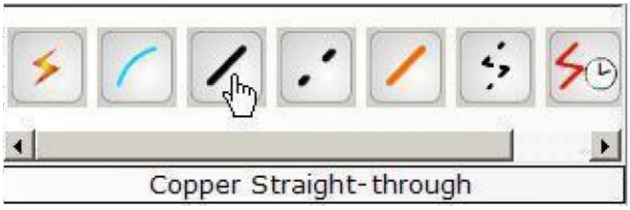

Fig 4d: Selecting copper straight-through wire in Packet Tracer

Perform the following steps to connect PC0 to Hub0:

1. Click once on **PC0**
2. Choose **FastEthernet**
3. Drag the cursor to **Hub0**
4. Click once on **Hub0** and choose **Port 0**
5. Notice the green link lights on both the **PC0** Ethernet NIC and the **Hub0** Port 0 showing that the link isactive.

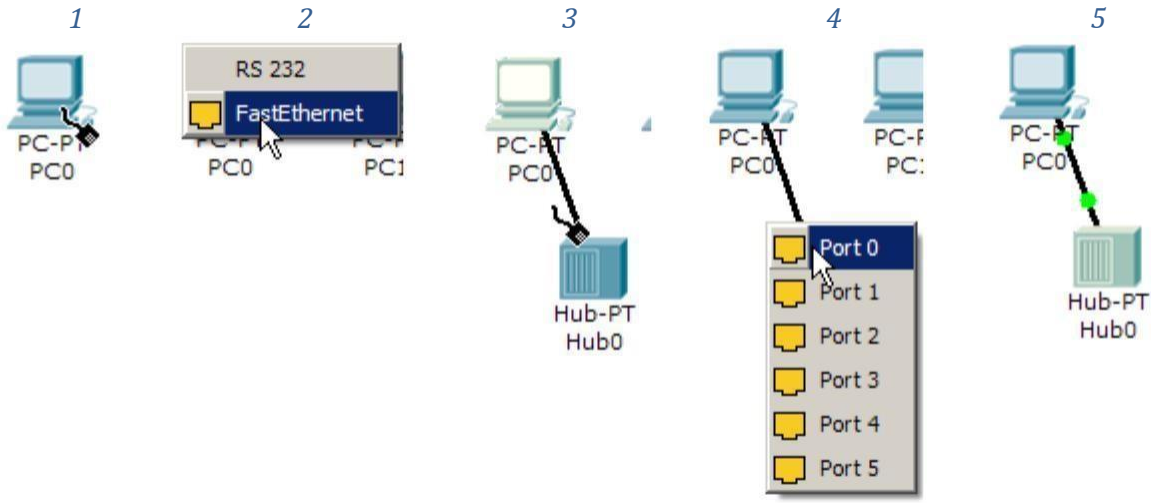

Fig 4e: Connecting PC port with Hub port in Packet Tracer

Repeat the steps above for PC1 connecting it to Port 1 on Hub0. (The actual hub port you choose does not matter.)

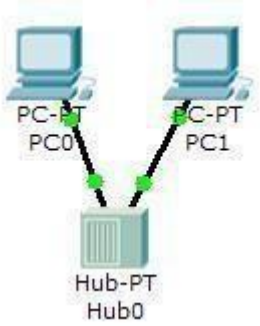

Fig 4f: Two PC connection with Hub in Packet Tracer

Adding a Switch

Select a switch, by clicking once on **Switches** and once on a **2950-24** switch.

Fig 4g: Selecting Switch in Packet Tracer

Add the switch by moving the plus sign " **+**" below PC2 and PC3 and click once.

Fig 4h: Adding Switch & PC in Packet Tracer

Connect PC2 to Hub0 by first choosing **Connections.**

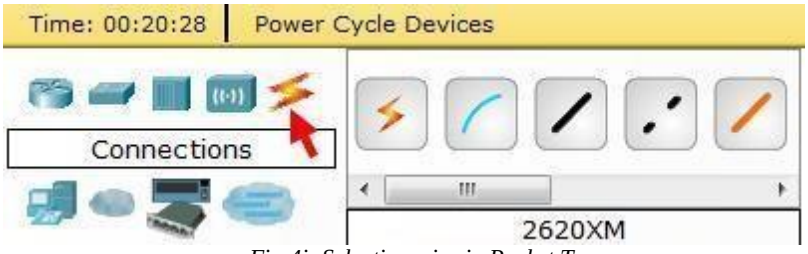

Fig 4i: Selecting wire in Packet Tracer

Click once on the **Copper Straight-through** cable.

Fig 4j: Selecting copper straight-through wire in Packet Tracer

Perform the following steps to connect **PC2** to **Switch0**:

1. Click once on **PC2**
2. Choose **FastEthernet**
3. Drag the cursor to **Switch0**
4. Click once on **Switch0** and choose **FastEthernet0/1**
5. Notice the green link lights on **PC2** Ethernet NIC and amber light **Switch0 FastEthernet0/1 port**. Theswitch port is temporarily not forwarding frames, while it goes through the stages **for the Spanning Tree Protocol (STP) process.**
6. After an about 30 seconds the amber light will change to green indicating that the port has entered theforwarding stage. Frames can now have forwarded out the switch port.

Note: Spanning Tree Protocol (STP) is discussed later.

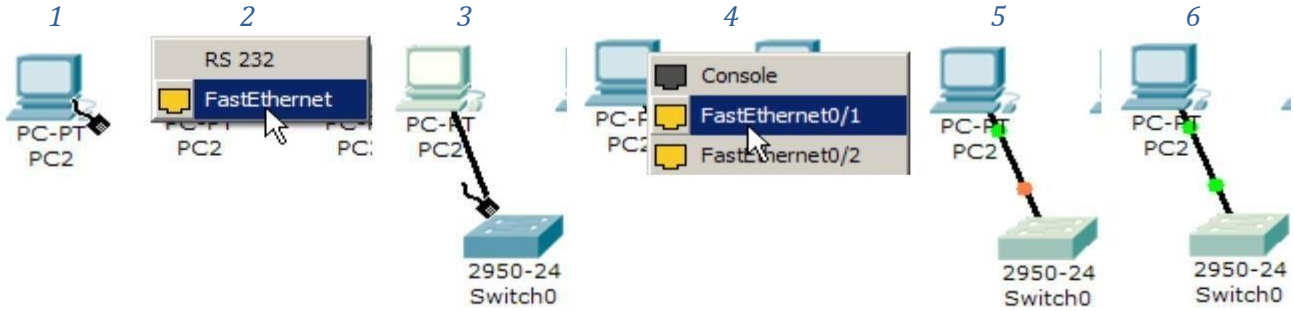

Fig 4k: Connecting PC port with Switch port in Packet Tracer

Repeat the steps above for **PC3** connecting it to **Port 3** on **Switch0** on port **FastEtherent0/2**. (The actual switch port you choose does not matter.)

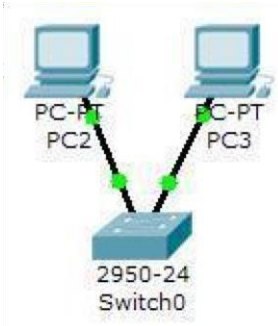

Fig 4l: Connecting PC port with Switch port in Packet Tracer

Move the cursor over the link light to view the port number. Fa means FastEthernet, 100 Mbps Ethernet.

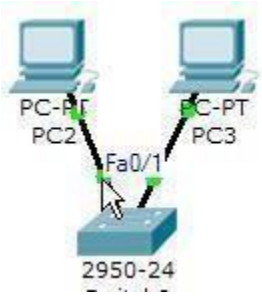

Fig 4m: Showing Port number in Packet Tracer

Step 5: Configuring IP Addresses and Subnet Masks on the Hosts

Before we can communicate between the hosts we need to configure IP Addresses and Subnet Maskson the devices.

Click once on PC0.

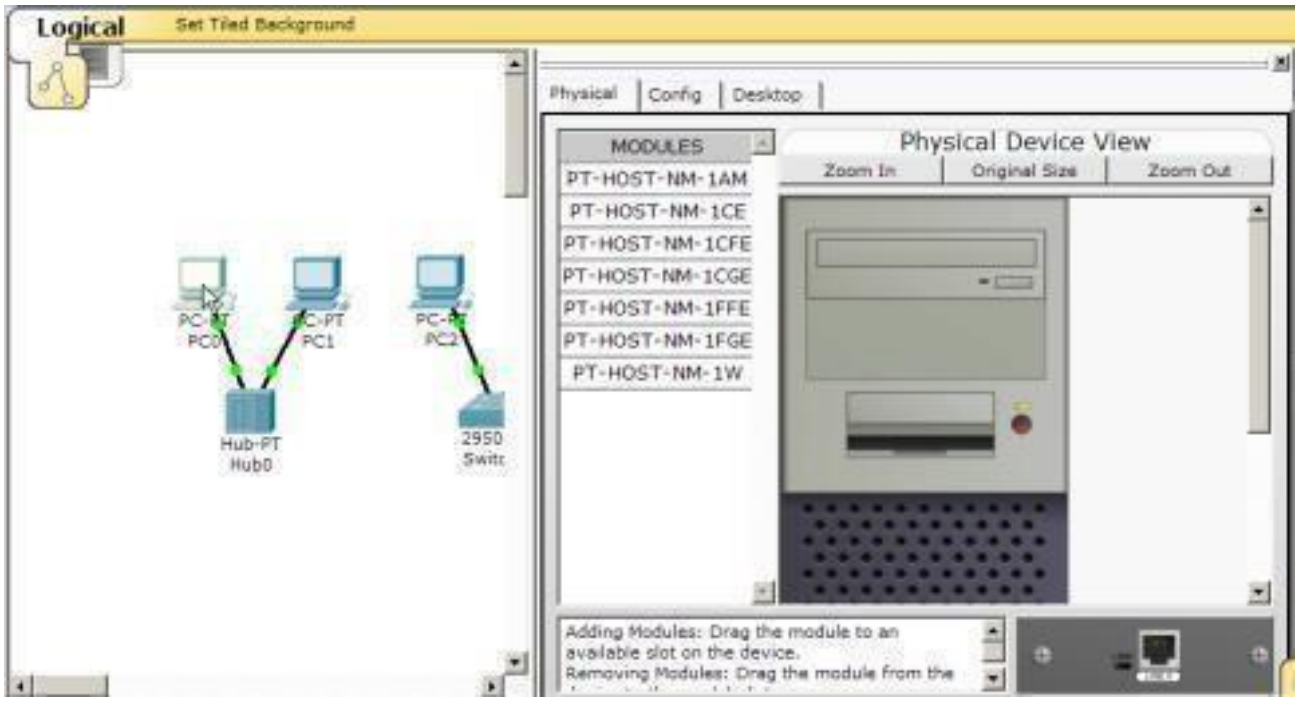

Fig 5a: PC device view with options in Packet Tracer

Choose the Config tab and click on Settings. It is here that you can change the name of PC0. It is also here where you would enter a Gateway IP Address, also known as the default gateway and the DNS Server IP.

Address. We will discuss this later, but this would be the IP address of the local router. If you want, you can enter the Gateway IP Address 172.16.1.1 and DNS Server IP Address 172.16.1.100, although it will not be used in this lab.

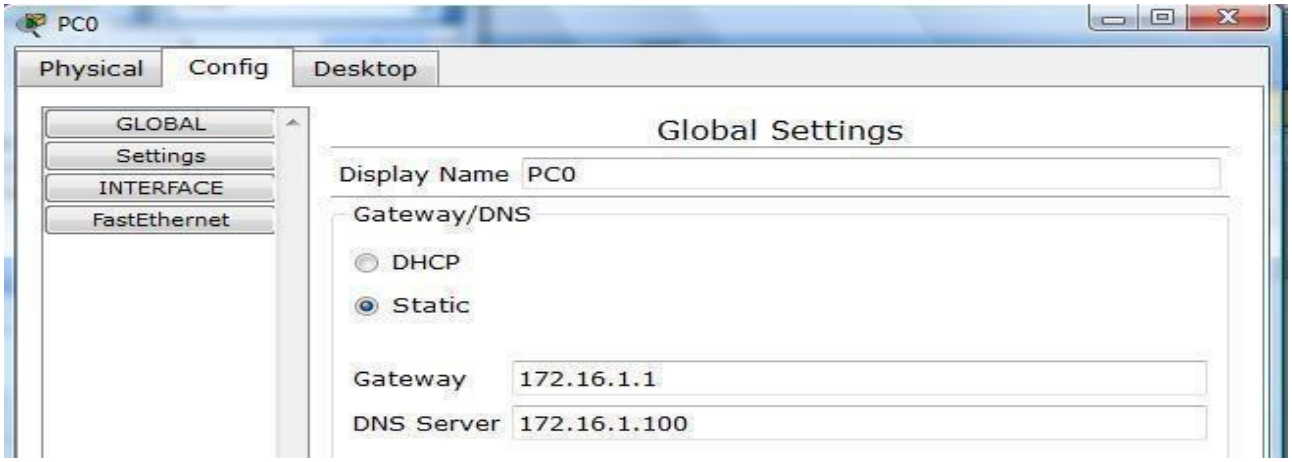

Fig 5b: Assigning Gateway IP & DNS server IP to PC in Packet Tracer

Click on Interface and then FastEthernet. Although we have not yet discussed IP Addresses, add theIP Address to 172.16.1.10. Click once in the Subnet Mask field to enter the default Subnet Mask. You can leave this at 255.255.0.0. We will discuss this later.

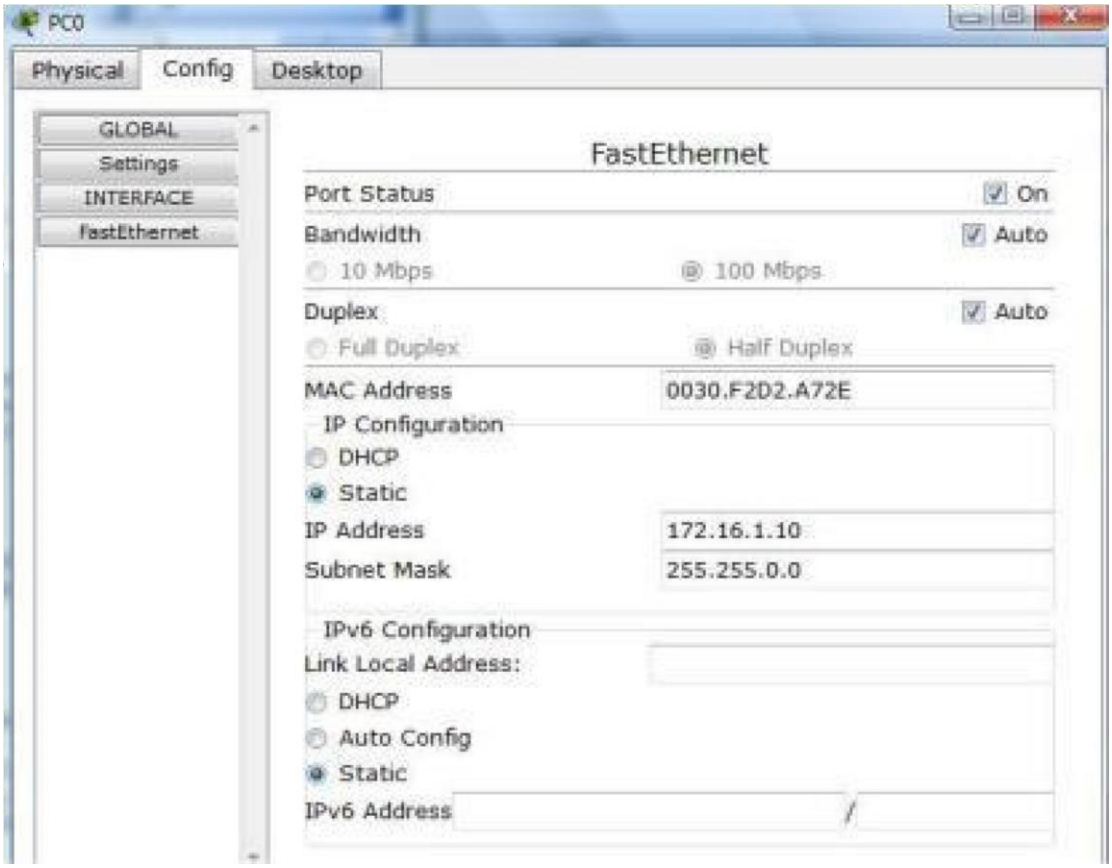

Fig 5b: Assigning IP Address & Subnet mask to PC in Packet Trace

Also, notice this is where you can change the Bandwidth (speed) and Duplex of the Ethernet NIC (Network Interface Card). The default is Auto (auto negotiation), which means the NIC will negotiate with the hub or switch. The bandwidth and/or duplex can be manually set by removing the check from the Auto box andchoosing the specific option.

Bandwidth - Auto

If the host is connected to a hub or switch port which can do 100 Mbps, then the Ethernet NIC on the host will choose 100 Mbps (Fast Ethernet). Otherwise, if the hub or switch port can only do 10 Mbps, then the Ethernet NIC on the host will choose 10 Mbps (Ethernet).

Duplex - Auto

Hub: If the host is connected to a hub, then the Ethernet NIC on the host will choose Half Duplex.

Switch: If the host is connected to a switch, and the switch port is configured as Full Duplex (or Auto negotiation), then the Ethernet NIC on the host will choose Full Duplex. If the switch port is configured as Half Duplex, then the Ethernet NIC on the host will choose Half Duplex. (Full Duplex is a much moreefficient option.)

The information is automatically saved when entered.
To close this dialog box, click the "X" in the upper right.

Repeat these steps for the other hosts. Use the information below for IP Addresses and Subnet Masks.

Host	*IP Address*	*Subnet Mask*
PC0	172.16.1.10	255.255.0.0
PC1	172.16.1.11	255.255.0.0
PC2	172.16.1.12	255.255.0.0
PC3	172.16.1.13	255.255.0.0

Verify the information

To verify the information that you entered, move the Select tool (arrow) over each host**.**

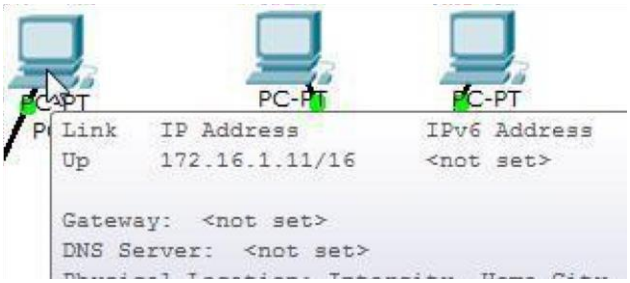

Fig 5c: PC showing information

Deleting a Device or Link

To delete a device or link, choose the Delete tool and click on the item you wish to delete.

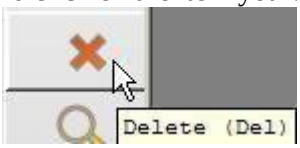

Fig 5d: Delete symbol for removing objects

Step 6: Connecting Hub0 to Switch0

To connect like-devices, like a Hub and a Switch, we will use a Cross-over cable. Click once the Crossover Cable from the Connections options**.**

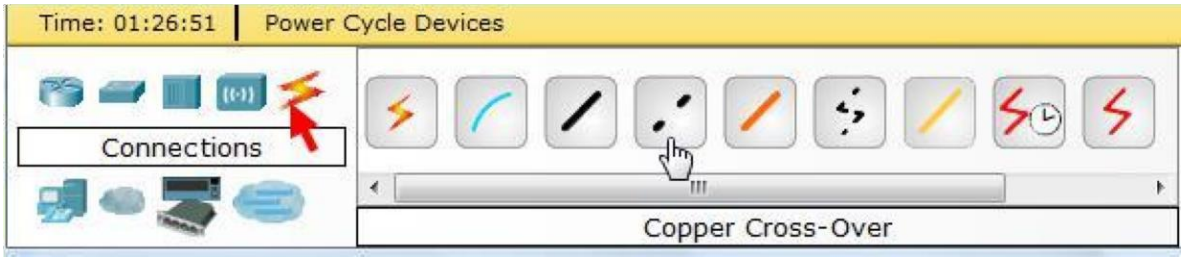

Fig 6a: Selecting Cross-Over wire

Move the Connections cursor over Hub0 and click once.

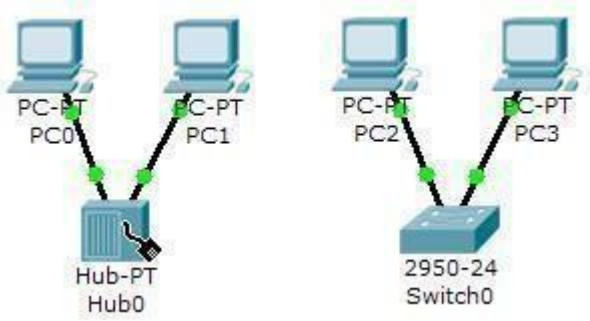

Fig 6b: Connecting PC with Hub & Switch

Select Port 5 (actual port does not matter).

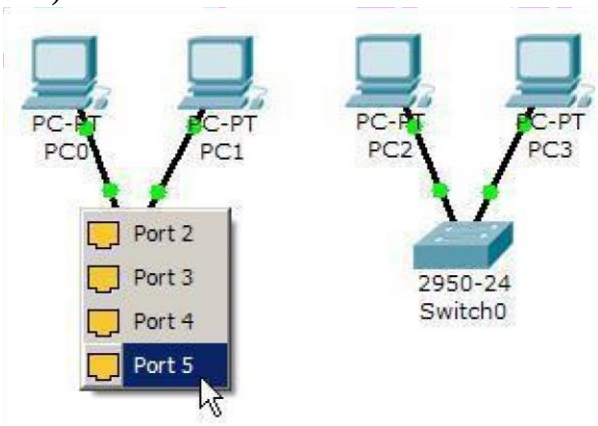

Fig 6c: Selecting Port

Move the Connections cursor to Switch0**.**

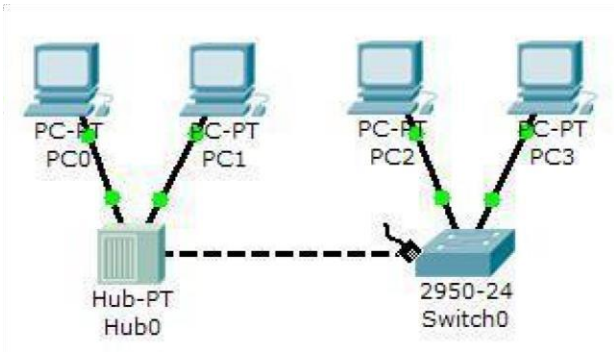

Fig 6d: Connecting Hub with Switch

Click once on **Switch0** and choose **FastEthernet0/4** (actual port does not matter).

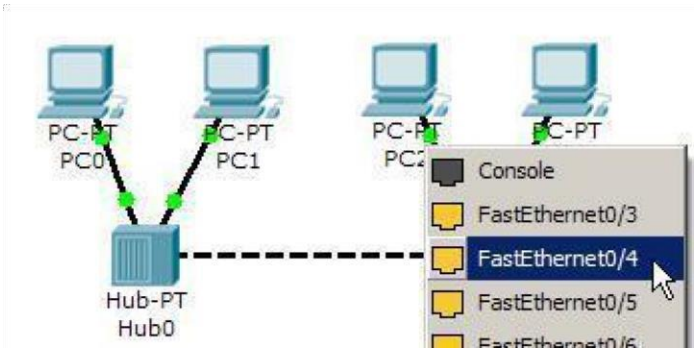

Fig 6e: Selecting Switch port

The link light for switch port FastEthernet0/4 will begin as amber and eventually change to greenas the Spanning Tree Protocol transitions the port to forwarding**.**

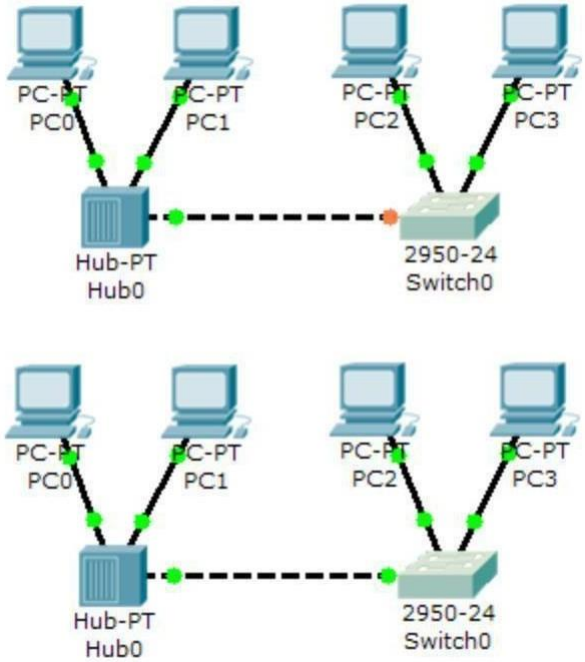

Fig 6f: Complete topology of Hub with Switch

Step 7: Verifying Connectivity in Realtime Mode

Be sure you are in **Realtime** mode.

Fig 7a: Realtime simulation symbol in Packet Tracer

Select the **Add Simple PDU** tool used to ping devices.

Fig 7b: Protocol Data Unit (PDU) symbol in Packet Tracer

Click once on PC0, then once on PC3.

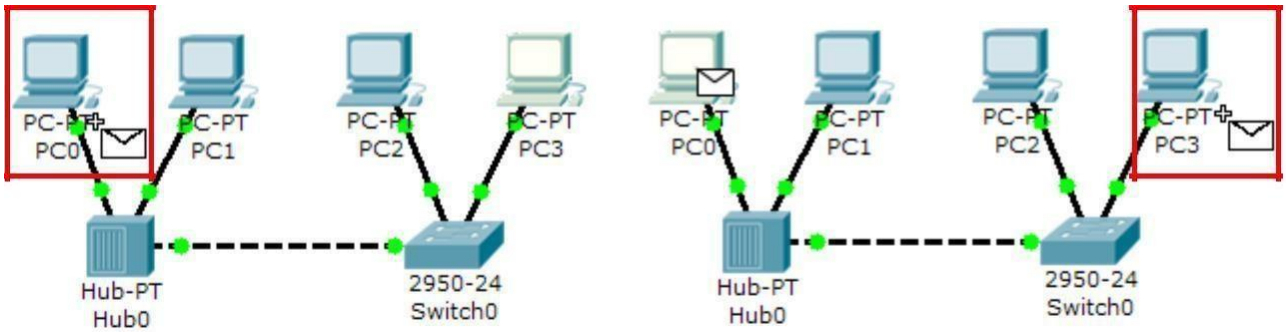

Fig 7c: Selecting two PCs to send PDU between them

The PDU **Last Status** should show as **Successful**.

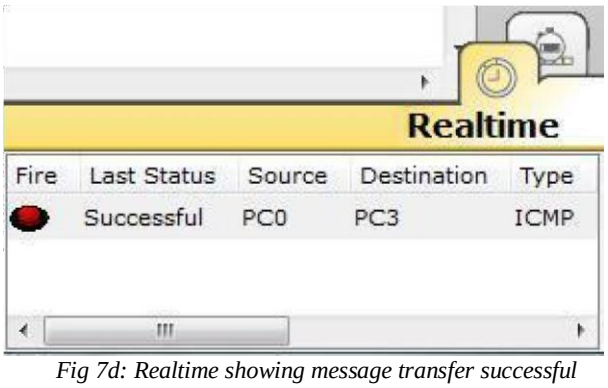

Fig 7d: Realtime showing message transfer successful

Resetting the Network

At this point we will want to reset the network, whenever you want to reset the network and begin the simulation again, perform the following tasks:

Click **Delete** in the PDU area.

Fig 7e: Realtime showing message transfer successful

Now, Power Cycle Devices and confirm the action.

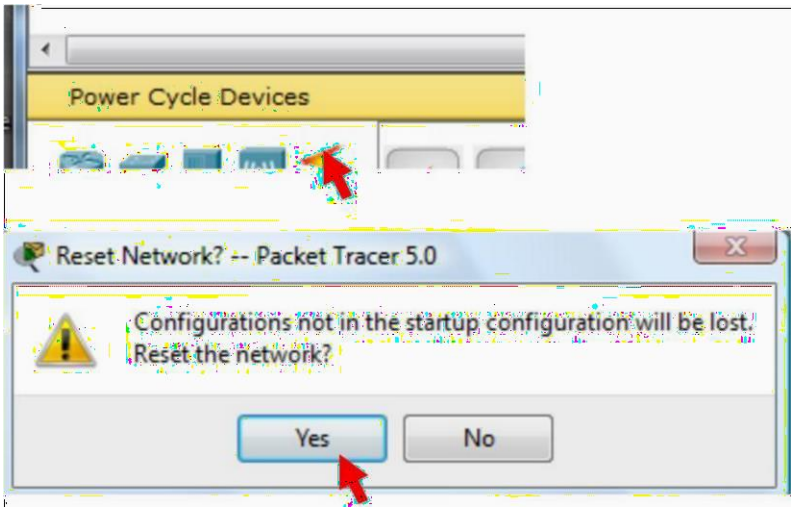

Fig 7f: Resetting network

Waiting for Spanning Tree Protocol (STP)

Note: Because Packet Tracer also simulates the Spanning Tree Protocol (later), at times the switch may show amber lights on its interfaces. You will need to wait for the lights to turn green on the switches before they will forward any Ethernet frames.

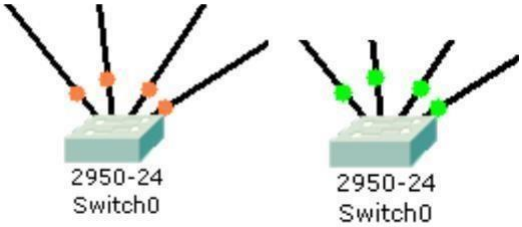

Fig 7g: Switch ports showing status

Step 8: Verifying Connectivity in Simulation Mode

Be sure you are in **Simulation** mode.

Fig 8a: Simulation Symbol in Packet Tracer

Deselect all filters (All/None) and select only ICMP.

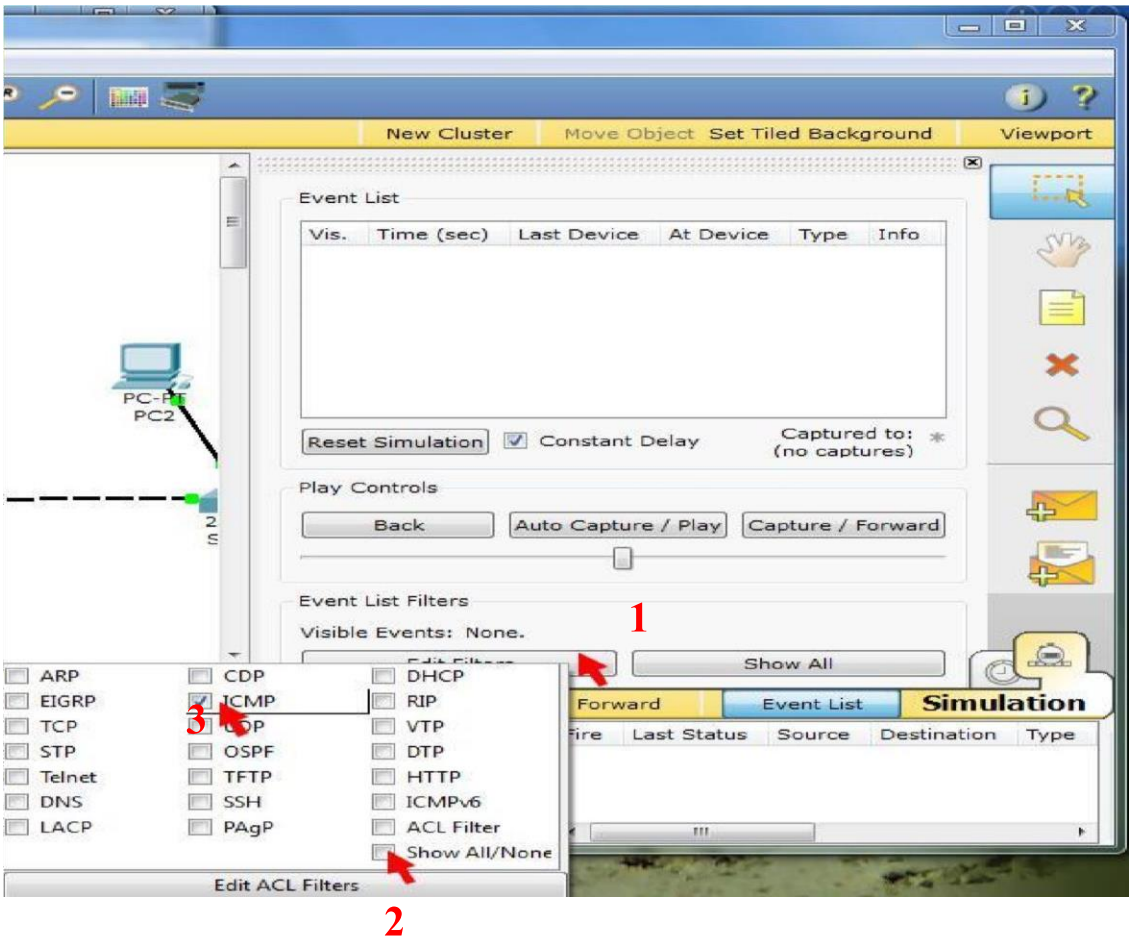

Fig 8b: Selecting ICMP filter

Select the **Add Simple PDU** tool used to ping device.

Fig 8c: Protocol Data Unit (PDU) symbol in Packet Tracer

Click once on PC0, then once on PC3.

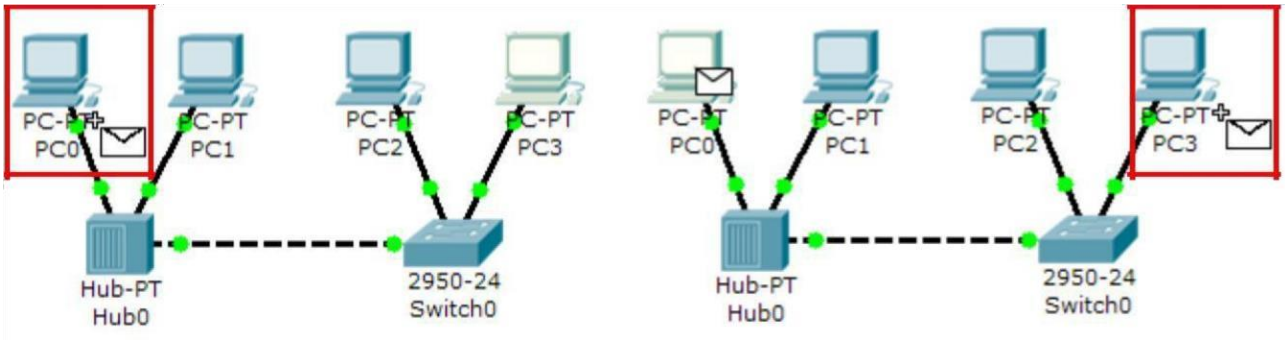

Fig 8d: Selecting two PCs to send PDU between them

Continue clicking **Capture/Forward** button until the ICMP ping is completed. You should see the ICMP messages move between the hosts, hub and switch. The PDU **Last Status** should show as **Successful**. Clickon **Clear Event List** if you do not want to look at the events or click **Preview Previous Events** if **you do. For this exercise it does not matter.**

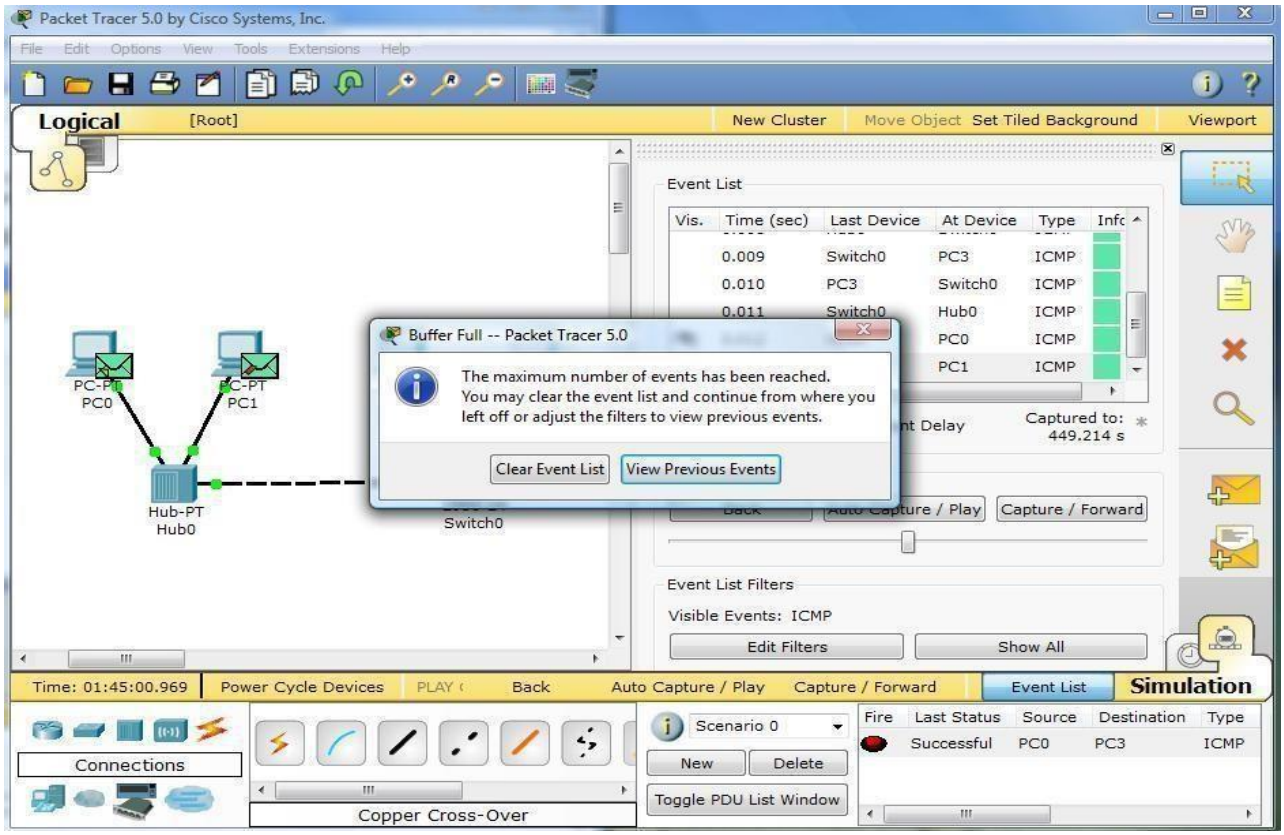

Fig 8e: ICPM packets flow between devices

Step 9: Saving the Topology

Perform the following steps to save the topology (uses. pkt file extension).

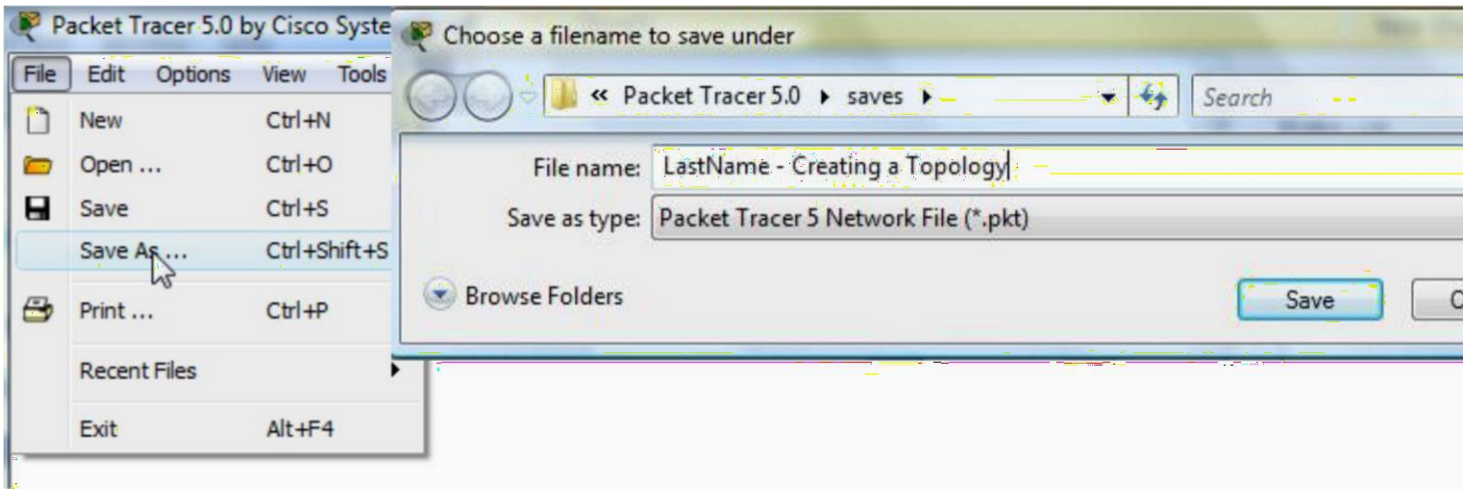

Fig 9: Saving topology file

Opening Existing Topologies

Opening Existing PT Topologies

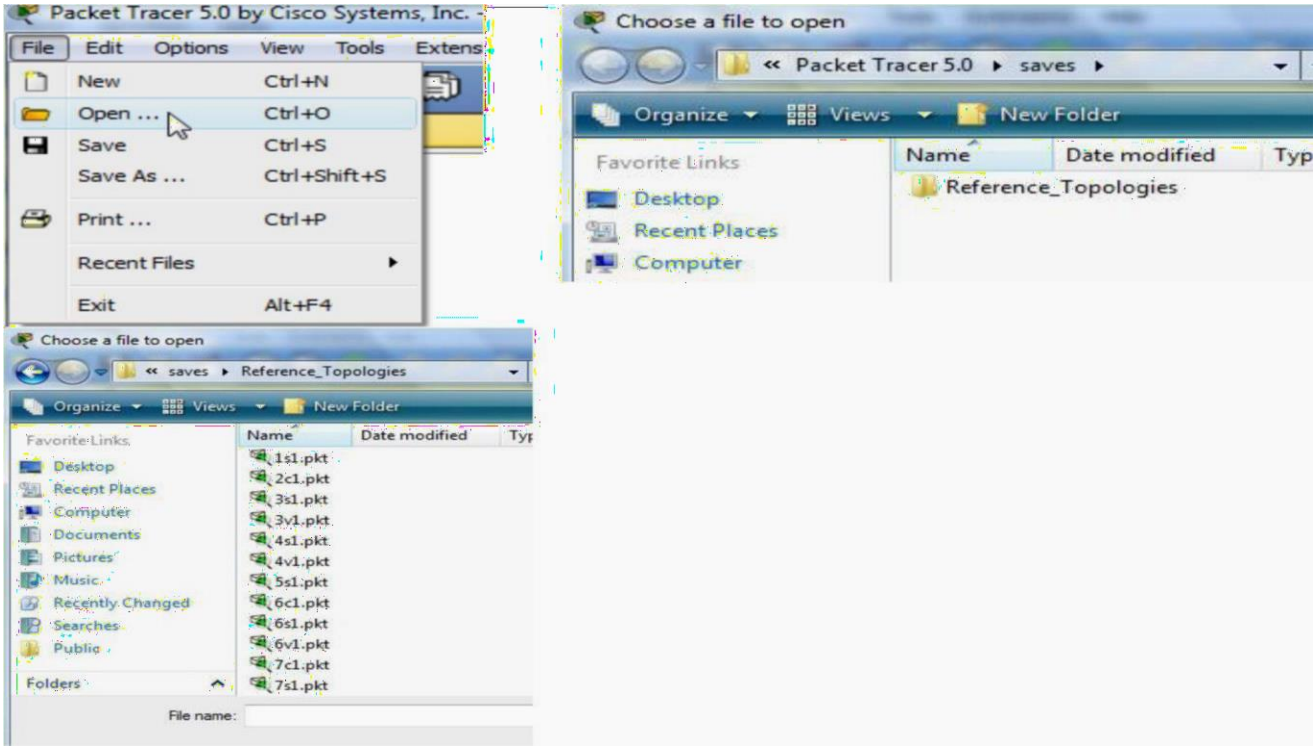

Fig 10: Opening Existing Topology

Simulation modal of bus topology:

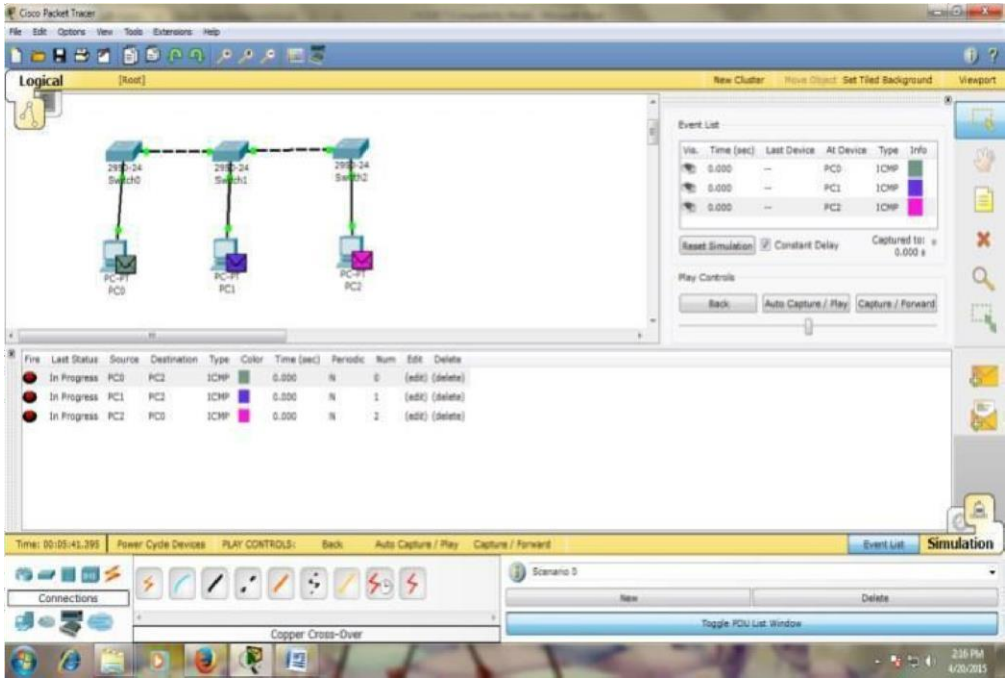

Fig 11: Bus Topology Simulation.

Simulation modal of star topology

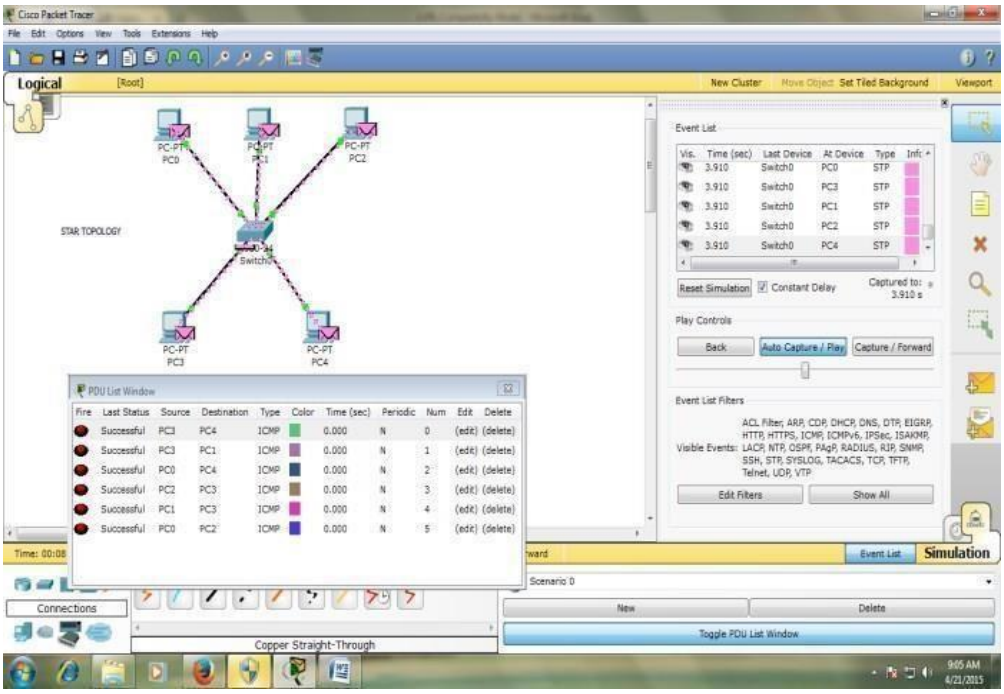

Fig 12: Star Topology Simulation.

Simulation modal of mesh topology:

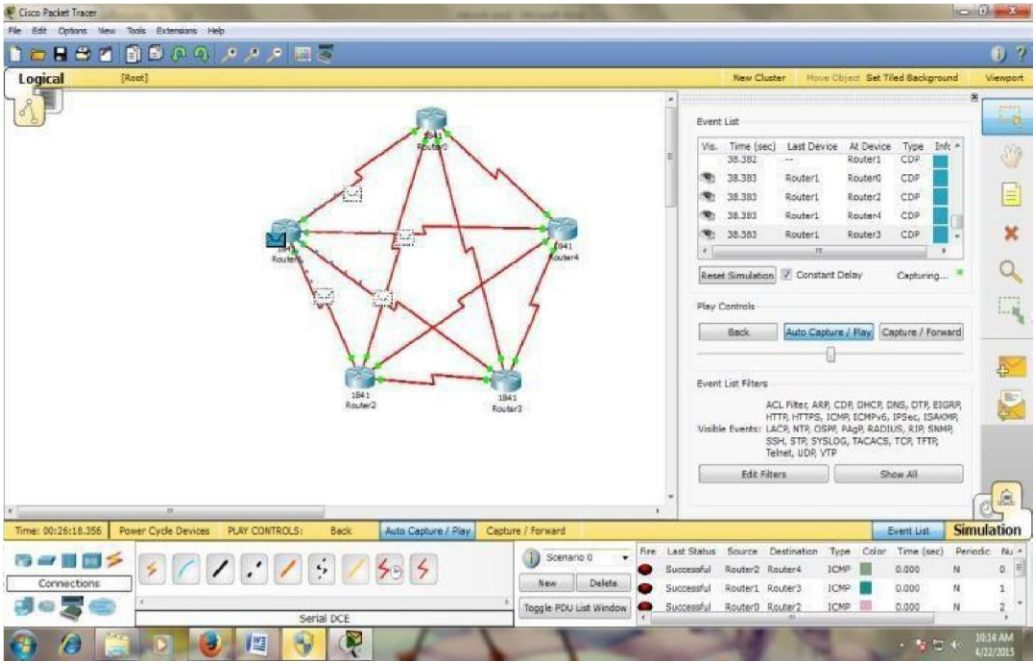

Fig 13: Mesh Topology Simulation

Tasks:

1. Show the packet header format of ARP in Cisco Packet tracer.
2. Identify the differences between Switch and Hub.
3. **Take two PCs, connect them and assign them an ip addresses and check theirconnectivity with the help of PING command.**
4. Take two PCs, connect them with suitable wire and also describe the reason of selection of wire. Assign them IP addresses and check their connectivity by using PINGcommand. (Use Packet tracer for this task).
5. **What are the main command modes? Compare them. Test basic commands on your designed network?**
6. Design and configure the network given in Figure-1 and check the connectivity byPING command. Also describe the functionality of devices in given scenario.

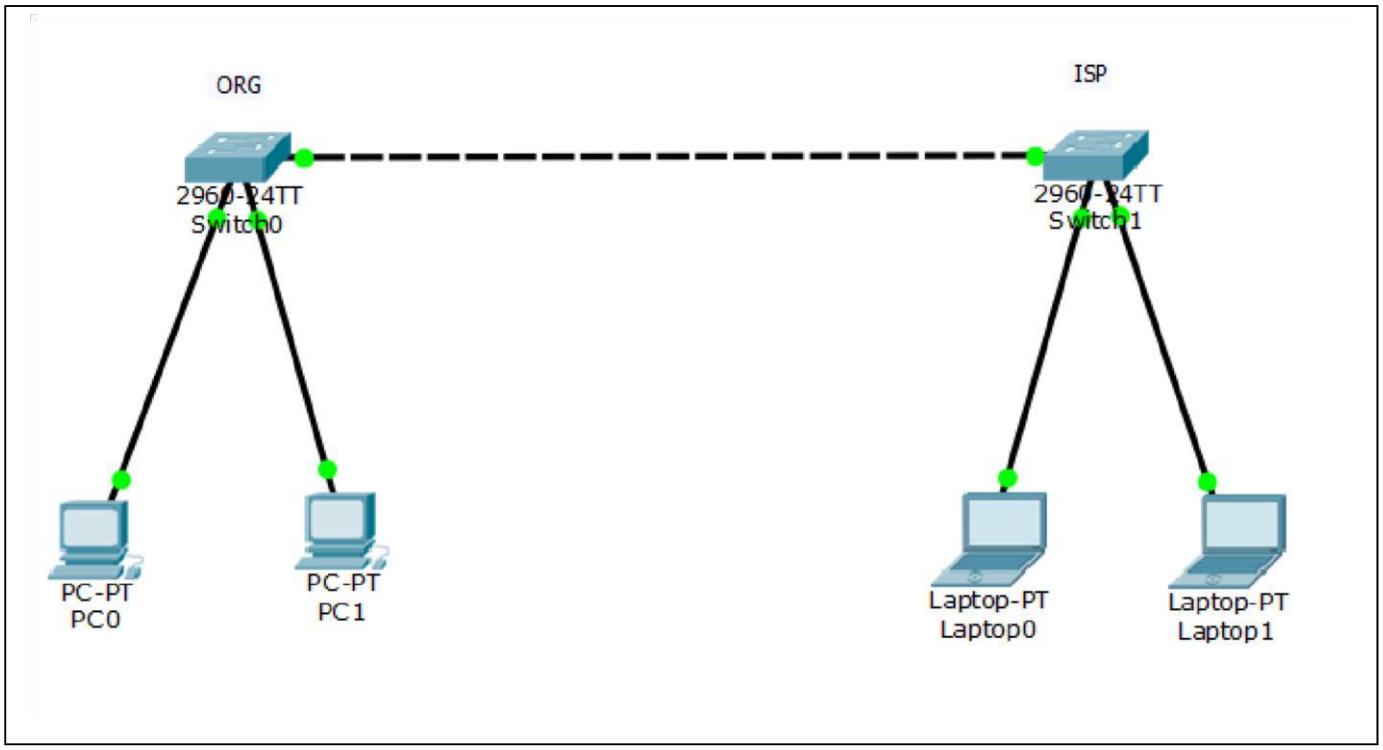

Fig 14: Topology for task