Computer Networks Lab 03

Course: Computer Networks (CL3001) **Semester:** Spring 2024
Instructor: Waseem Rauf **T.A:** N/A

Note:

- Maintain discipline during the lab.
- Listen and follow the instructions as they are given.
- Just raise hand if you have any problem.
- Completing all tasks of each lab is compulsory.
- Get your lab checked at the end of the session.

Lab 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 Addressing

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

Class Exercise: IP Address Class Identification

Address	Class
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	_____
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	_____

Class Exercise: Network & Host Identification

Circle the network portion of these addresses:	Circle the host portion of these addresses:
177.100.18.4	10.15.123.50
119.18.45.0	171.2.199.31
209.240.80.78	198.125.87.177
199.155.77.56	223.250.200.222
117.89.56.45	17.45.222.45
215.45.45.0	126.201.54.231
192.200.15.0	191.41.35.112
95.0.21.90	155.25.169.227
33.0.0.0	192.15.155.2
158.98.80.0	123.102.45.254
217.21.56.0	148.17.9.155
10.250.1.1	100.25.1.1
150.10.15.0	195.0.21.98
192.14.2.0	25.250.135.46
148.17.9.1	171.102.77.77
193.42.1.1	55.250.5.5
126.8.156.0	218.155.230.14
220.200.23.1	10.250.1.1

Class Exercise: Network Addresses Identification

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

188.10.18.2
255.255.0.0 _____

10.10.48.80
255.255.255.0 _____

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 _____

Class Exercise: Host Addresses Identification

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

188.10.18.2
255.255.0.0 _____

10.10.48.80
255.255.255.0 _____

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 _____

Class Exercise: Default Subnet Masks Identification

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

177.100.18.4 _____

119.18.45.0 _____

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 Packet Tracer

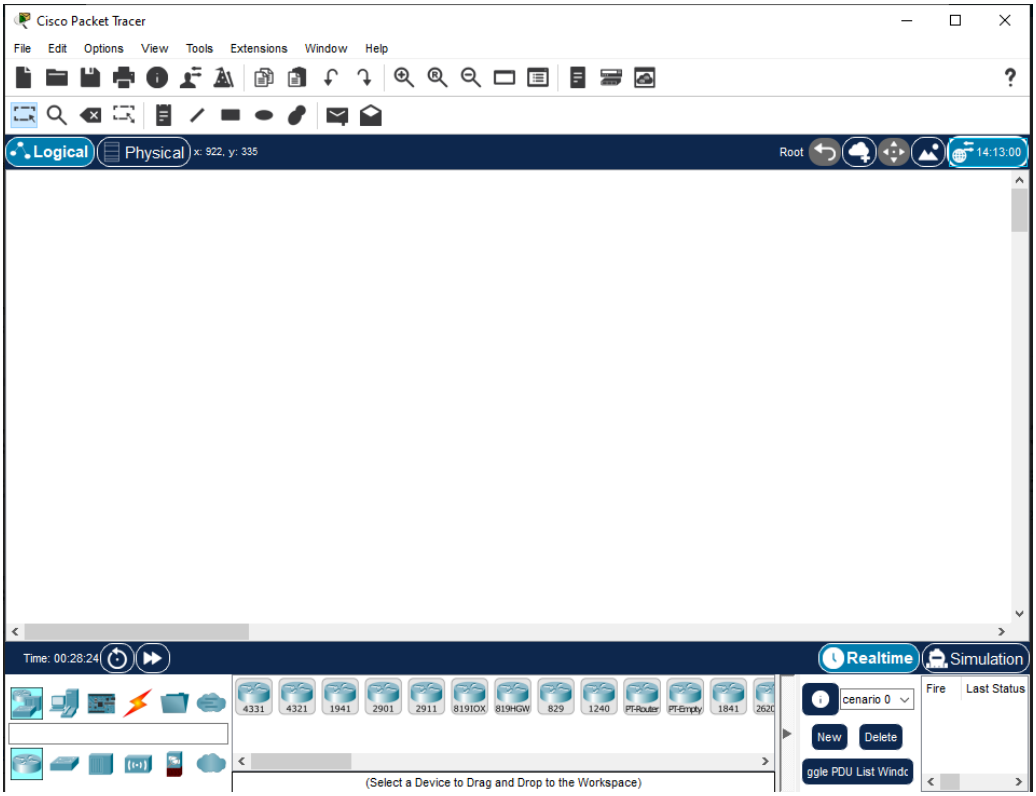
Packet Tracer – Creating a New Topology

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.

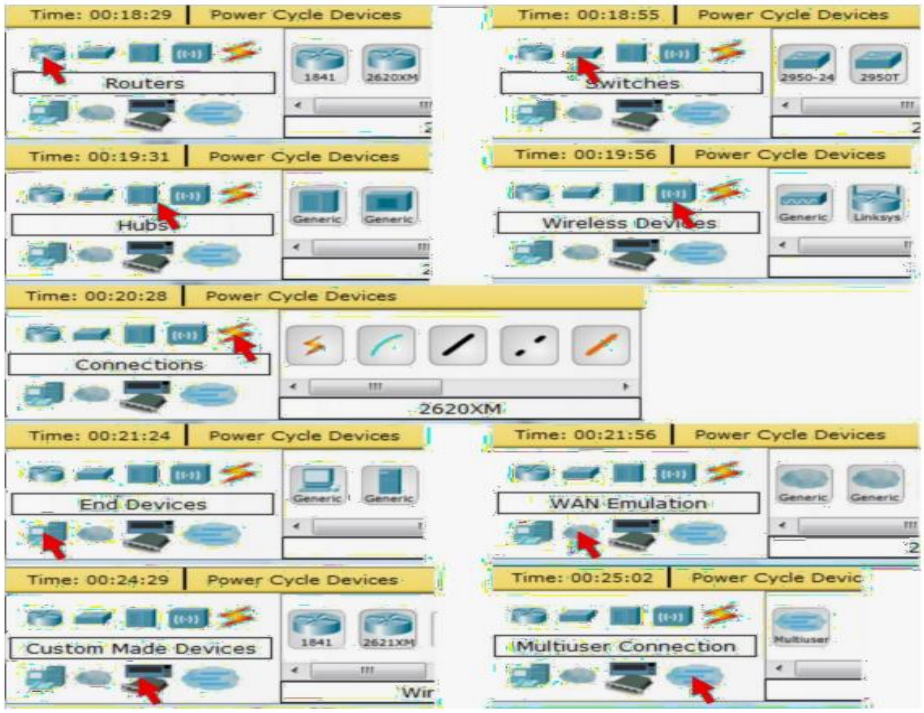
Purpose: The purpose of this lab is to become familiar with building topologies in Packet Tracer.

Perquisite 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 – I:
Start packet tracer



STEP – II:
Choosing Devices & Connections

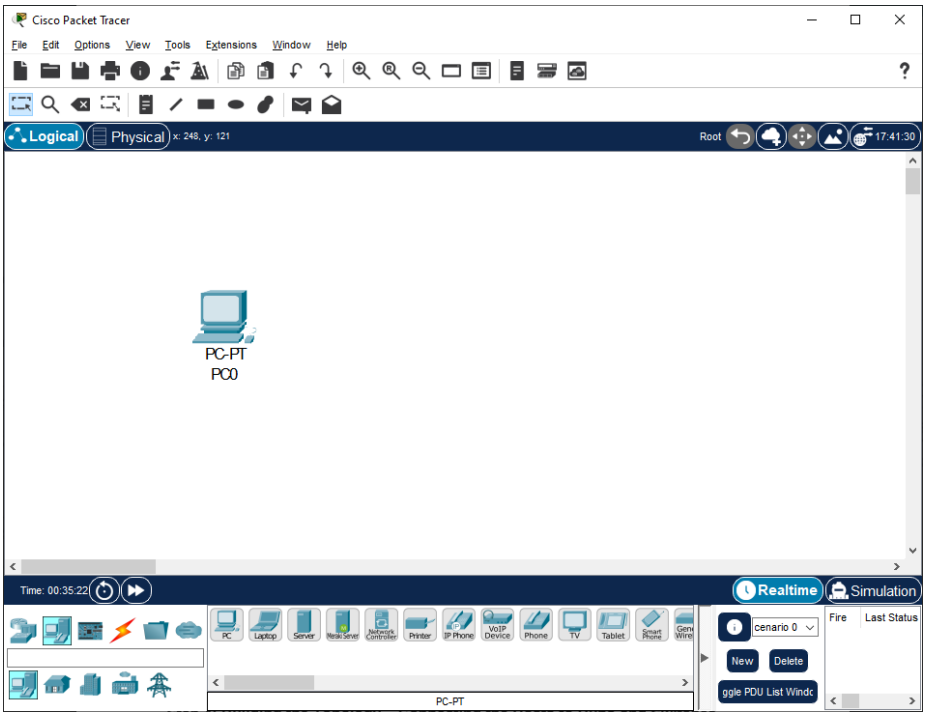


STEP – III:
Building the topology (adding the hosts)

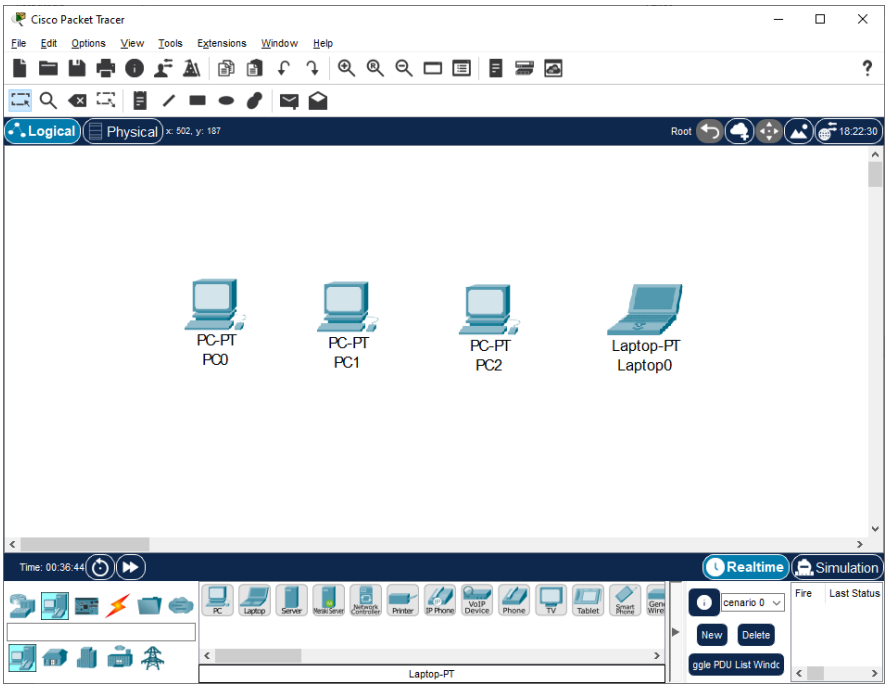
Single click on the end devices.

Single click on generic host or any other required end device/host machine.

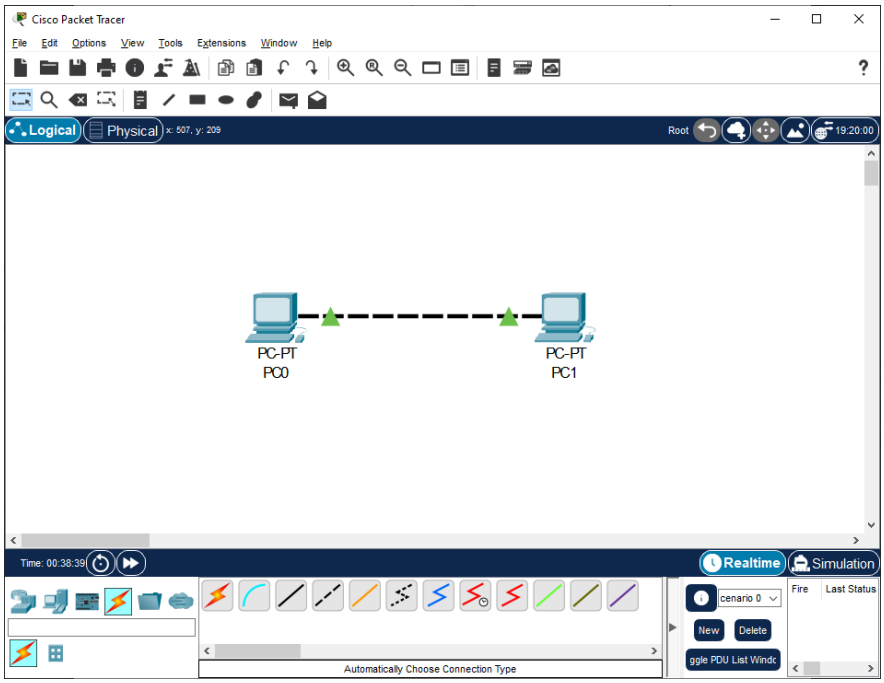
Move the cursor into topology area. You will notice it turns into a ‘+’ sign.
Single click in the topology area and your selected end device gets copied in the topology area.



Let`s add 3 more hosts now (2 PCs and 1 Laptop).

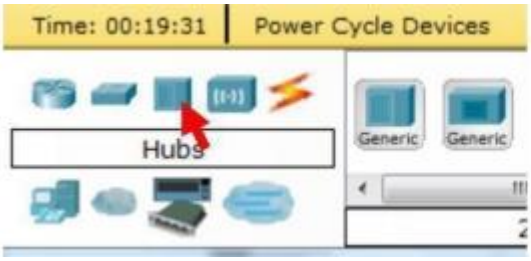


STEP – IV(a):
Building the topology (Connecting hosts to hosts).



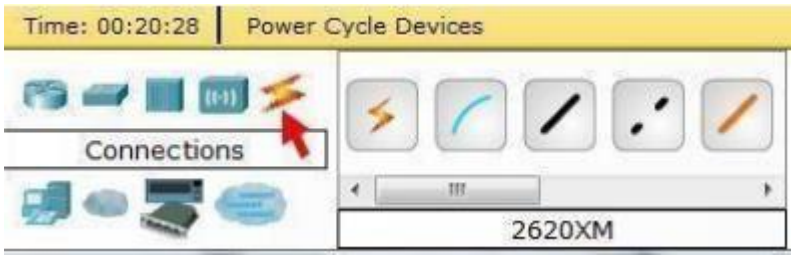
STEP – IV(b):
Building the topology (Connecting hosts to hubs and switches).

Adding a hub:
Select a hub, by clicking once on hubs and once on a generic hub.



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

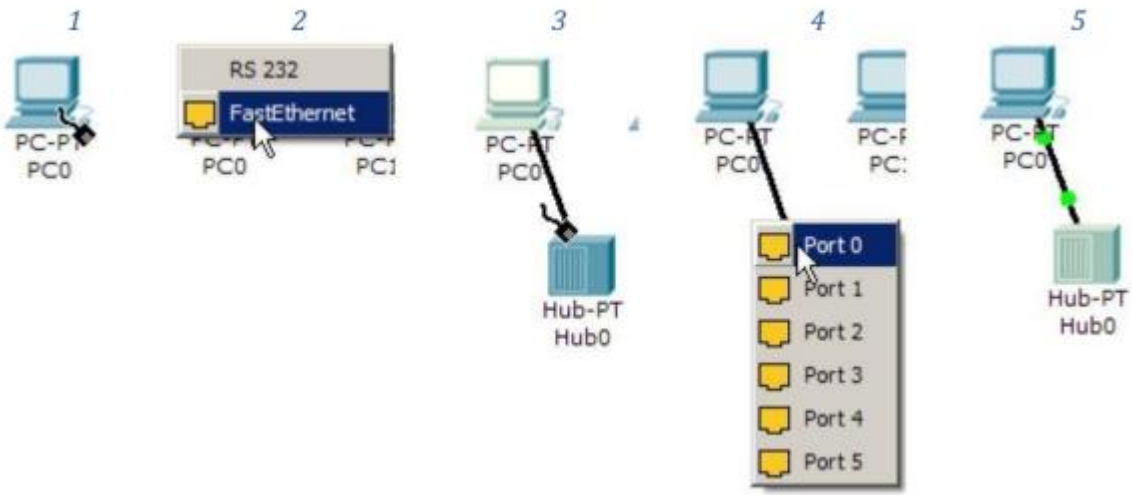
Connect PC0 to Hub0 by first choosing Connections.



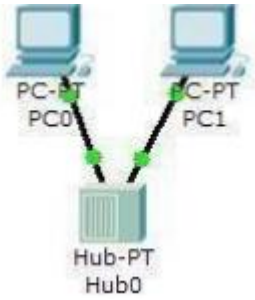
Click once on the Copper Straight-through cable.

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 Port0.
5) Notice the green link lights on both the PC0 Ethernet NIC and the Hub0 Port0 showing that the link is active.



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



Adding a switch.
Select a switch, by clicking once on Switches and once on a 2950-24 (2960 in newer versions) switch.

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

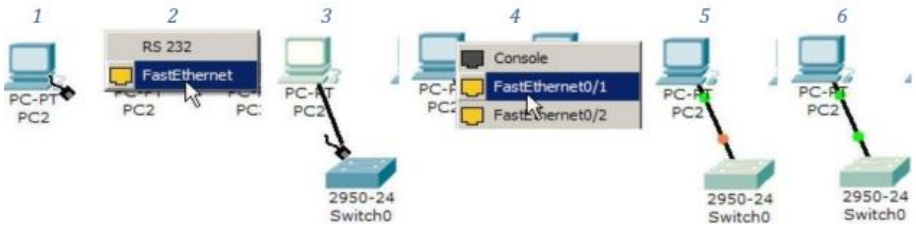
Connect PC2 to Switch0 by first choosing Connections.

Click once on the Copper Straight-through cable.

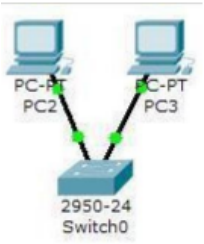
Perform the following steps to connect PC2 to Switch0:

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. The switch 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 the forwarding stage. Frames can now have forwarded out the switch port.

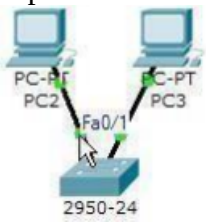
Note: Spanning Tree Protocol (STP) is will be discussed later.



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.)

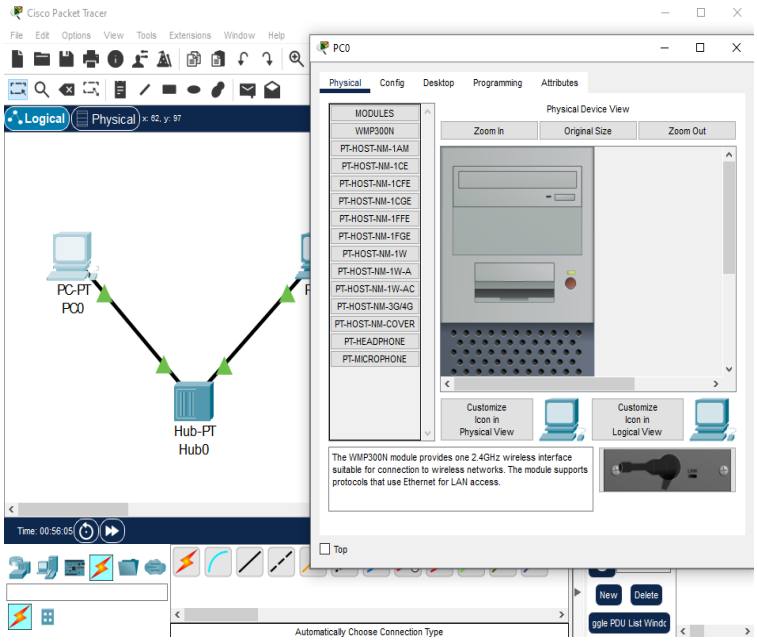


Move the cursor over the link light to view the port number. Fa means FastEthernet, 100 Mbps Ethernet.

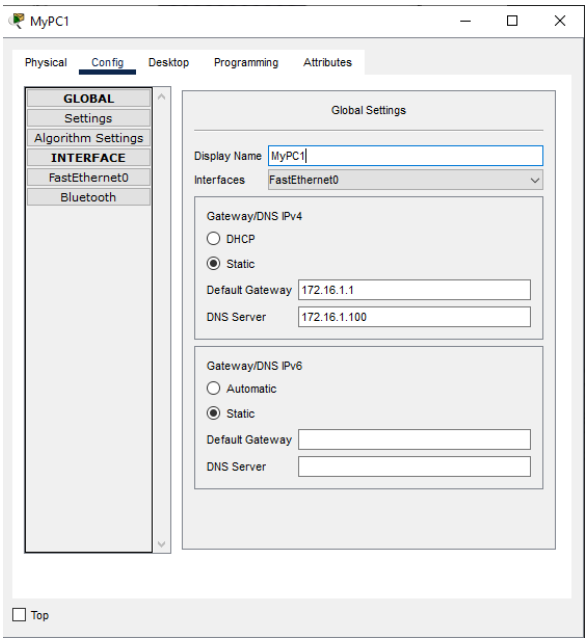


STEP – V:
Configuring IP addresses and subnet masks on the hosts.
Before we can communicate between the hosts we need to configure IP Addresses and Subnet Mask on the devices.

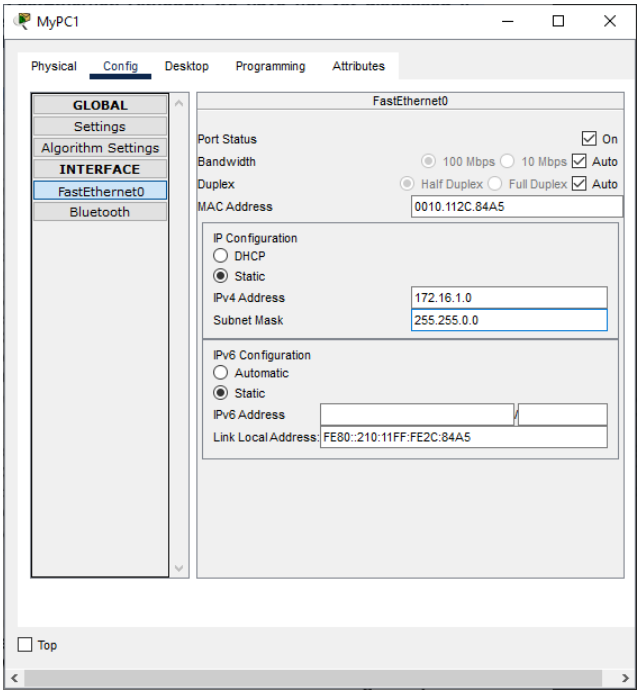
1) Click once on PC0.



2) 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.



3) Click on Interface and then FastEthernet. Although we have not yet discussed IP Addresses, add the IP 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.



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 and choosing 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.

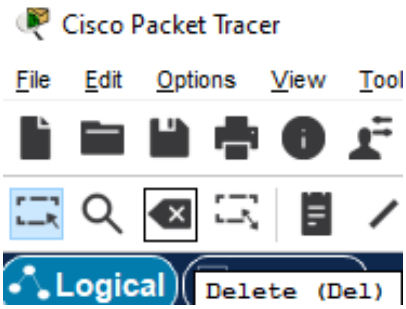
If the switch port is configured as Half Duplex, then the Ethernet NIC on the host will choose Half Duplex. (Full Duplex is a much more efficient option.)
The information is automatically saved when entered. To close this dialog box, click the "X" in the upper right.

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

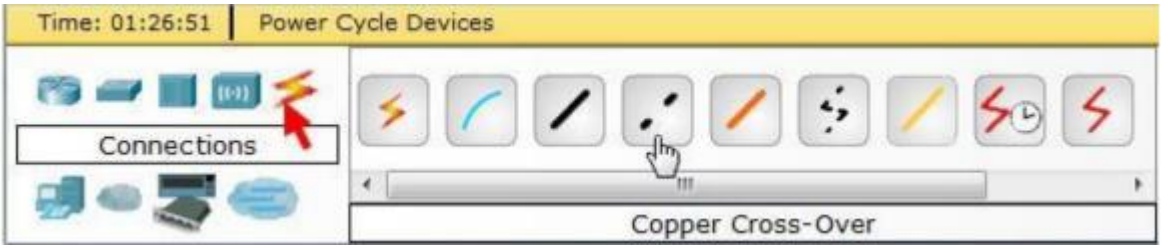
To verify the information that you entered, move the Select tool (arrow) over each host.

STEP – VI (Optional):
Deleting a device or link.
To delete a device or link, choose the Delete tool and click on the item you wish to delete.

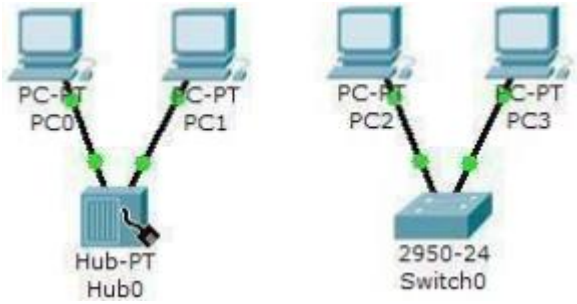


STEP – VII:
Connecting Hub0 to Switch0.
To connect like-devices, like a Hub and a Switch, we will use a Cross-over cable.

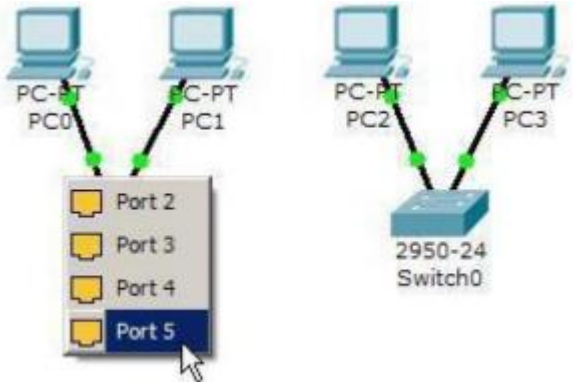
Click once the Crossover Cable from the Connections options.



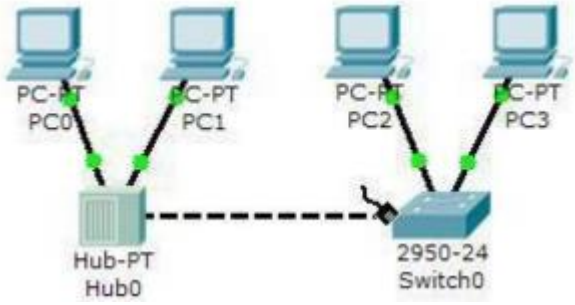
Move the Connections cursor over Hub0 and click once.



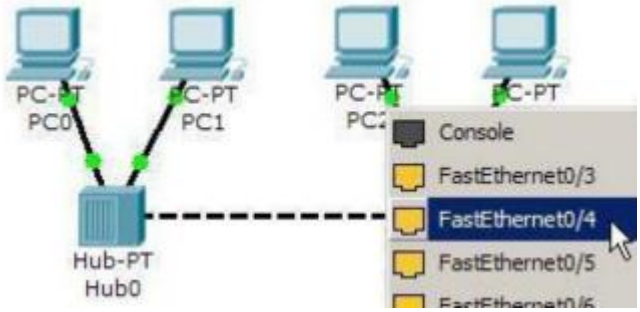
Select Port 5 (actual port does not matter).



Move the Connections cursor to Switch0.

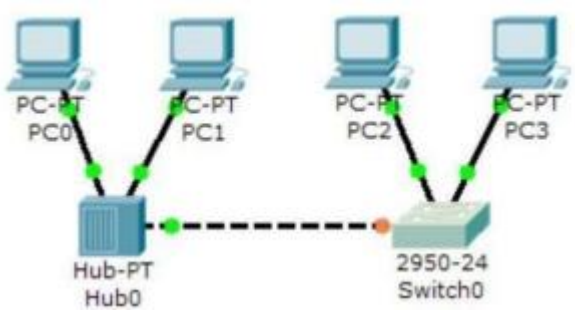


Click once on Switch0 and choose FastEthernet0/4 (actual port does not matter).

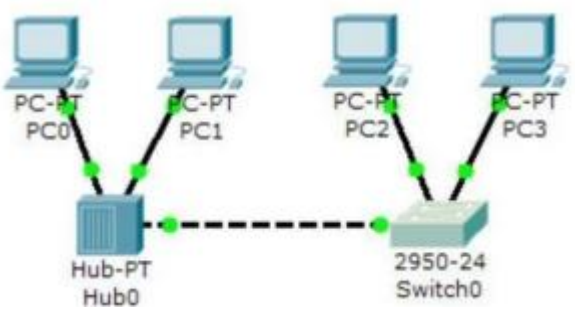


The link light for switch port FastEthernet0/4 will begin as amber and eventually changes to green as the Spanning Tree Protocol transitions the port to forwarding.

1



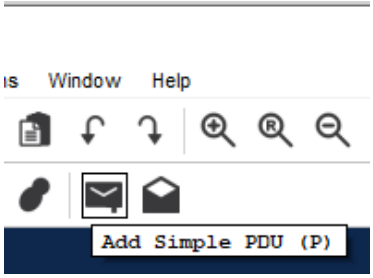
2



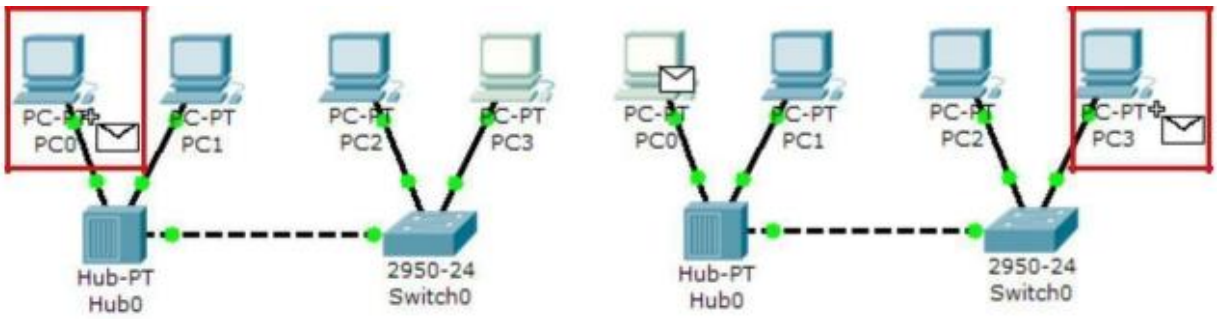
STEP – VIII:
Verifying connectivity in ‘Realtime’ mode.

Be sure you are in Realtime mode.

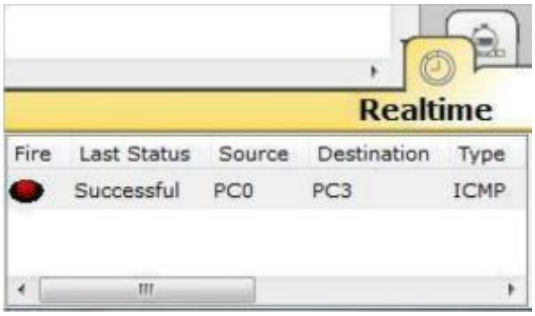
Select the Add Simple PDU tool used to ping devices.



Click once on PC0, then once on PC3.



The PDU Last Status should show as Successful.



STEP – IX:

Resetting the network.

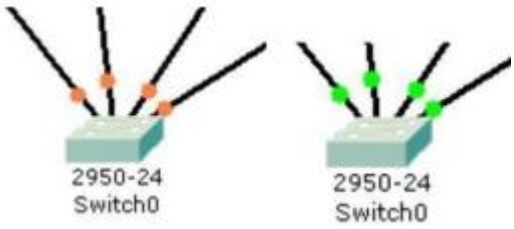
At this point we will want to reset the network, whenever you want to reset the network and begin the simulation again, perform the following tasks:

1) Click Delete in the PDU area.

2) Now, Power Cycle Devices and confirm the action.

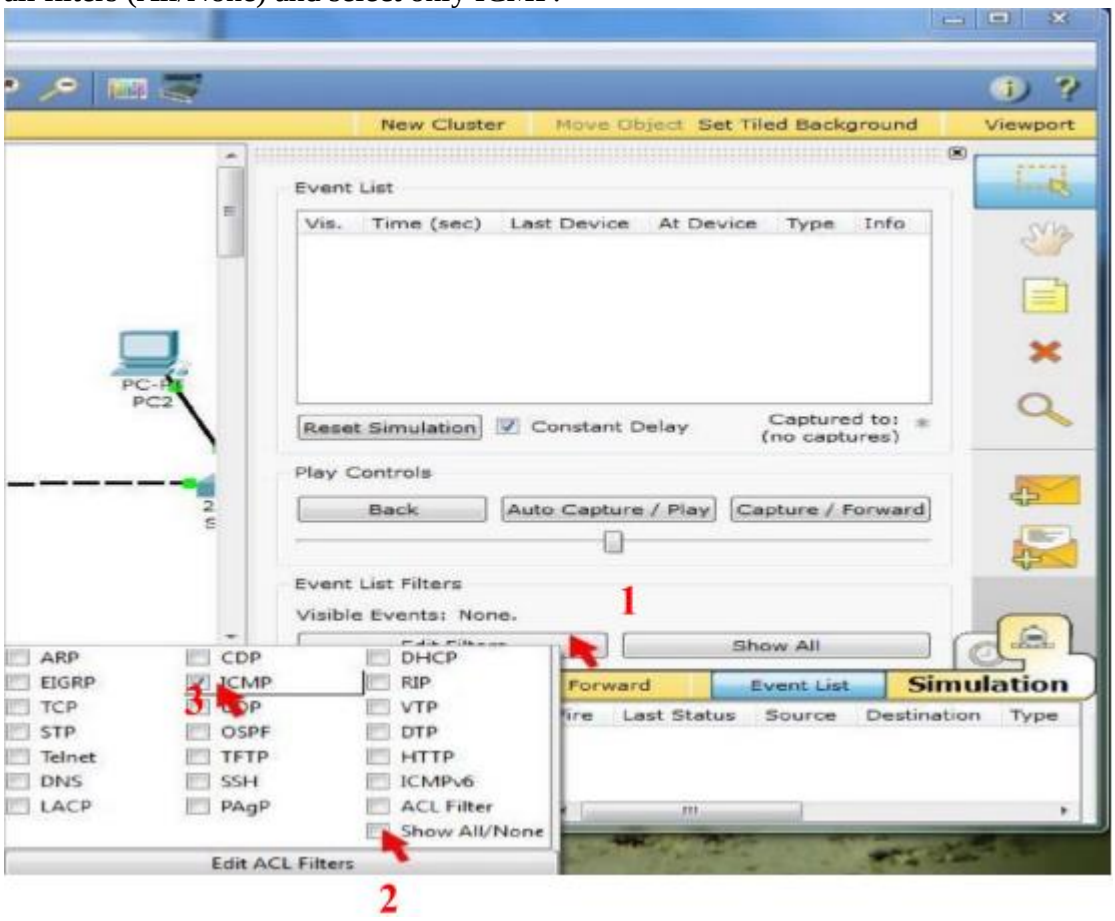
3) Waiting for Spanning Tree Protocol(STP).

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.



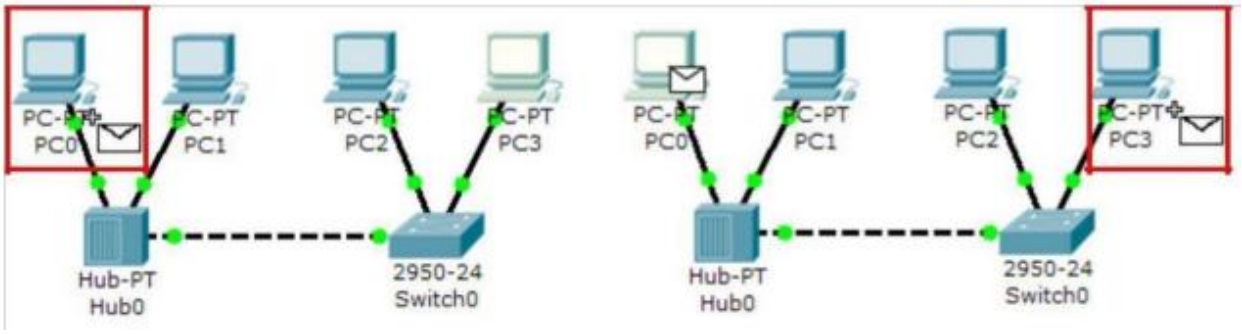
STEP – X (Optional):
Verifying Connectivity in Simulation Mode.
Be sure you are in Simulation mode.

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

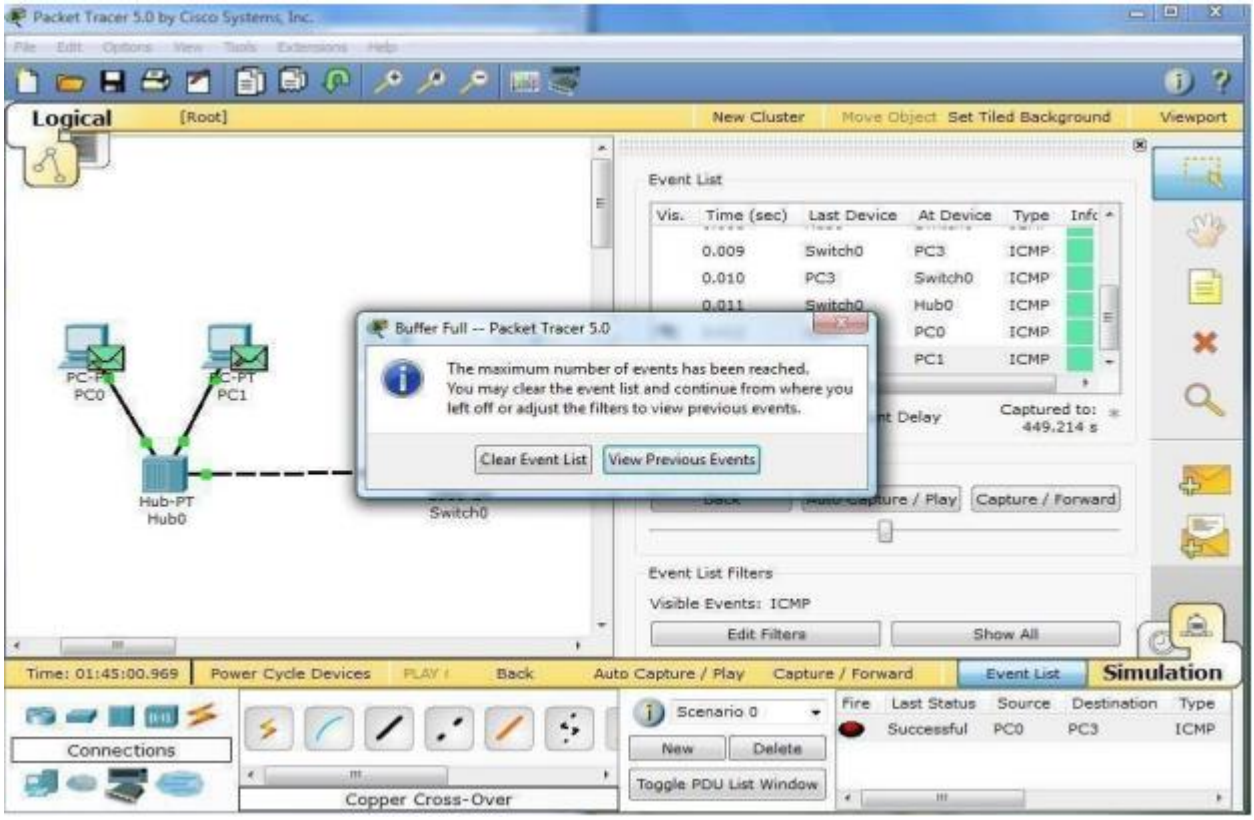


Select the Add Simple PDU tool used to ping device.

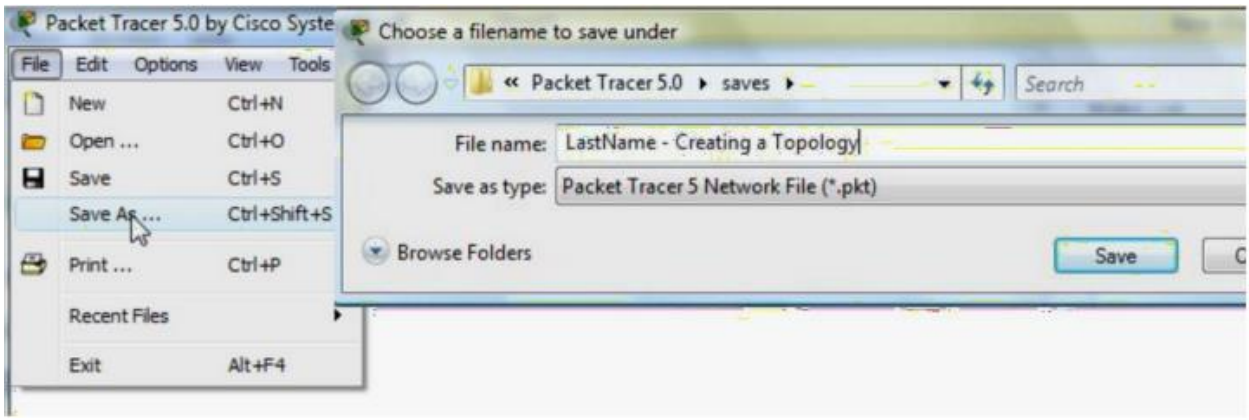
Click once on PC0, then once on PC3.



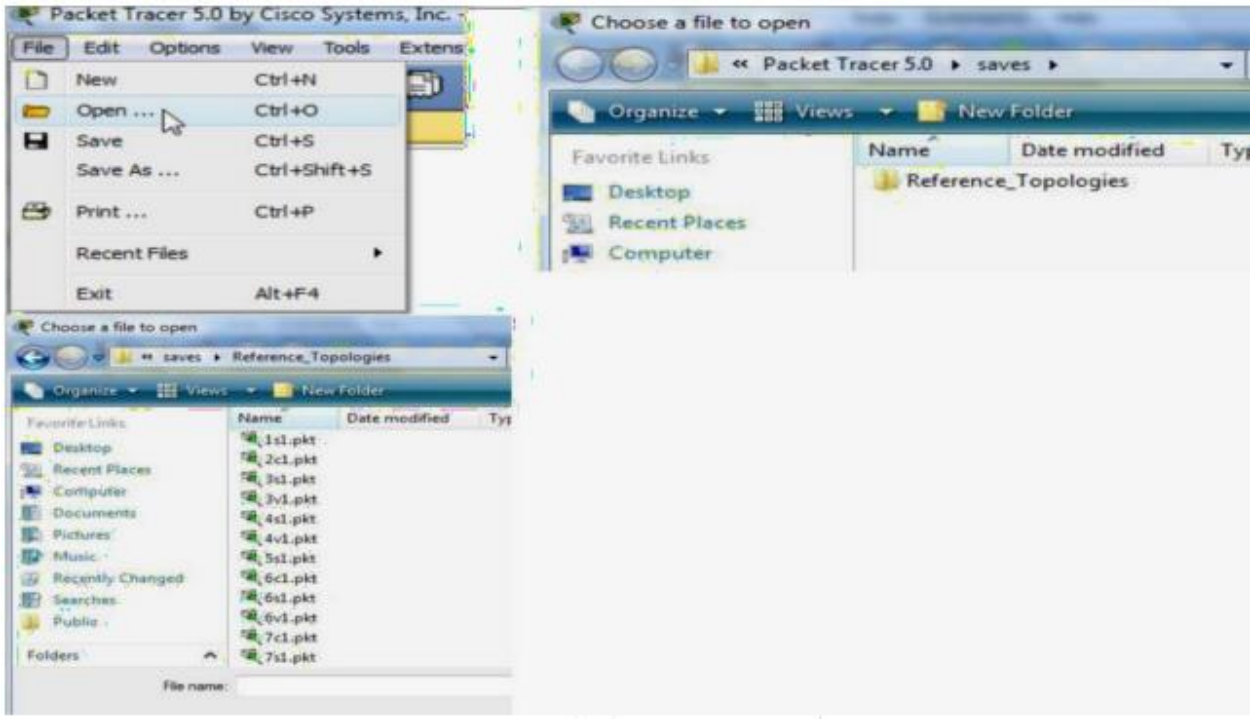
Continue clicking Capture/Forward button until the ICMP ping is completed. You should see the ICMP messages move between the hosts, hub and switch. The PDU Last Status should show as Successful. Click on Clear Event List if you do not want to look at the events or click Preview Previous Events if you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



STEP – XI:
Saving the topology.
Perform the following steps to save the topology (uses .pkt file extension).

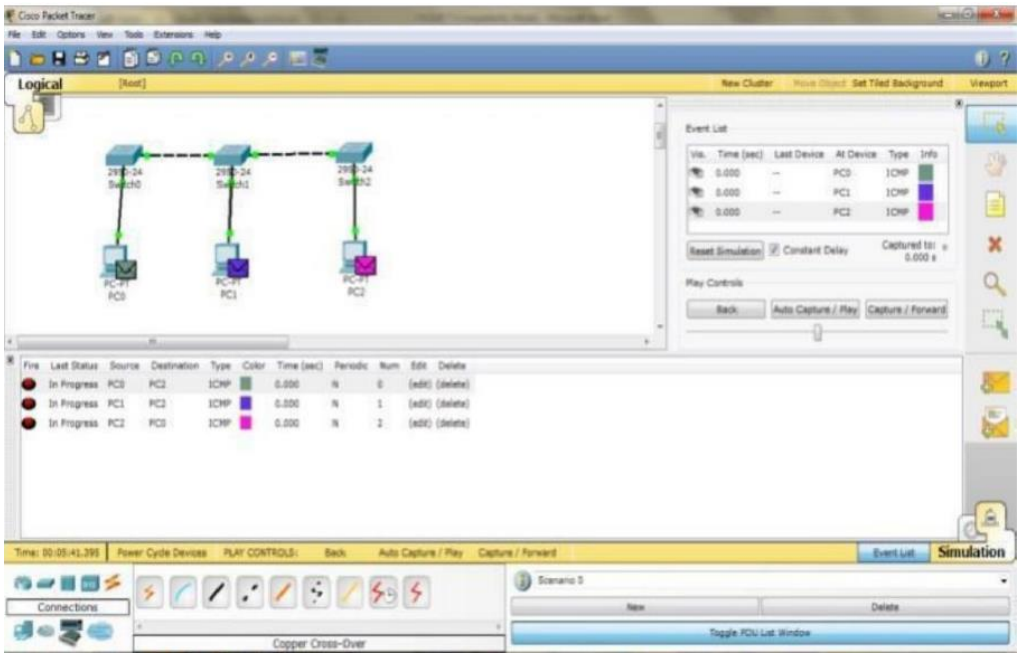


Opening Existing PT Topologies:

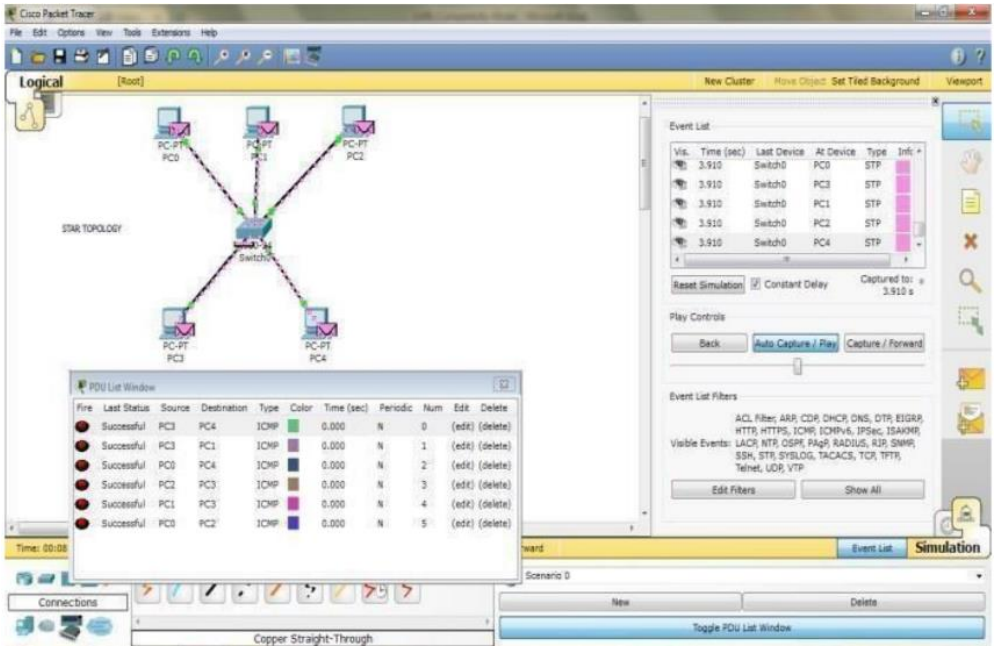


Simulation of Different Topologies

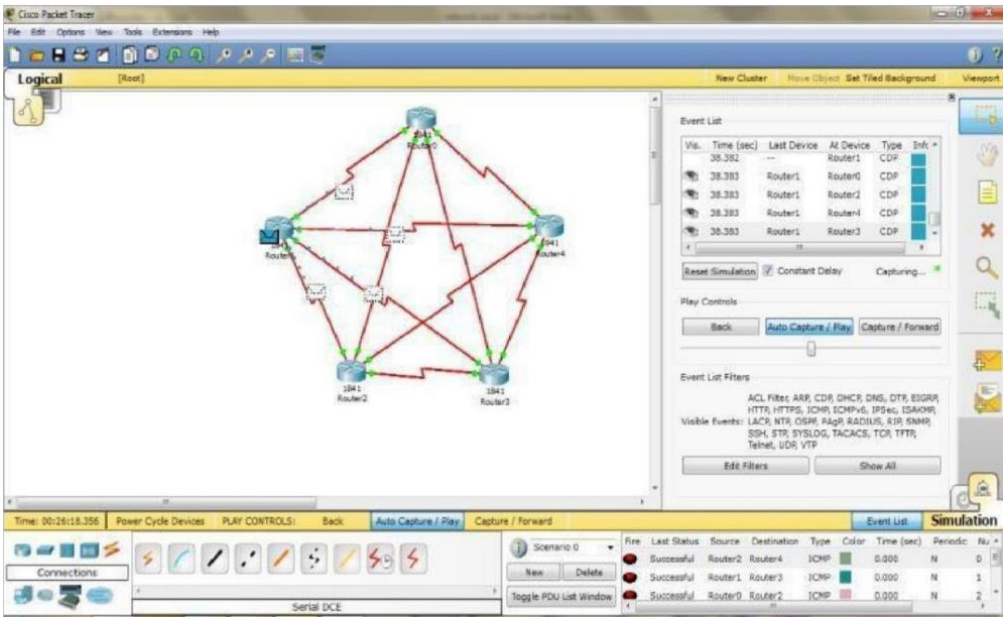
1) Bus Topology



2) Star Topology

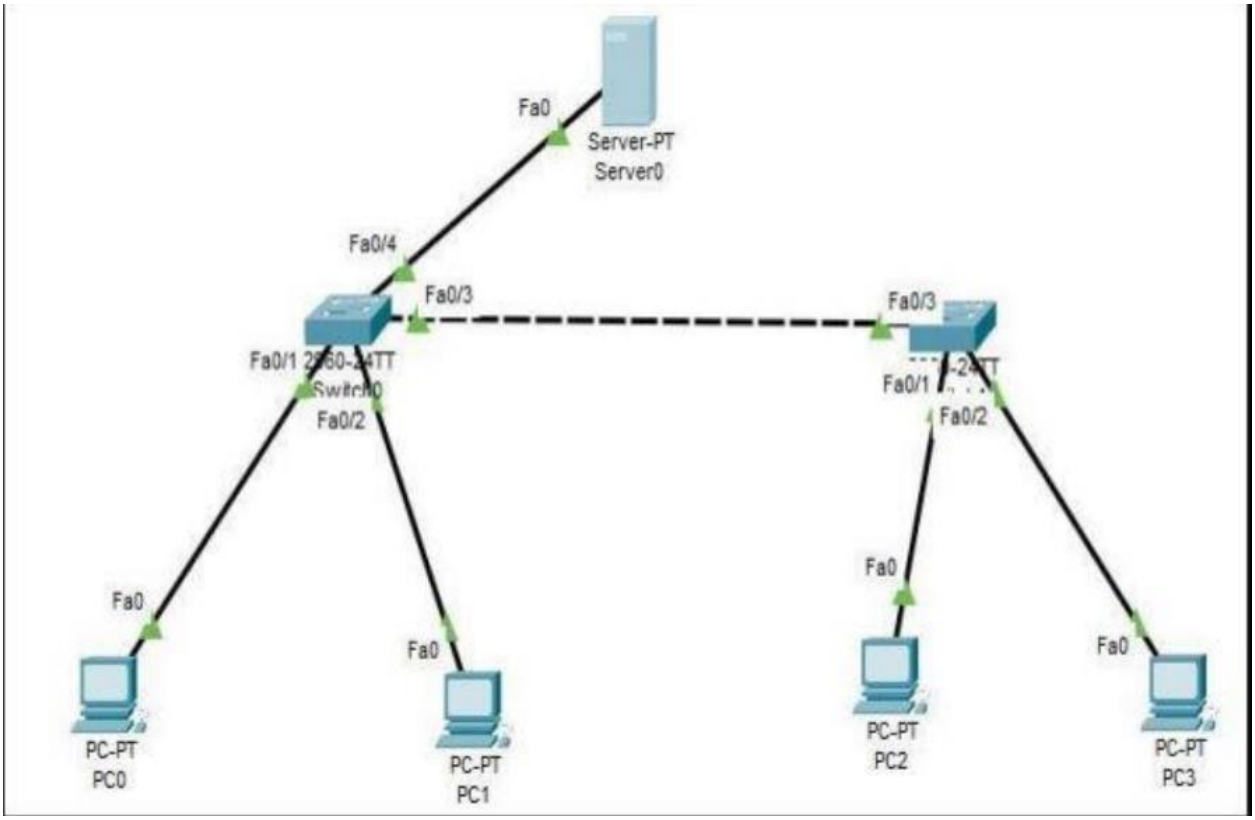


3) MESH Topology



Tasks

1) Design and configure the network given in figure given below and check the connectivity by PING command. Also describe the functionality of devices in given scenario. Show the packet header format of ARP in Cisco Packet Tracer.



2) Identify the difference between Switch and Hub?

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_____

3) Differentiate between physical and logical mode?

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