Design & Simulation of Network Devices using Cisco Packet Tracer

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***Abstract*— In today's computer network plays an important role for exchange of information between end users. Emails, online banking, chats and other important services provided by the internet are becoming prominent features of computer network. For interconnectivity between end users, network topology describe the physical and logical appearance and interconnection between arrangement of computers, cables and other component in a data communication network and how to be used for taking a packet from one device and sending it through the network to another device on a different network. So we can say computer network, along with transportation networks, have become essential infrastructure in every society that allows the flow of people information and goods.**
So in this paper, i am designing a network using a network simulator tool i.e. Cisco packet tracer. This network will deal with how packets can be send from one network device to other network device and will help us to understand the concept of IP configuration, Network devices, Network cables and Topology etc

***Keywords*— Computer network, Ethernet, Cisco packet tracer software, CIDR-Classless Interdomain Routing**

I. INTRODUCTION

The network is defined as group of computers connected together to share information. Example sharing the files from one computer to another computer connected in network or sharing the printer between group of computers.

Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable. For data communications to occur, the communicating devices must be part of a communication system made up of a combination of hardware (physical equipment) and software (programs). The effectiveness of a data communications system depends on four fundamental characteristics: delivery, accuracy, timeliness, and jitter.

1. Delivery-The system must deliver data to the correct destination. Data must be received by the intended device or user and only by that device or user.
2.Accuracy-The system must deliver the data accurately. Data that have been altered in transmission and left uncorrected are unusable.
3. Timeliness-The system must deliver data in a timely manner. Data delivered late are useless. In the case of video and audio, timely delivery means delivering data as
they are produced, in the same order that they are produced, and without significant delay. This kind of delivery is called *real-time* transmission.
4. Jitter-Jitter refers to the variation in the packet arrival time. It is the uneven delay in the delivery of audio or video packets. For example, let us assume that video packets
are sent every 3ms. If some of the packets arrive with 3ms delay and others with 4ms delay, an uneven quality in the video is the result.
There are five components in computer network:

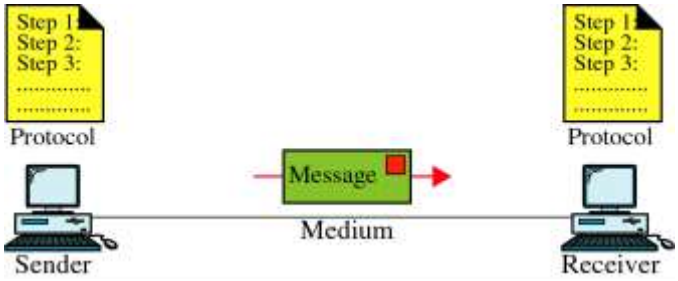

Fig. 1 Components in computer network

1. Message. The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video.
2. Sender. The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.
3. Receiver. The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.
4. Transmission medium. The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves.
5. Protocol. A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating, just as a person speaking French cannot be understood by a person who speaks only Japanese.

Cisco Packet Tracer (CPT) [1] [2] is multi-tasking network simulation software to perform and analyze various network activities such as implementation of different topologies, select optimum path based on various routing algorithms, create DNS and DHCP server, sub netting, analyze various network configuration and troubleshooting commands. In order to start communication between end user devices and to design a network, we need to select appropriate networking devices [3] like routers, switches, hubs and make physical

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Connection by connection cables to serial and fast Ethernet ports from the component list of packet tracer. Networking devices are costly so it is better to perform first on packet tracer to understand the concept and behavior of networking.

II. DESIGNING THE NETWORK

The network can be designed by selecting devices and the media in which to connect them. Several types of devices and network connections can be used. In this paper we will keep it simple by using end devices, switches, hubs and connections.

Single click on each group of devices and connections to display the various choices in cisco packet tracer software.

• Single click on the End Devices.

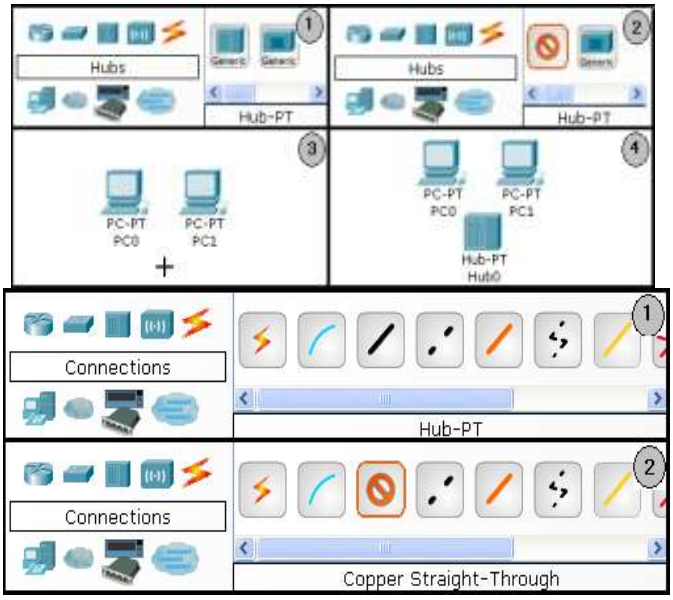
• Single click on the Generic host.

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. Add the number of devices as per requirement of the design

Building the Topology – Connecting the Hosts to Hubs and Switches

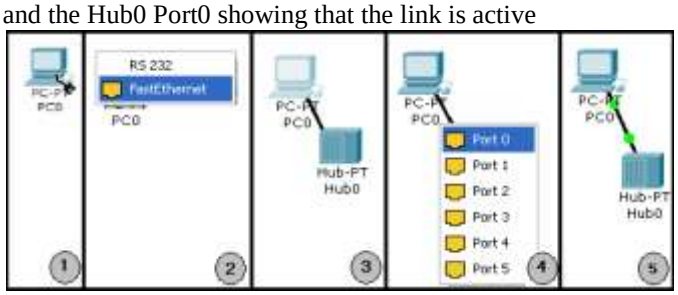
Adding a Hub

- Select a hub, by clicking once on Hubs and once on a Generic hub.
- Connect PC0 to Hub0 by first choosing Connections.
- Click once on the Copper Straight-through cable.

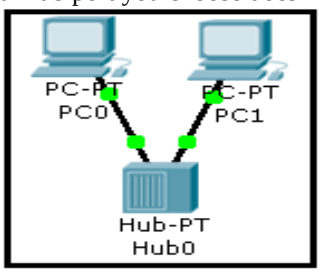


Perform the following steps to connect PC0 to Hub0:

1. Click once on PC0
2. Choose Fast Ethernet
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 Port1 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 switch.

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

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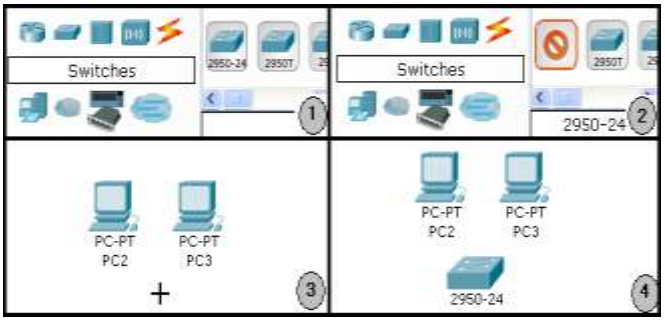
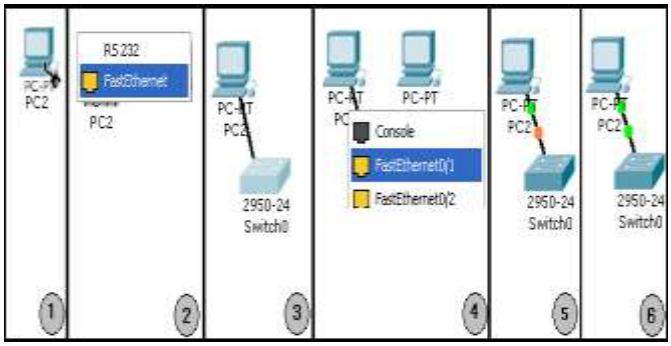
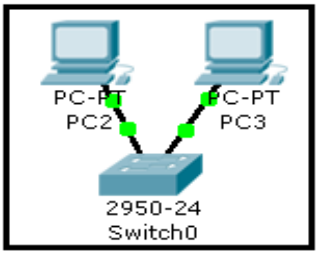


- Connect PC2 to Switch0 by first choosing Connections.
- Click once on the Copper Straight-through cable.
- Perform the following steps to connect PC2 to Switch0:

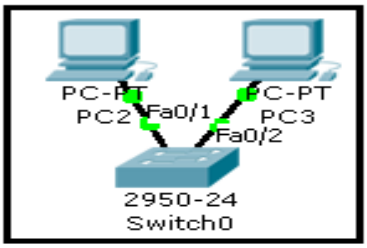
1. Click once on PC2
2. Choose Fast Ethernet
3. Drag the cursor to Switch0
4. Click once on Switch0 and choose FastEthernet0/1
5. Notice the green link lights on PC2 Ethernet NIC and amber light Switch0 FastEthernet0/1 port. The switch port is temporarily not forwarding frames, while it goes through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



Repeat the steps above for PC3 connecting it to Port3 on switch0 on port FastEthernet0/2. (The actual switch port you choose does not matter.)



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



III. CONFIGURATION OF NETWORK

Before we can communicate between the hosts we need to configure IP Addresses and Subnet Masks on the devices. The IP address are the 32-bit logical address used to route the packet from source the destination. The IP address is represented in dotted decimal notation. It consist of four octet separated by dot. Each octet is of eight bit.

The IP address is defined in internet layer of TCP/IP model. The IP address can be static or dynamic depending on configuration. The subnet mask is used to distinguish between network and host part in IP address.

Although the length of the netid and hostid (in bits) is predetermined in classful addressing, we can also use a mask (also called the default mask).

TABLE 1:Default Subnet Mask

Class	*Binary*	*Dotted-Decimal*	*CIDR*
A	11111111 00000000 00000000 00000000	255.0.0.0	/8
B	11111111 11111111 00000000 00000000	255.255.0.0	/16
C	11111111 11111111 11111111 00000000	255.255.255.0	/24

To configure the network click on PC0 Choose the Config tab, then click on desktop option and after that proceed to set IP address in IP configuration option as shown in Fig 2

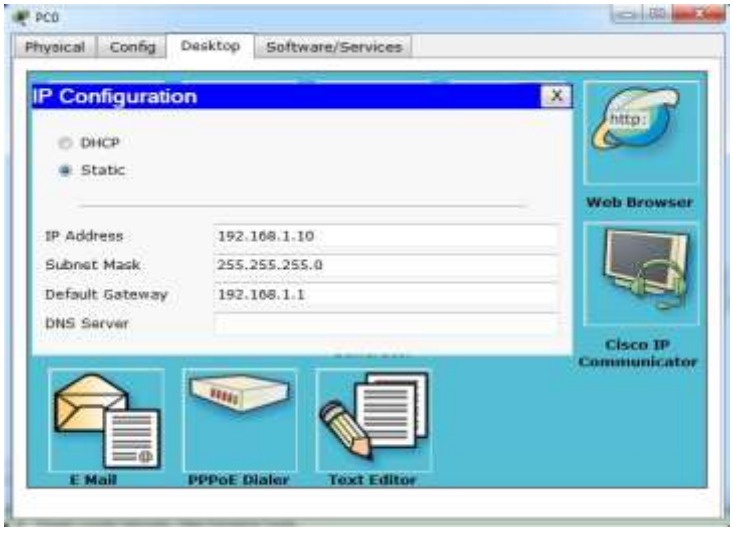


Fig 2. IP configuration fro PC0

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Similarly configure all other PC on the network as shown below-

Fig 3. IP configuration fro PC1

Fig 4. IP configuration fro PC2

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

TABLE 2:IP Address and Subnet Mask for each host

Host	IP Address	Subnet Mask
PCO	192.168.1.10	255.255.255.0
PC1	192.168.1.11	255.255.255.0
PC2	192.168.1.12	255.255.255.0
PC3	192.168.1.13	255.255.255.0
PC4	192.168.1.14	255.255.255.0
PC5	192.168.1.15	255.255.255.0

To Connect Hub0 to Switch0 To, we will use a Cross-over cable. Click once the Cross-over Cable from the Connections options. Move the Connections cursor over Hub0 and click once, Select Port2 (actual port does not matter) as shown in Fig 5.

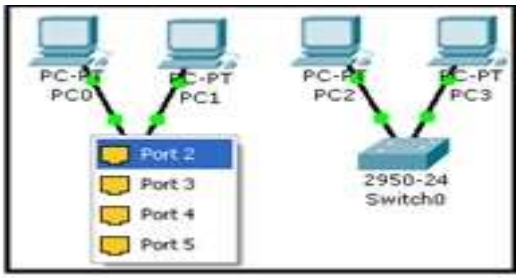

Fig 5. Connecting Hub0 to Switch0

Now Move the Connections cursor to Switch0 and Click once on Switch0 and choose FastEthernet0/3 (actual port does not matter). The link light for switch port FastEthernet0/3 will begin as amber and eventually change to green as the Spanning Tree Protocol transitions the port to forwarding as shown in Fig 6.

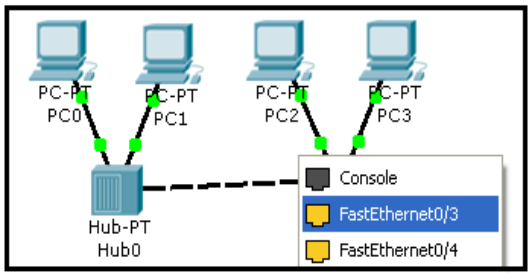

Fig 6. Connecting Hub0 to Switch0

IV. SIMULATION OF NETWORK

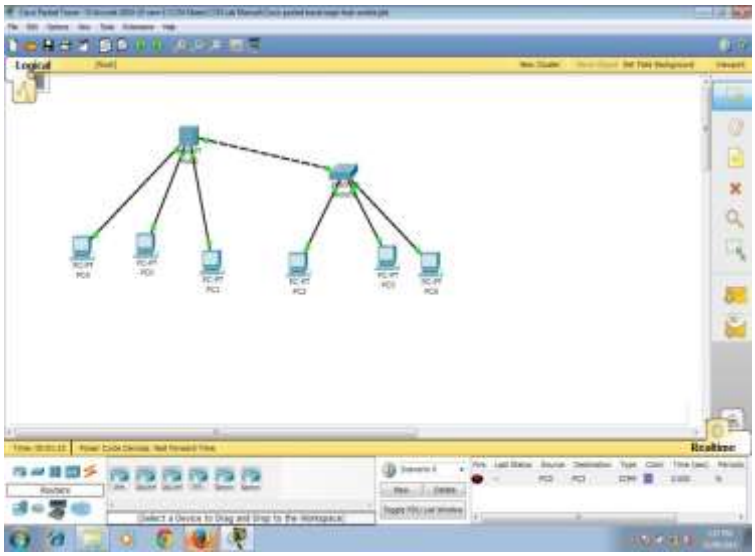

Fig 7.Result 1

The Fig 7. Shows the connectivity between number of hosts at hub and switch side. For connection between host and network devices, we have used straight-through cable. For connection between switch and hub , we have used cross-over cable.

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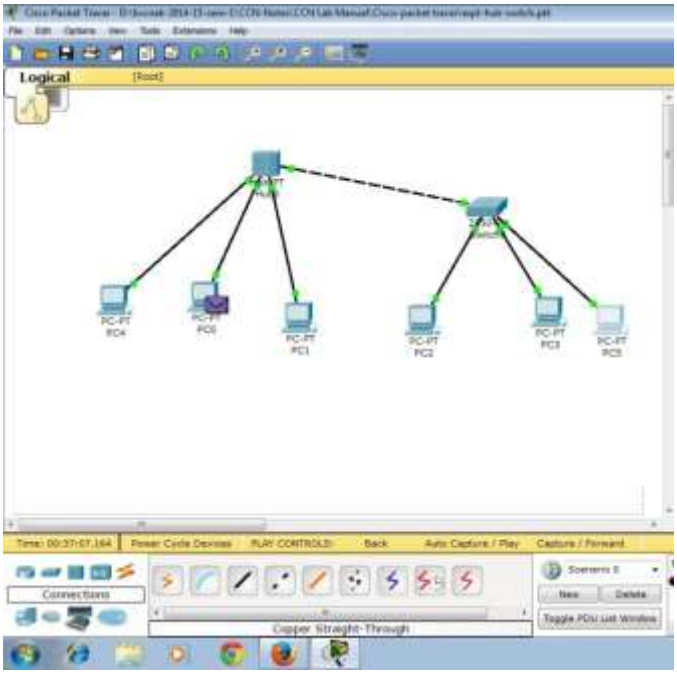

Fig 8. Result 2

In Fig 8. the ICMP packet is destined from PC0 to PC3.Hub is the device that broadcast the incoming packet to all other nodes connected to it. Switch is the intelligent device which will forward the packet to intended destination only.

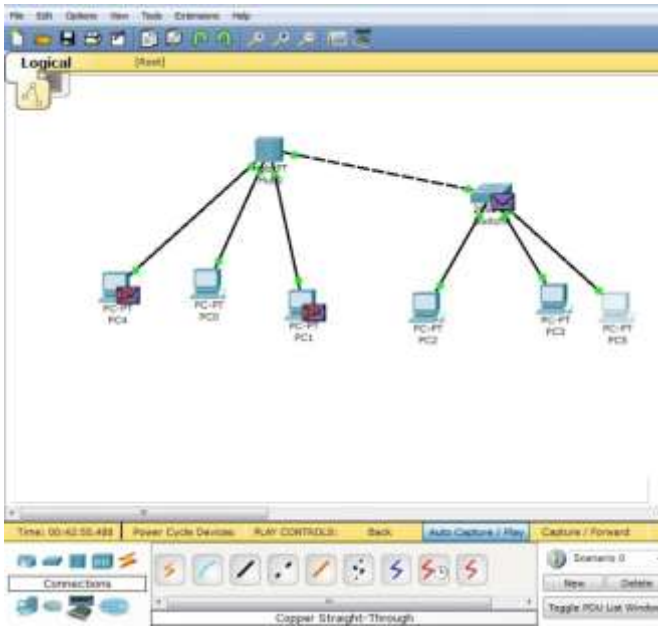

Fig 9. Result 3

In Fig 9. The hub will broadcast the packet to all other nodes connected to hub.PC4 and PC1 will discard this packet and switch will accept this packet.

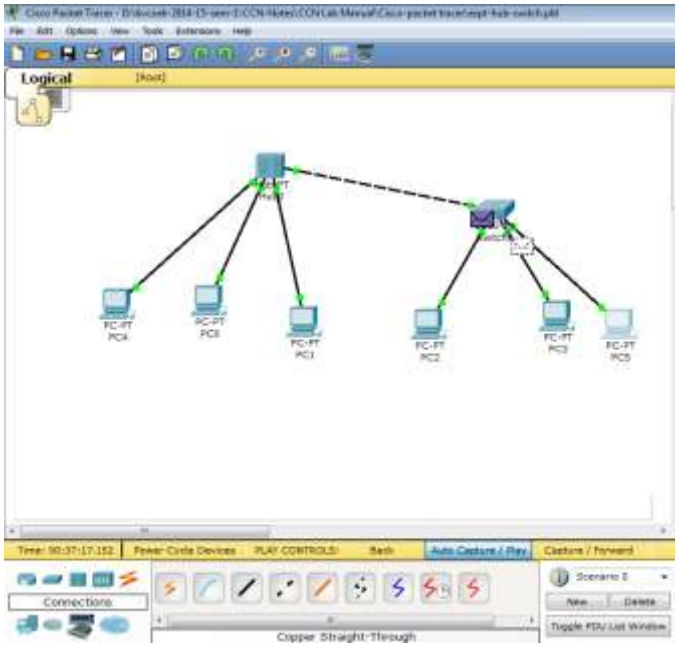

Fig 10. Result 4

In Fig 10, the switch will forward the packet to intended destination, rather than sending the packet to all other nodes.Switch0 sends the packet to PC3.

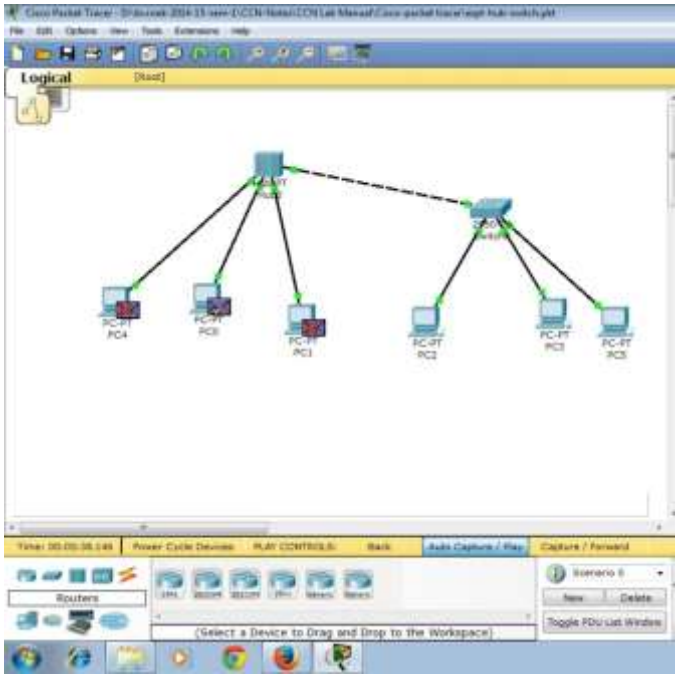

Fig 11. Result 4

In Fig 11. PC3 will not send reply packet to source PCO. This reply packet will travel from PC3 to switch 0, switch 0 to hub 0 and hub 0 to PC0. Here again hub0 will replicate this reply packet to PC4 and PC1, but they will discard it.

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V. CONCLUSION

In this paper, we have implemented the network using switch and hub by configuring the number of PC to it and shown how packets can be transmitted from hub to switch.

Here we have used Cisco packet tracer to simulate this scenario and understand the concept of data communication over network devices like switch and hub.

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