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LAB MANUAL

COMPUTER NETWORK LAB

(PC/CSE/42-P)

Practical No. 1

Aim:-To study about the components and specifications of Computer and Laptop.

❖ **Computer :-**

A computer is a machine that can store, process, and execute instructions to perform tasks. Computers come in many different sizes and shapes, from smart phones to supercomputers.



• **Motherboard:-**

A motherboard is the main circuit board in a computer, acting as the central hub that connects and allows communication between all the internal components, including the CPU, RAM, and storage devices.

Motherboard and their parts:-

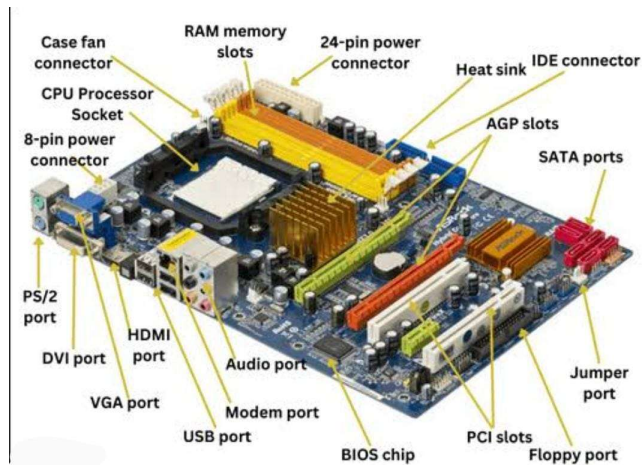


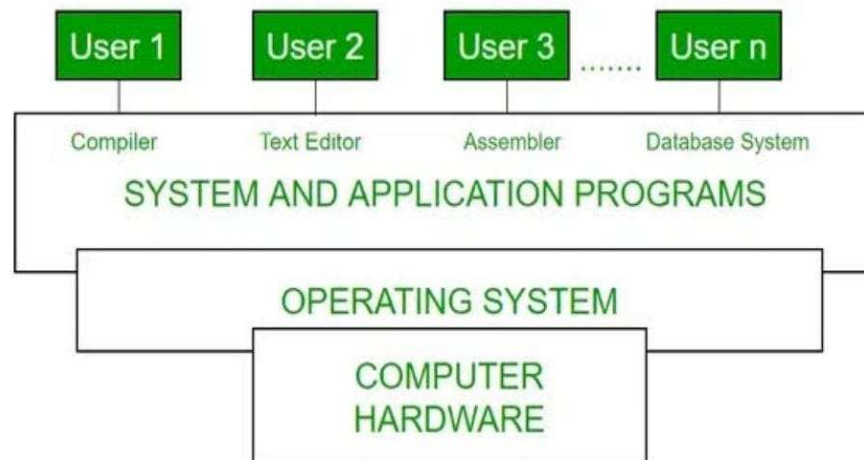
Diagram: Motherboard with Label Diagram

• **Processor:-**

A processor (CPU) is the logic circuitry that responds to and processes the basic instructions that drive a computer. The CPU is seen as the main and most crucial integrated circuitry (IC) chip in a computer, as it is responsible for interpreting most of computers commands.



❖ **Operating system:-**



- An Operating System (OS) is an interface between a computer user and computer hardware. An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

Network interface card:-

- A network interface card, also known as NIC or network interface controller, is typically a circuit board installed on the computer to connect to the network. It works as an indispensable component for the network connection of computers.

Memory:-

- It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address, which varies from zero to memory size minus one.

1.RAM:-

- RAM, or Random Access Memory, is a computer's short-term memory that stores data and instructions currently being used by the CPU, allowing for quick access and processing, but it's volatile, meaning it loses data when power is off. Mentioned computer have 512 MB RAM.



2. Hard disk drive:-

- A Hard Disk Drive (HDD) is a data storage device that uses spinning magnetic disks (platters) and a read/write head to store and retrieve digital data, acting as a primary or secondary storage device in computers. mentioned computer have HDD of 160GB .



❖ Laptop:-

- A laptop, also known as a notebook, is a portable personal computer designed for use on the go, featuring a built-in keyboard, screen, and touchpad, and capable of running full desktop operating systems.

Laptop specifications:-

Processor:-

A processor, often called the Central Processing Unit (CPU), is the "brain" of a computer, responsible for interpreting and executing instructions from software programs and managing the flow of data within the system. Mentioned laptop have intel core i5 processor.



❖ Operating system:-

The screenshot shows the Windows System Information window, divided into two sections: "Device specifications" and "Windows specifications".

Device specifications	
Device name	Himanshi-Panchal
Processor	12th Gen Intel(R) Core(TM) i5-1235U 1.30 GHz
Installed RAM	16.0 GB (15.7 GB usable)
Device ID	63CB7A11-AAA4-45CD-A6E8-2ECC84E8540C
Product ID	[Redacted]
System type	[Redacted]
Pen and touch	No pen or touch input is available for this display

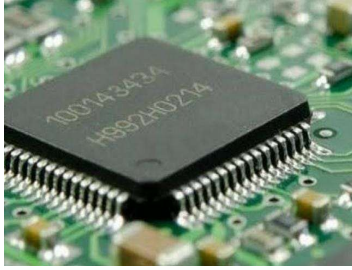
Related links: [Domain or workgroup](#) [System protection](#) [Advanced system settings](#)

Windows specifications	
Edition	Windows 11 Home Single Language
Version	24H2
Installed on	26-12-2024
OS build	26100.3194
Experience	Windows Feature Experience Pack 1000.26100.48.0
Microsoft Services Agreement	
Microsoft Software License Terms	

- An operating system (OS) is the core software that manages a computer's hardware and software resources, providing a platform for applications to run and allowing users to interact with the computer. Mentioned laptop have 64-bit operating system , x64-based processor .

Types of memory used:-

➤ Cache memory:-



Cache memory is a small, fast memory that acts as a buffer between the CPU and main memory (RAM), storing frequently accessed data and instructions for quicker retrieval, thus improving overall system performance. Mentioned laptop have 12MB cache size.

➤ RAM:-

Random-access memory is a form of electronic computer memory that can be read and changed in any order, typically used to store working data and machine code. Mentioned laptop have 16MB RAM size.



➤ Hard disk drive:-

A hard disk drive (HDD), also known as a hard disk or fixed disk, is a data storage device that uses magnetic storage with one or more rigid, rapidly rotating platters coated with magnetic material to store and retrieve digital data.

➤ Solid state drive:-

A Solid-State Drive (SSD) is a digital storage medium that uses integrated circuit assemblies, specifically flash memory, to store data persistently, unlike traditional hard disk drives (HDDs) which use spinning disks.



Screen resolution:-

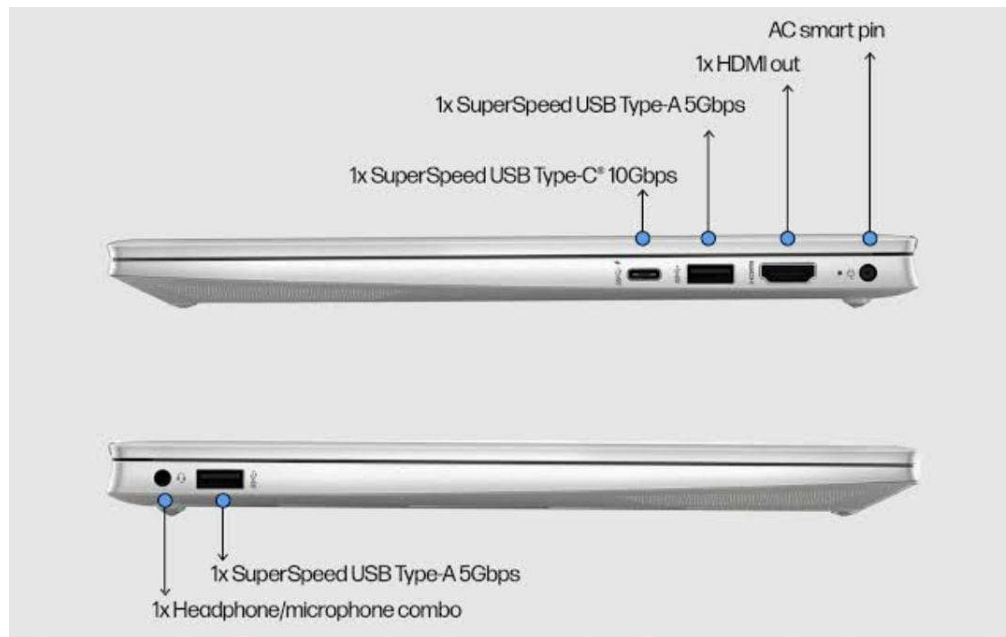
Display Type Full HD.

Screen Resolution 1920 x 1080 - FHD.

Screen Size (Diagonal) 35.56 cm (14 inch).

Ports in laptop:-

1. AC smart pin
2. HDMI out
3. USB Type -A
4. USB Type-C
5. Headphone/microphone combo



Practical No. 2

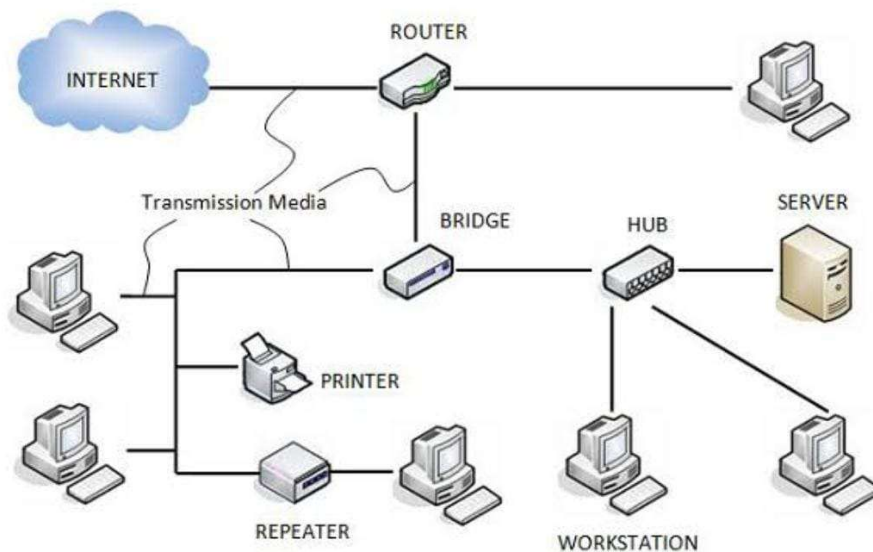
Aim:-Familiarization with networking components and devices LAN adapters, hubs, switches, routers etc.

❖ **What is a network?**

- A network is a system of interconnected devices that share data and resources. Networks can be made up of computers, servers, or other electronic devices. They can be connected by cables or wirelessly.

Networking Components:-

- Computer networks components comprise both Hardware parts as well as the software parts required for installing computer networks, both at organizations and at home. The hardware components are the server, client, peer, transmission medium, and connecting devices. The software components are operating system and protocols.



COMPUTER NETWORK COMPONENTS

❖ **Hardware Components:-**

- **Servers:** Servers are high-configuration computers that manage the resources of the network. The network operating system is typically installed in the server and so they give user accesses to the network resources. Servers can be of various kinds: file servers, database servers, print servers etc.
- **Clients:** Clients are computers that request and receive service from the servers to access and use the network resources.

Peers: Peers are computers that provide as well as receive services from other peers in a work group network.

Transmission Media: Transmission media are the channels through which data is transferred from one device to another in a network. Transmission media may be guided media like coaxial cable, fiber optic cables etc; or maybe unguided media like microwaves, infra-red wave etc.

Networking Devices: Connecting devices act as middleware between networks or computers, by binding the network media together.

Some of the common connecting devices are:

1. Routers
2. Hub
3. Switch
4. Bridge
5. Repeater
6. Gateway

Software components:

Operating System – Network Operating Systems is typically installed in the server and facilitate workstations in a network to share files, database, applications, printers etc.

Protocol Suite – A protocol is a rule or guideline followed by each computer for data communication. Protocol suite is a set of related protocols that are laid down for computer networks.

The two popular protocol suites are –

- OSI Model (Open System Interconnections)
- TCP / IP Model.

LAN adaptor:-

A LAN (Local Area Network) adaptor, also known as a network interface card (NIC) or Ethernet adaptor, is a hardware component that enables a device to connect to and communicate over a local area network (LAN). The primary function of a LAN adaptor is to allow a computer or other device to connect to a wired Ethernet network and transmit and receive data.



Types:

- **Ethernet Adapters:** These are the most common type and use Ethernet cables (RJ45 connectors) to connect to a network.
- **Wireless Network Adapters:** These adapters allow devices to connect to a network wirelessly (e.g., Wi-Fi).

Networking devices

❖ **Router:-**

- A Router is a networking device that forwards data packets between computer networks. One or more packet-switched networks or subnetworks can be connected using a router. By sending data packets to their intended IP addresses, it manages traffic between different networks and permits several devices to share an internet connection.

How Does Router Work?

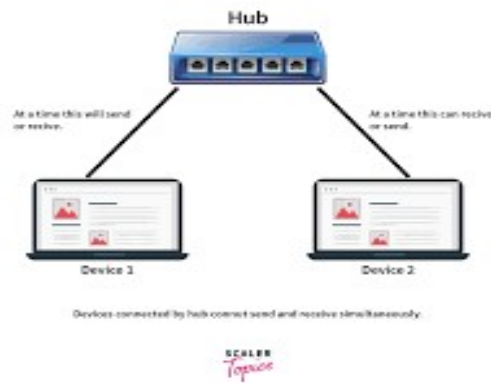
- A router determines a packet's future path by examining the destination IP address of the header and comparing it to the routing database. The list of routing tables outlines how to send the data to a specific network location. They use a set of rules to determine the most effective way to transmit the data to the specified IP address.
- To enable communication between other devices and the internet, routers utilize a modem, such as a cable, fiber, or DSL modem. Most routers include many ports that can connect a variety of devices to the internet simultaneously. In order to decide where to deliver data and where traffic is coming from, it needs routing tables.
- A routing table primarily specifies the router's default path. As a result, it might not determine the optimum path to forward the data for a particular packet. For instance, the office router directs all networks to its internet service provider through a single default channel.
- Static and dynamic tables come in two varieties in the router. The dynamic routing tables are automatically updated by dynamic routers based on network activity, whereas the static routing tables are configured manually.



❖ **HUB:-**

- A Network Hub is one of the most commonly used networking devices can be easily found on any small networks such as home or office. Hub operates at the physical layer of OSI model. It is the simplest networking device hence has low cost. Basically, a hub is a repeater with multiple ports. The function of a hub in networking is similar to the repeater. It transfers data in the form of binary bits and uses for broadcasting data.

Working of Hubs:-



When a host sends frames, the hub forwards the frames in all the ports. Hubs do not separate the type of the frame, for example, whether the frame unicast should be either multicast or broadcast. Hubs forward all the frames into all the ports. Although a hub sends the frames to all the ports, a computer accepts the ones, whose MAC match matches the destination MAC address field. The rest of the frames are discarded after receiving the required information.

Switch:-

The Switch is a network device that is used to segment the networks into different subnetworks called subnets or LAN segments. It is responsible for filtering and forwarding the packets between LAN segments based on MAC address.

Switches have many ports, and when data arrives at any port, the destination address is examined first and some checks are also done and then it is processed to the devices. Different types of communication are supported here like unicast, multicast, and broadcast communication.



How Does a Network Switch Works?

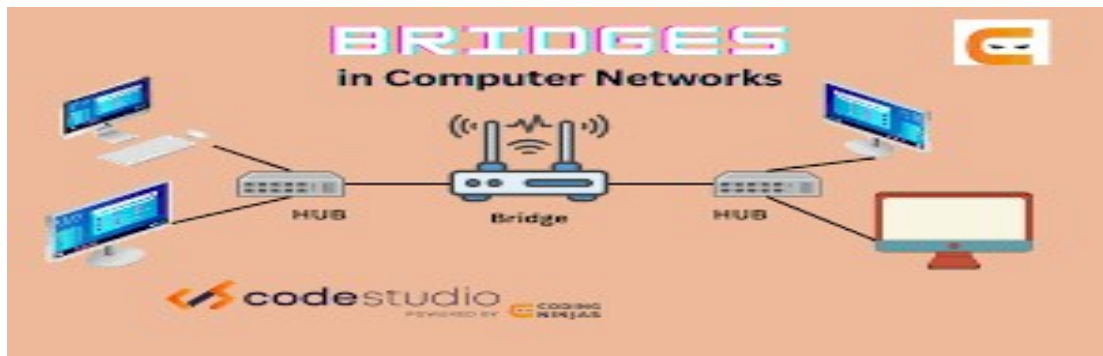
When the source wants to send the data packet to the destination, the packet first enters the switch and the switch reads its header and finds the MAC address of the destination to identify the device then it sends the packet out through the appropriate ports that lead to the destination devices.

Switch establishes a temporary connection between the source and destination for communication and terminates the connection once the conversation is done. Also, it offers full bandwidth to network traffic going to and from a device simultaneously to reduce collision.



Bridge:-

In computer networking, a bridge is a device that connects two or more network segments (like LANs) at the data link layer (Layer 2 of the OSI model) to create a larger, single network, forwarding traffic based on MAC addresses.



Working of Bridges

Let's see the step-by-step working of the bridge in computer networks:

- **Receiving Data:** The bridge gets data packets (or frames) from both network segments A and B.
- **Building a Table:** It creates a table of MAC addresses by looking at where the data is coming from to know which device is on which segment.
- **Filtering Data:** If the data from network A is meant for a device also on network A, the bridge stops it from going further.
- **Forwarding Data:** If the data from network A is meant for a device on network B, the bridge sends it to the correct place on network B.
- **Repeating for Both Sides:** The bridge does the same thing for data coming from network B.

Repeater:-

A repeater is a network device that retransmits a received signal with more power and to an extended geographical or topological network boundary than what would be capable with the original signal. A repeater is implemented in computer networks to expand the coverage area of the network, re-propagate a weak or broken signal and/or service remote nodes. Repeaters amplify the received/input signal to a higher frequency domain so that it is reusable, scalable.

Working of Repeaters

- Initially the source system transmits the signals. This source systems can be a mobile phone, laptop or radio.
- This transmitted signal from the source system travels in air if it's wireless network or through the cable if it is wired network. As the signal goes away from the source it's strength gets weak.
- The signal received to the repeater is not the actual signal sent by source system but a weak signal. Therefore repeater amplifies this weak signal to get it strengthen.
- The strengthen signal is now being sent from the repeater to its destination. This signal is more stronger and can travel at longer distance. In short, it extends the network without losing the quality of signal.
- Repeaters are therefore used in various wireless technologies such as Wi-Fi and wired technologies such as ethernet.



Gateway:-

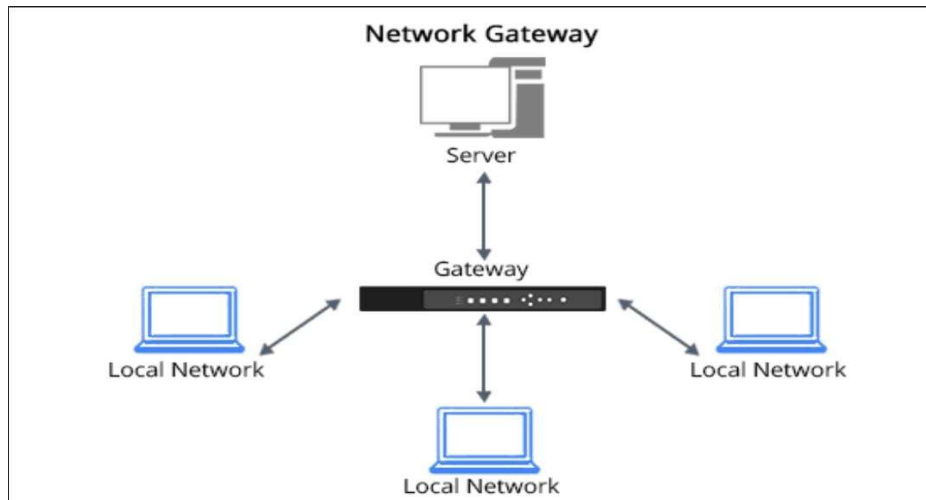
A gateway is a network connectivity device that connects two different configuration networks. Gateways are also known as protocol converters, because they play an important role in converting protocols supported by traffic on different networks. As a result, it allows smooth communication between two networks. It works as the entry-exit point for a network because all traffic that passes across the networks must pass through the gateway. A gateway monitors and controls all the incoming and outgoing network traffic. Gateways are also known as protocol converters In this article, we are going to discuss all important points related to Gateways.



How Gateways Work?

- The gateway receives data from devices within the network.
- After receiving data the gateway intercept and analyze data packets, which include analyzing packet header, payload etc.
- Based on the analysis of the data packets, the gateway calculate an appropriate destination address of data packet. It then routes the data packets to their destination address.

- In some cases, the gateway might also want to transform the format of the obtained data to ensure compatibility at the receiver.
- Once the data packets have been analyzed, routed, and converted, then the gateway sends the last packets to their respective destinations address inside the network

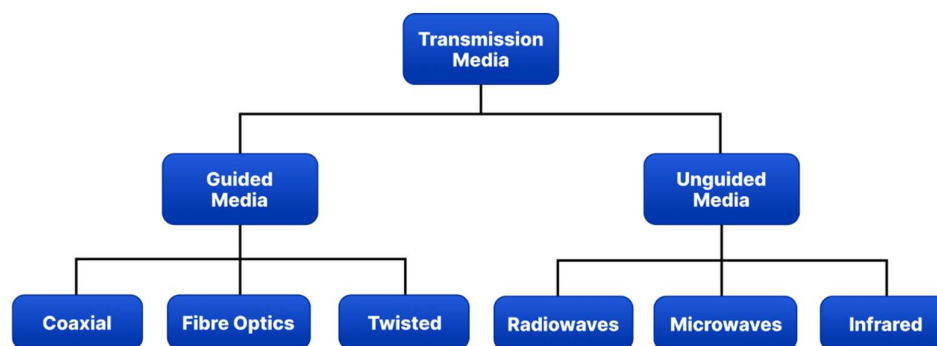


Practical No. 3

Aim:-Familiarization with Transmission media and Tools Coaxial cable, UTP Cable, Crimping Tools, Connectors etc.

❖ **Transmission Medium:-**

Transmission media refers to the physical medium through which data is transmitted from one device to another within a network. These media can be wired or wireless. The choice of medium depends on factors like distance, speed, and interference. A transmission media is a physical path between the transmitter and the receiver i.e. it is the channel through which data is sent from one device to another. Transmission Media is broadly classified into the following types:



1. Guided Media

Guided media is also referred to as Wired or Bounded transmission media. Signals being transmitted are directed and confined in a narrow pathway by using physical links.

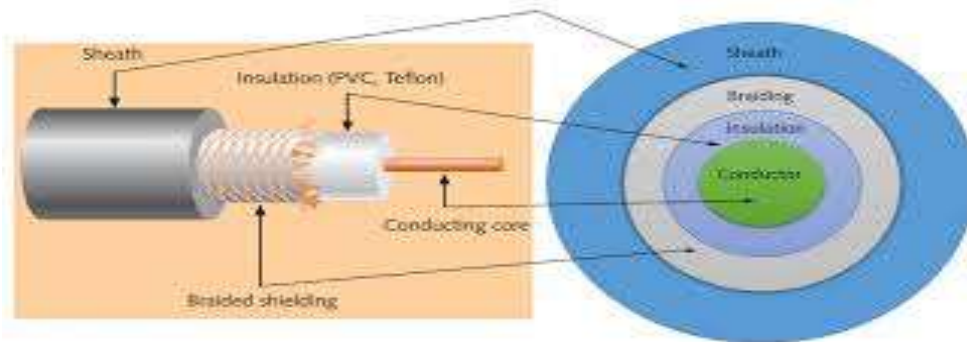
Features:

- High Speed
- Secure
- Used for comparatively shorter distances

There are 3 major types of Guided Media:

➤ **Coaxial Cable**

Coaxial cable has an outer plastic covering containing an insulation layer made of PVC or Teflon and 2 parallel conductors each having a separate insulated protection cover. The coaxial cable transmits information in two modes: Baseband mode(dedicated cable bandwidth) and Broadband mode(cable bandwidth is split into separate ranges). Cable TVs and analog television networks widely use Coaxial cables.



Advantages of Coaxial Cable

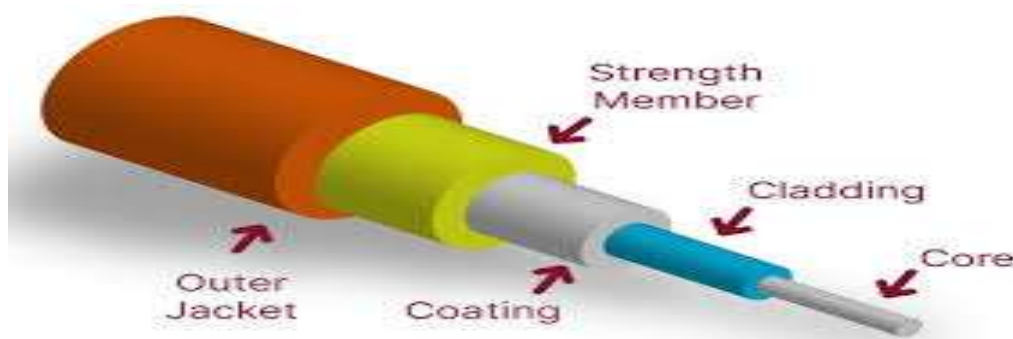
- Coaxial cables has highbandhwidth .
- It is easy to install.
- Coaxial cables are more reliable and durable.
- Less affected by noise or cross-talk or electromagnetic inference.
- Coaxial cables support multiple channels

Disadvantages of Coaxial Cable

- Coaxial cables are expensive.
- The coaxial cable must be grounded in order to prevent any crosstalk.
- As a Coaxial cable has multiple layers it is very bulky.
- There is a chance of breaking the coaxial cable and attaching a “t-joint” by hackers, this compromises the security of the data.

➤ Fiber optical Cable

Fibre optical cable uses the concept total internal reflection of light through a core made up of glass. The core is surrounded by a less dense glass or plastic covering called the coating. It is used for the transmission of large volumes of data. The cable can be unidirectional or bidirectional. The WDM supports two modes, namely unidirectional and bidirectional mode.



Advantages of Fibre optical Cable

- Increased capacity and bandwidth
- Lightweight
- Less signal attenuation
- Immunity to electromagnetic interference
- Resistance to corrosive materials

Disadvantages of Fibre optical Cable

- Difficult to install and maintain
- High cost

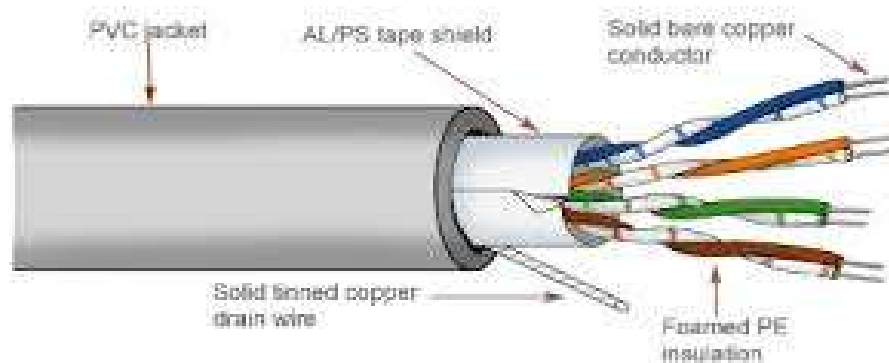
Applications of Fibre optical Cable

- **Medical Purpose:** Used in several types of medical instruments.
- **Defence Purpose:** Used in transmission of data in aerospace.
- **For Communication:** This is largely used in formation of internet cables.
- **Industrial Purpose:** Used for lighting purposes and safety measures in designing the interior and exterior of automobiles.

❖ Twisted Pair Cable

It consists of 2 separately insulated conductor wires wound about each other. Generally, several such pairs are bundled together in a protective sheath. They are the most widely used Transmission Media. twisted pair is of two types:

- **Unshielded Twisted Pair (UTP):**UTP consists of two insulated copper wires twisted around one another. This type of cable has the ability to block interference and does not depend on a physical shield for this purpose. It is used for telephonic applications.



Advantages of Unshielded Twisted Pair

- Least expensive
- Easy to install
- High-speed capacity

Disadvantages of Unshielded Twisted Pair

- Lower capacity and performance in comparison to STP
- Short distance transmission due to attenuation.
- **Shielded Twisted Pair (STP):** Shielded twisted pair cable consists of a special jacket (a copper braid covering or a foil shield) to block external interference. It is used in fast-data-rate Ethernet and in voice and data channels of telephone lines.

Advantages of Shielded Twisted Pair

- Better performance at a higher data rate in comparison to UTP
- Eliminates crosstalk
- Comparatively faster

Disadvantages of Shielded Twisted Pair

- Comparatively difficult to install and manufacture.
- More expensive.
- Bulky.

2. Unbounded/Unguided Transmission Media:

Unguided medium transport electromagnetic waves without using a physical conductor. This type of communication is often referred to as wireless communication. Signals are normally broadcast through free space and thus are available to anyone who has a device capable of receiving them.

Types of unguided Transmission media:

Radio Transmission: Its frequency is between 10Khz to 1Ghz. It is simple to install and has high attenuation. These waves are used for multicast communication.

Types of propagation:

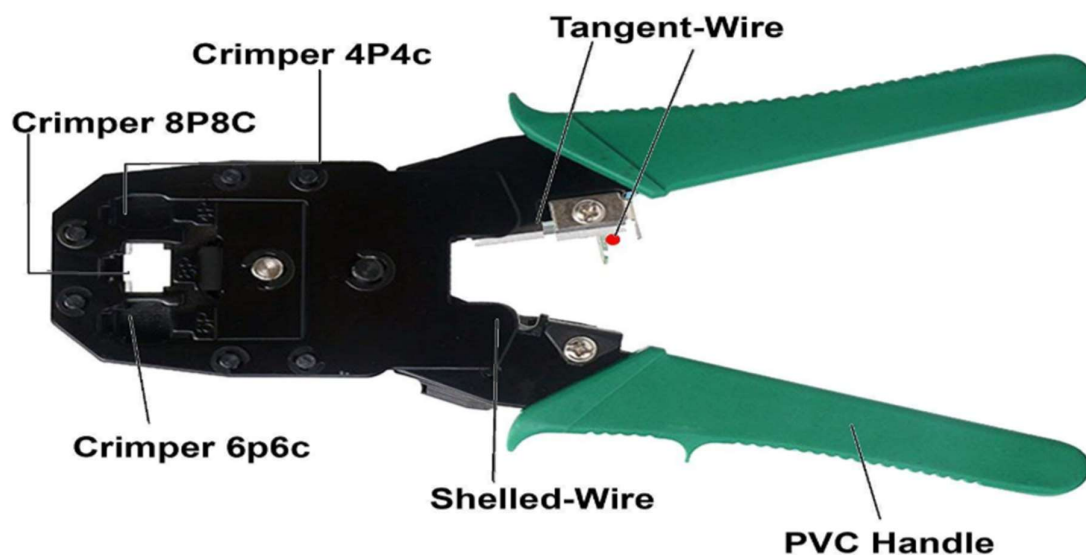
1. Troposphere
2. Ionosphere

Microwaves: It is a line of sight transmission i.e. the sending and receiving antennas need to be properly aligned with each other. The distance covered by the signal is directly proportional to the height of the antenna. Frequency Range:1GHz – 300GHz. These are majorly used for mobile phone communication and television distribution.

Infrared: Infrared waves are used for very short distance communication. They cannot penetrate throughobstacles. This prevents interference between systems. Frequency Range:300GHz – 400THz. It is used in TV remotes, wireless mouse, keyboard, printer, etc.

Crimping tool:

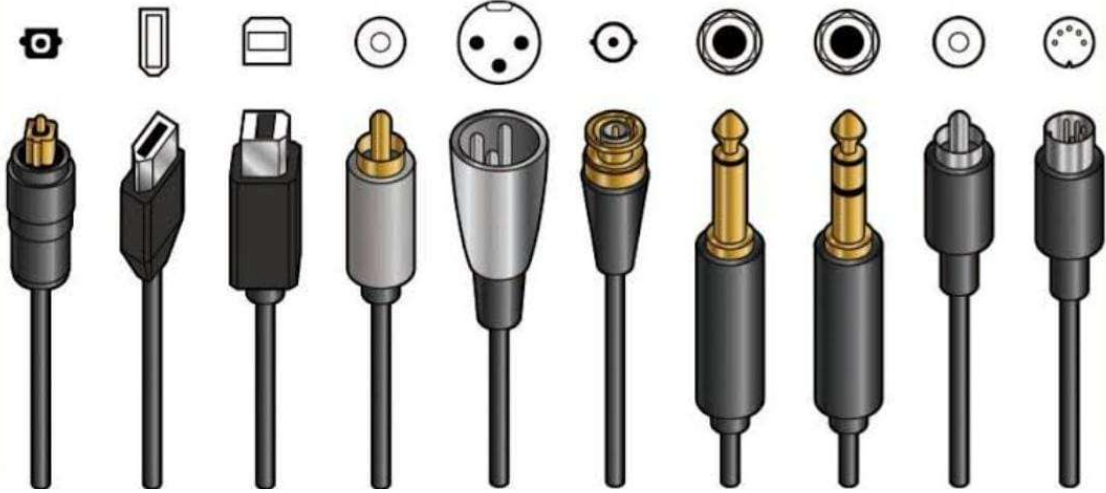
A crimping tool is a device used to conjoin two pieces of metal by deforming one or both of them to hold each other. The result of the tool's work is called a crimp. An example of crimping is affixing a connector to the end of a cable. For instance, network cables and phone cables are created using a crimping tool (shown below) to join RJ-45 and RJ-11 connectors to both ends of phone or Cat 5 cable.



Connector:

A device that terminates a segment of cabling or provides a point of entry for networking devices such as computers, hubs, and routers. Connectors can be distinguished according to their physical appearance and mating properties, such as jacks and plugs (male connectors) or sockets and ports (female connectors).

ADAT **FIRE-WIRE** **USB** **S/PDIF
RCA** **XLR** **BNC** **TS** **TRS** **RCA** **MIDI**



Practical No. 4

Aim:

Preparing the UTP cable for cross and direct connection using Crimping Tools.

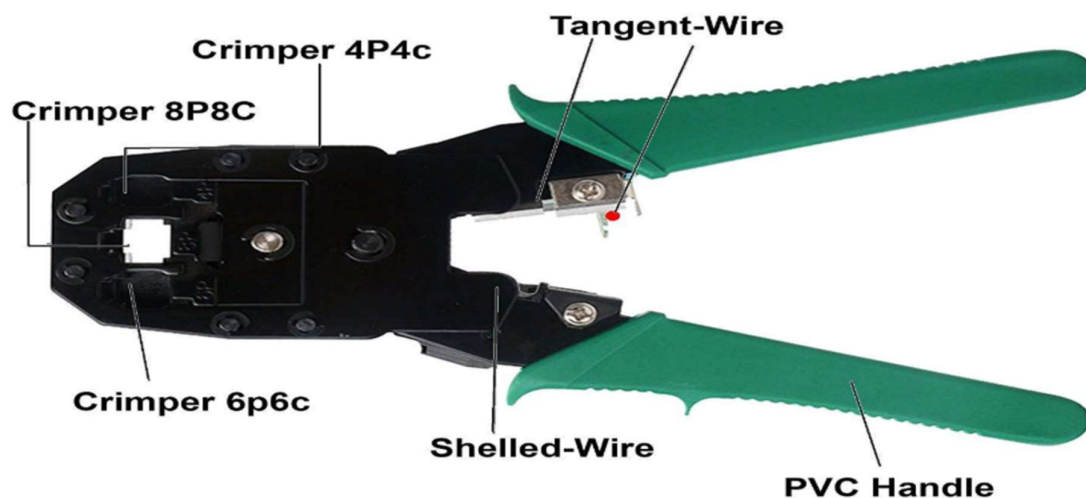
Requirements:

Crimping tools, UTP Cable, RJ-45 connector, Cable tester.

Procedure:

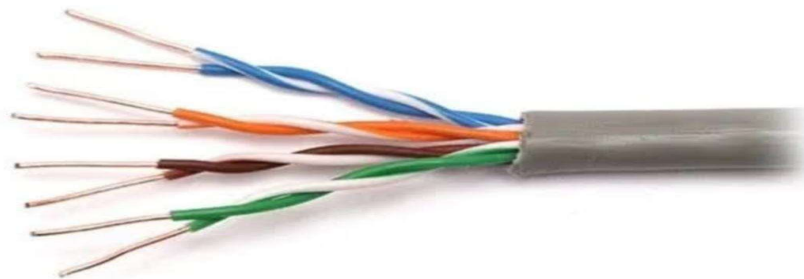
Crimping Tools:

A crimping tool is a handy device that allows you to create secure connections between wires and connectors. It works by deforming the connector onto the wire, ensuring a strong bond. With a crimping tool, you can easily join electrical wires, network cables, coaxial cables, and more. For instance, network cables and phone cables are created using a crimping tool (shown below) to join RJ-45 and RJ-11 connectors to both ends of phone or Cat 5 cable.



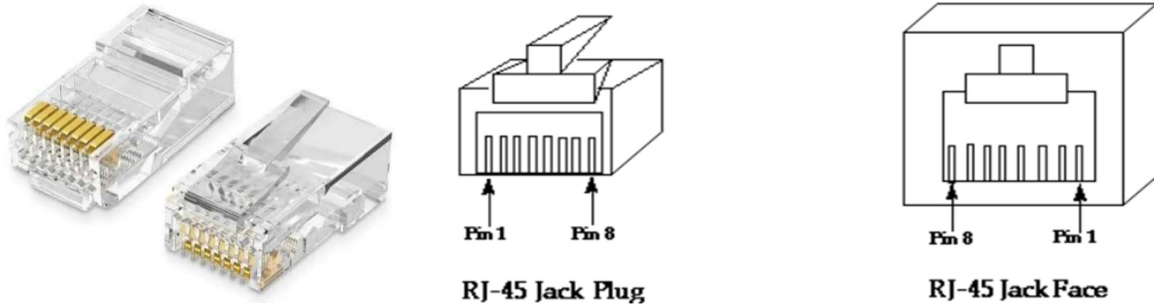
UTP Cables:

UTP stands for Unshielded Twisted Pair cable. UTP cable is a 100 ohm copper cable that consists of 2 to 1800 unshielded twisted pairs surrounded by an outer jacket. They have no metallic shield. This makes the cable small in diameter but unprotected against electrical interference. The twist helps to improve its immunity to electrical noise and EMI.



RJ-45 Connector:

An RJ45 connector is a standardized 8-position, 8-contact (8P8C) modular plug and jack commonly used for Ethernet networking, connecting devices like computers, routers, and switches to create local area networks (LANs).



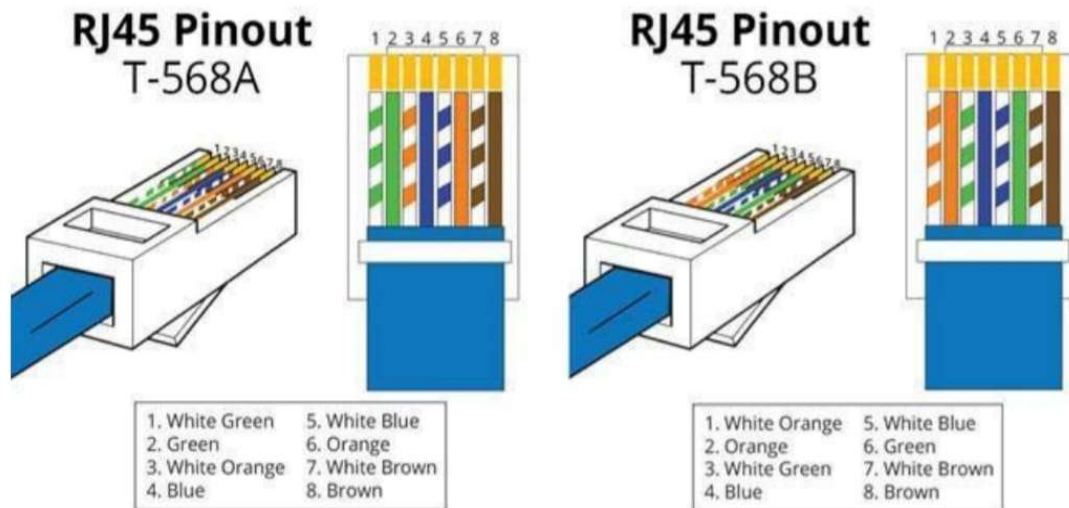
Cable tester:

A cable tester is an electronic device used to verify the electrical connections and integrity of cables, ensuring proper wiring and identifying potential issues like breaks, shorts, or miswiring. Cable testers are essential tools for network technicians, installers, and anyone working with wired systems to ensure reliable data transmission and troubleshoot connectivity problems.



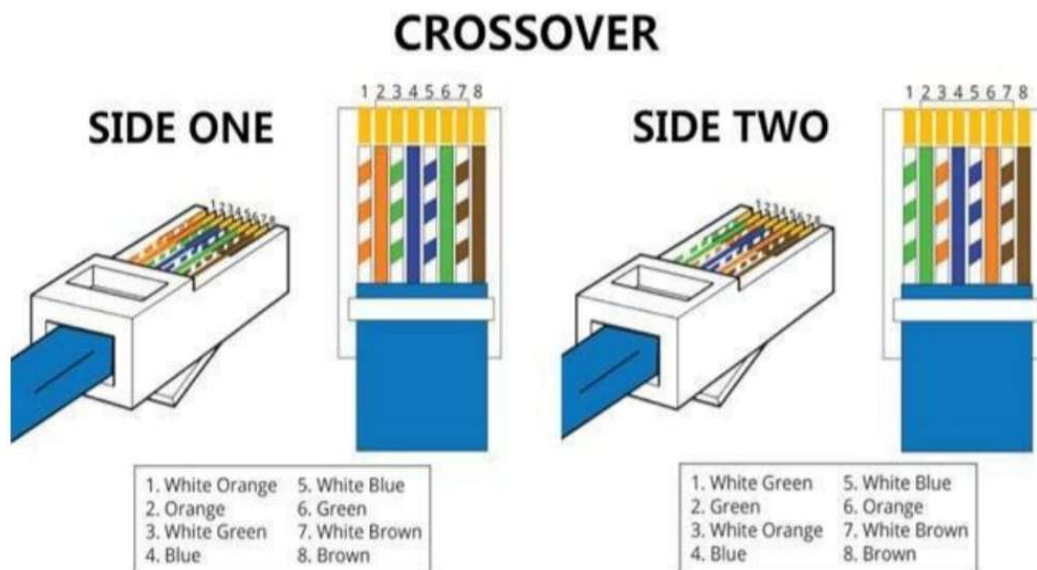
Straight cable:

A straight-through cable is a type of twisted pair cable that is used in local area networks to connect a computer to a network hub such as a router. This type of cable is also sometimes called a patch cable and is an alternative to wireless connections where one or more computers access a router through a wireless signal. On a straight-through cable, the wired pins match. Straight-through cable use one wiring standard: both ends use T568A wiring standard or both ends use T568B wiring standard. The following figure shows a straight-through cable of which both ends are wired as the T568B standard.



Cross cable:

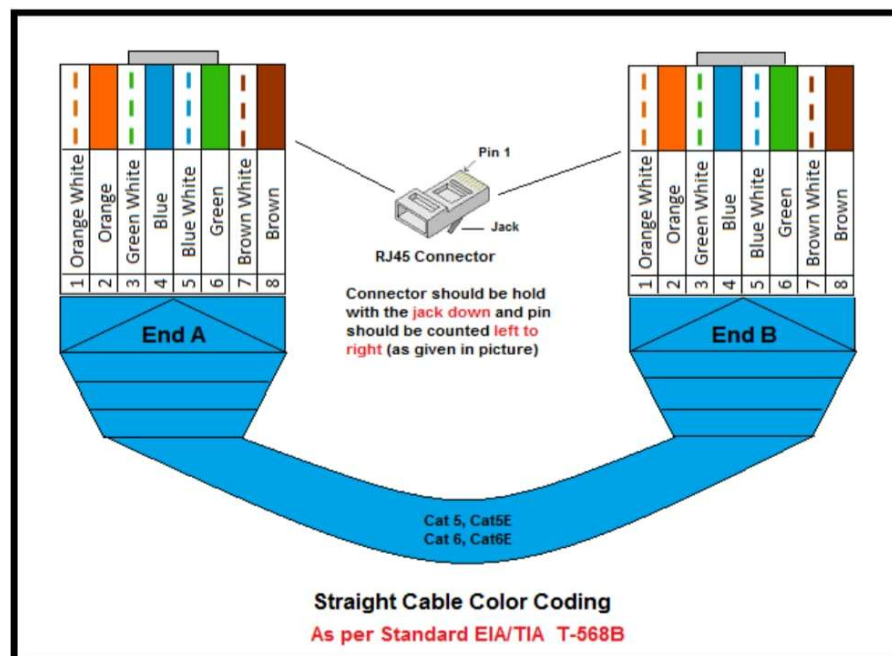
An Ethernet crossover cable is a type of Ethernet cable used to connect computing devices together directly. Unlike straight-through cable, crossover cables use two different wiring standards: one end uses the T568A wiring standard, and the other end uses the T568B wiring standard. The internal wiring of Ethernet crossover cables reverses the transmit and receive signals. It is most often used to connect two devices of the same type: e.g. two computers (via network interface controller) or two switches to each other.



Making Straight UTP Cable:

- Peel the end of the UTP cable , approximately 2 cm.
- Open the cable strands , align and follow the arrangement as standard cable image shown below .
- Once the order is according to the standard , cut and flatten the ends of the cable,
- Put the cable is straight and aligned into the RJ - 45 connector , and make sure all cables are in correct position as follows:

1. Orange White
2. Orange
3. Green White
4. Blue
5. Blue White
6. Green
7. White Brown
8. Brown



- Make crimping using crimp tools , press crimping tool and make sure all the pins (brass) on the RJ - 45 connector has " bite " of each cable . usually when done will sound "click ". Once finished at the end of this one , do it again at the other end cable. The final step is to check the cable that you created earlier using the LAN tester , enter each end of the cable (RJ- 45) to each LAN port available on the tester , turn and make sure all of the LEDs light up according to the order of the wires we created.

Creating Cross UTP Cable:-

Creating a cross cable has almost the same steps with straight cable , the difference lies only in the colour sequence from both ends of the cable . Unlike the straight cable that has the same colour sequence at both ends of the cable , the cross cable has a different colour sequences at both ends of the cable.

The first ends is same with straight cable :

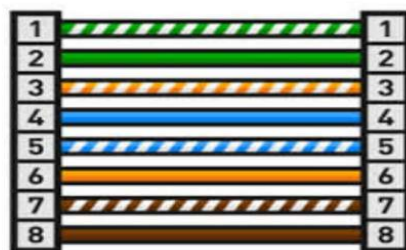
1. Orange White
2. Orange
3. Green White
4. Blue
5. Blue White
6. Green
7. White chocolate
8. Brown

For the second end of the cable, the colour composition is different from the first . The colour arrangement is as follows

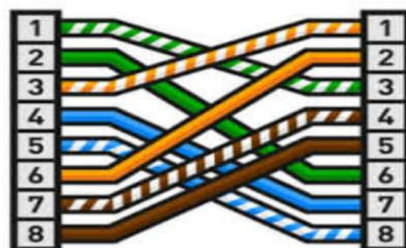
1. Green White
2. Green
3. Orange White
4. Blue
5. Blue White
6. Orange
7. White chocolate
8. Brown



Ethernet Patch Cable



Ethernet Crossover Cable



Practical No. 5

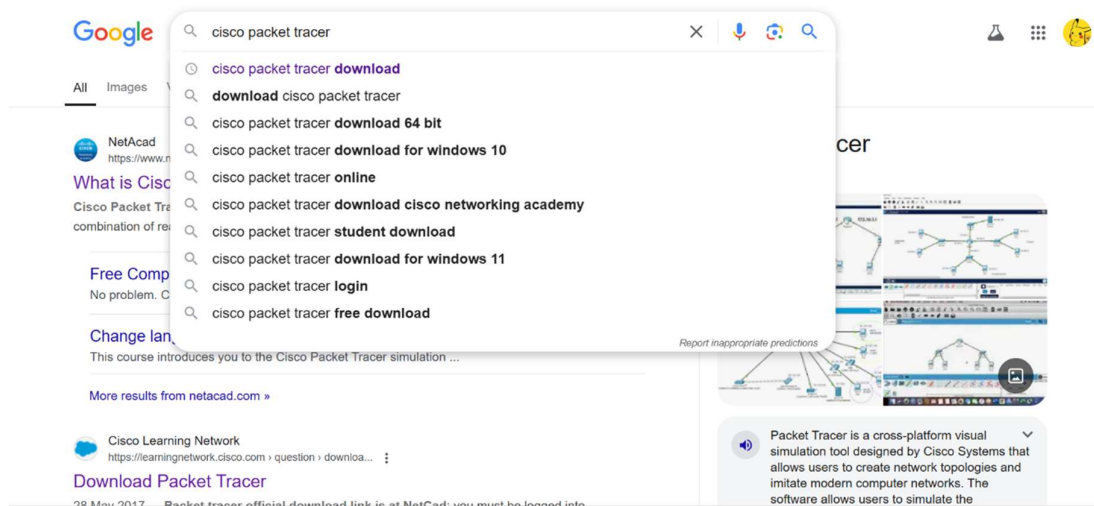
Aim :- Installation and Introduction of simulation tools packet tracer/ GNS3.

❖ GNS3 (Graphical Network Simulator -3) :

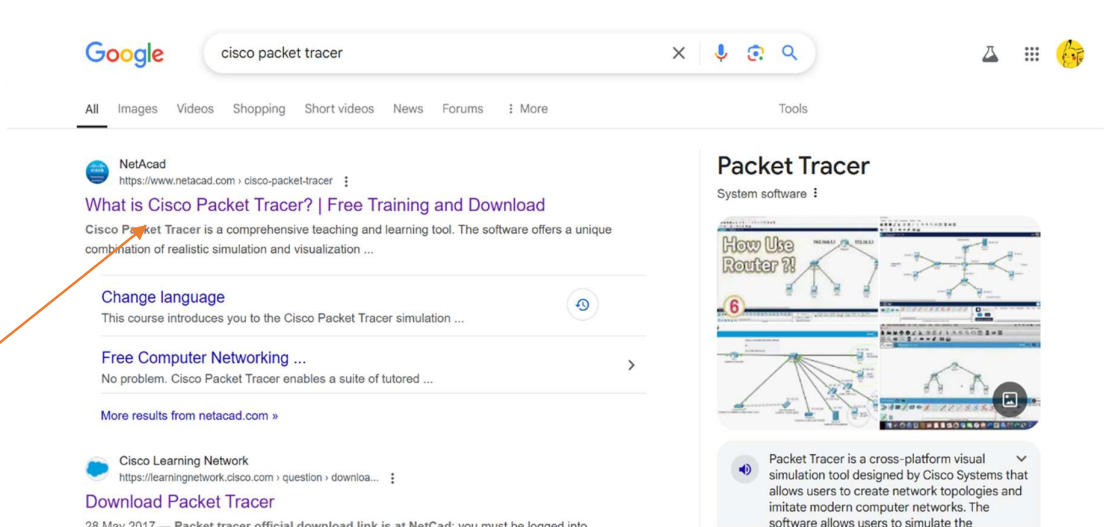
GNS3 (Graphical Network Simulator-3) is a free and open-source network emulation software that allows users to simulate and test complex network topologies in a virtual environment, without requiring physical hardware. GNS3 enables network engineers and students to build, design, and test networks of various sizes, from small labs to complex deployments, all within a virtualized environment.

Installation of Packet Tracer:

Step 1 : First search “ cisco packet tracer ” in browser.



Step 2 : Now click on the website <https://www.netacad.com/courses/packet-tracer> .



Step 3 : After clicking on this link now slide down and then we find page as shown in below and the we click on learn more option.

netacad.com/cisco-packet-tracer

Google Chrome isn't your default browser [Set as default](#)

NetAcad Legacy NetAcad

Downtime Schedule - March 2025
- Friday, 28 March 2025 at 5:30 p.m. to 8:30 p.m. PST (UTC-7)...

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You'll be able to start classes as soon as you sign up.

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State: Select state

Year of Birth: Select year

Month of Birth: Select month

Step 5 : After signing up we need to accept the terms & conditions .

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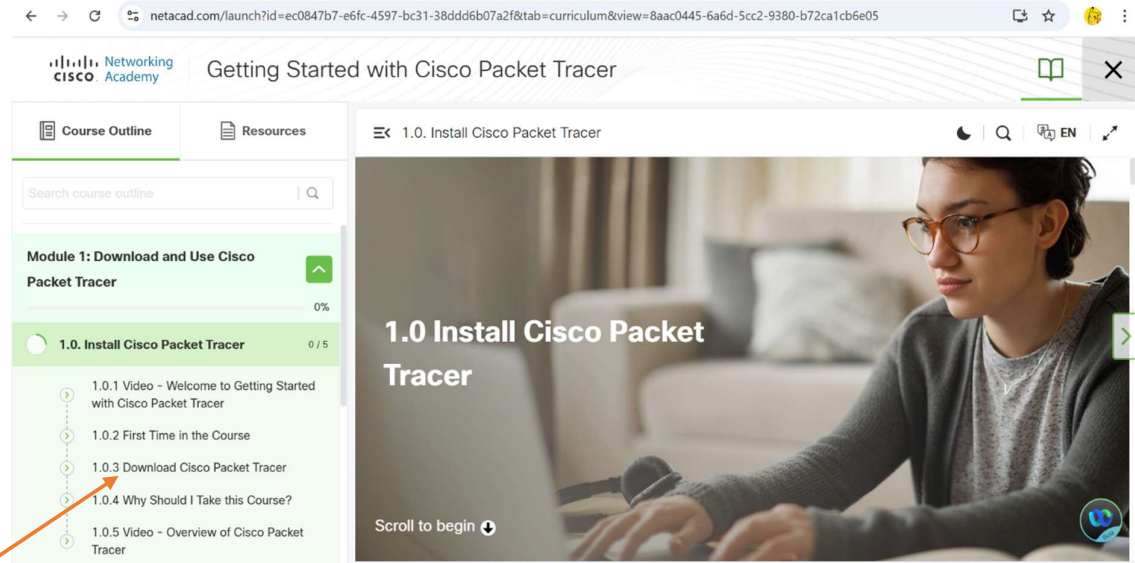
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I would like to receive communications and updates about the program, including information about functionality and learning offerings from Cisco Networking Academy. I understand I can unsubscribe at any time.

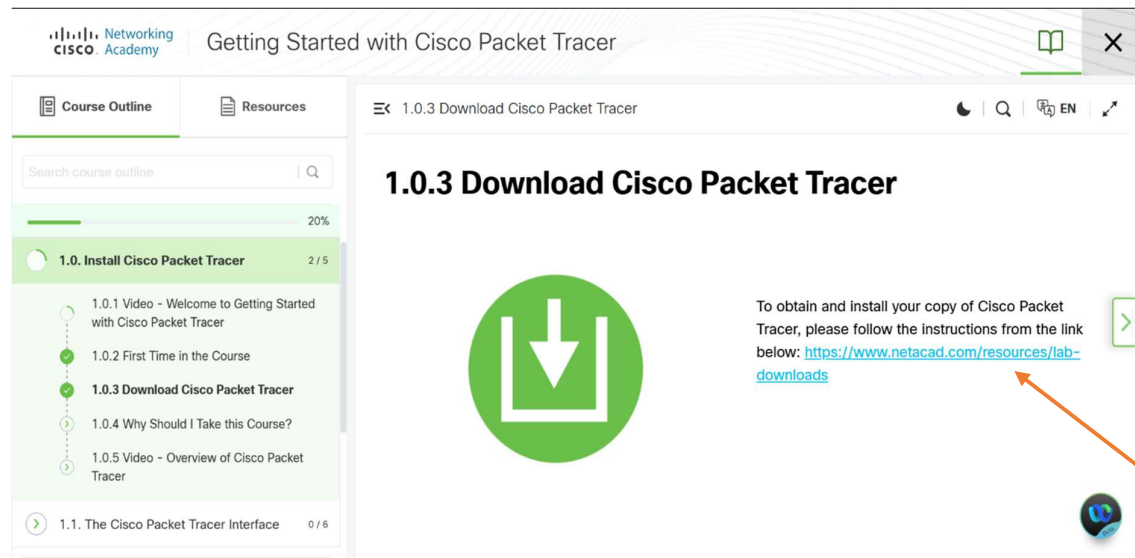
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Accept & Continue Cancel

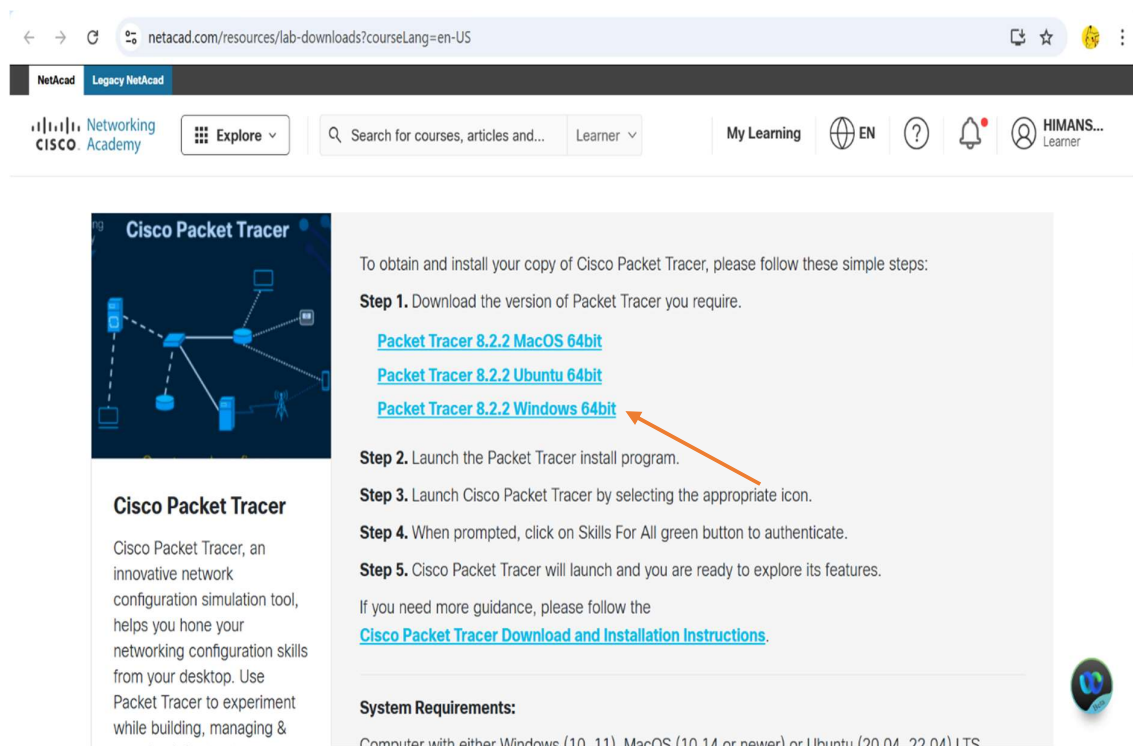
Step 6: After accepting the terms & conditions we automatically come on course interface then click on “Download cisco packet tracer”.



Step 7: Click on the shown link below.



Step 8: Now see the below options and download the required version according to your laptop.



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To obtain and install your copy of Cisco Packet Tracer, please follow these simple steps:

Step 1. Download the version of Packet Tracer you require.

- [Packet Tracer 8.2.2 MacOS 64bit](#)
- [Packet Tracer 8.2.2 Ubuntu 64bit](#)
- [Packet Tracer 8.2.2 Windows 64bit](#)

Step 2. Launch the Packet Tracer install program.

Step 3. Launch Cisco Packet Tracer by selecting the appropriate icon.

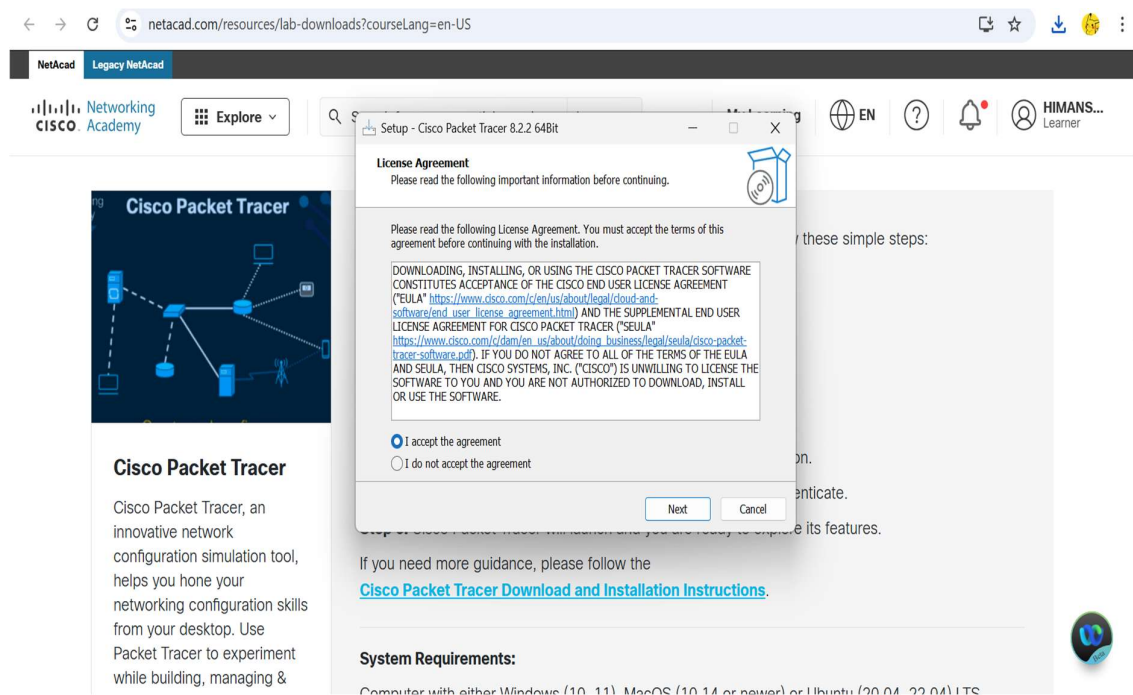
Step 4. When prompted, click on Skills For All green button to authenticate.

Step 5. Cisco Packet Tracer will launch and you are ready to explore its features.

If you need more guidance, please follow the [Cisco Packet Tracer Download and Installation Instructions](#).

System Requirements:
Computer with either Windows (10, 11), MacOS (10.14 or newer) or Ubuntu (20.04, 22.04) LTS

Step 9: Accept the agreement .



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Cisco Packet Tracer

Cisco Packet Tracer, an innovative network configuration simulation tool, helps you hone your networking configuration skills from your desktop. Use Packet Tracer to experiment while building, managing &

To obtain and install your copy of Cisco Packet Tracer, please follow these simple steps:

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- [Packet Tracer 8.2.2 MacOS 64bit](#)
- [Packet Tracer 8.2.2 Ubuntu 64bit](#)
- [Packet Tracer 8.2.2 Windows 64bit](#)

Step 2. Launch the Packet Tracer install program.

Step 3. Launch Cisco Packet Tracer by selecting the appropriate icon.

Step 4. When prompted, click on Skills For All green button to authenticate.

Step 5. Cisco Packet Tracer will launch and you are ready to explore its features.

If you need more guidance, please follow the [Cisco Packet Tracer Download and Installation Instructions](#).

System Requirements:
Computer with either Windows (10, 11), MacOS (10.14 or newer) or Ubuntu (20.04, 22.04) LTS

Setup - Cisco Packet Tracer 8.2.2 64Bit

License Agreement
Please read the following important information before continuing.

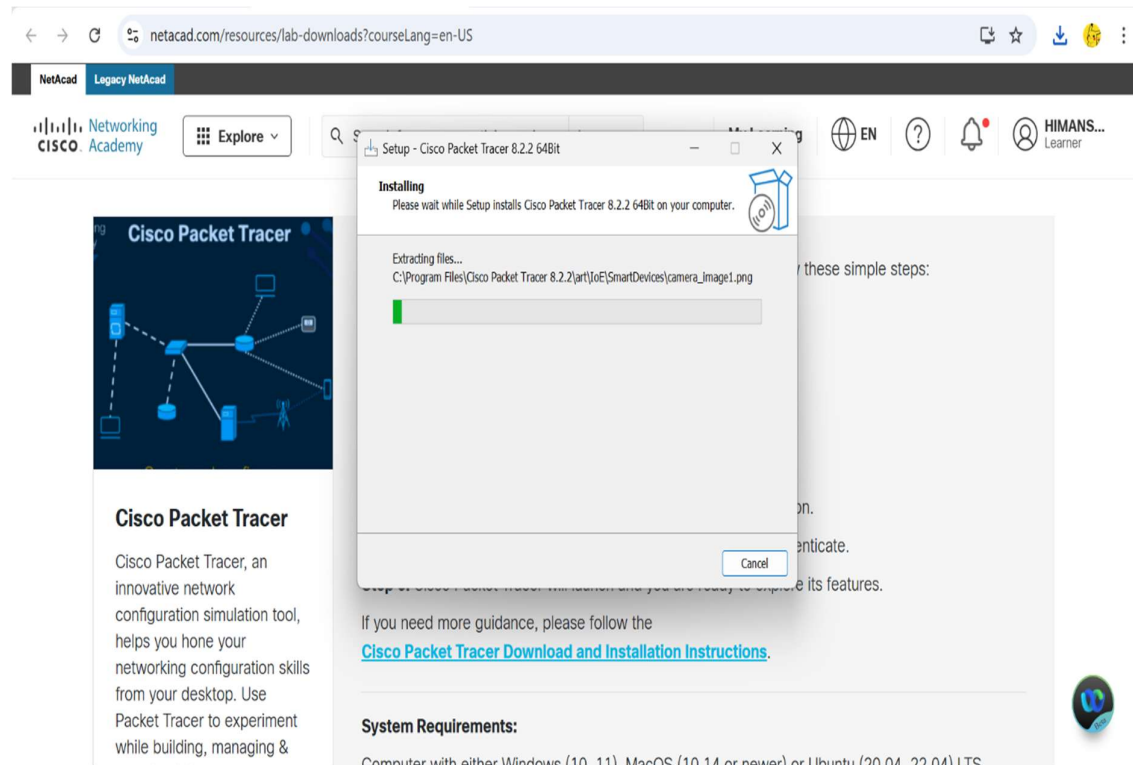
Please read the following License Agreement. You must accept the terms of this agreement before continuing with the installation.

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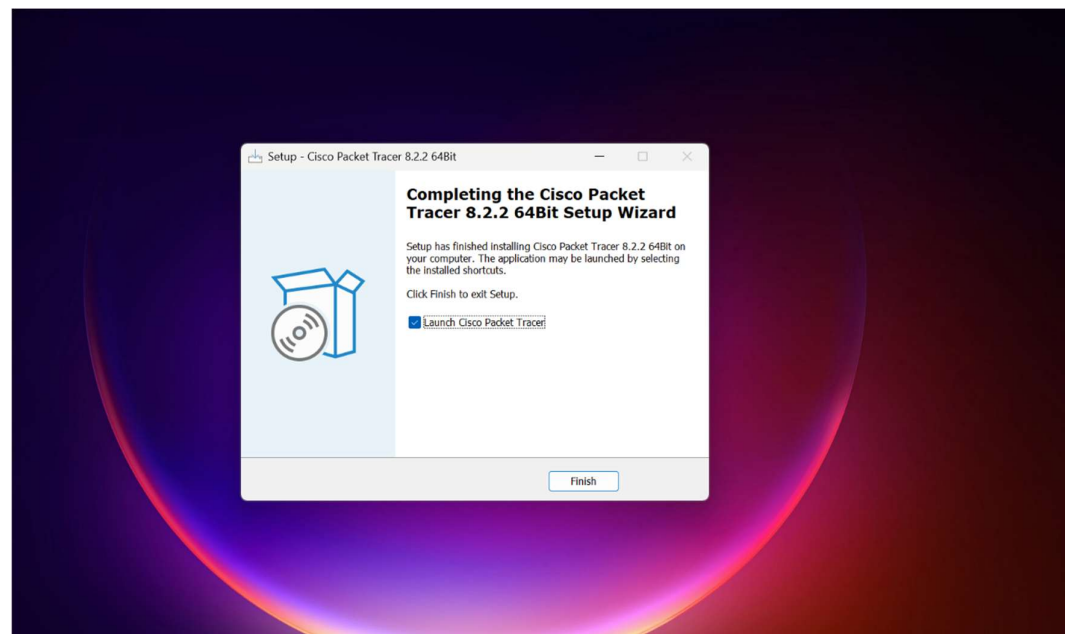
I accept the agreement
 I do not accept the agreement

Next Cancel

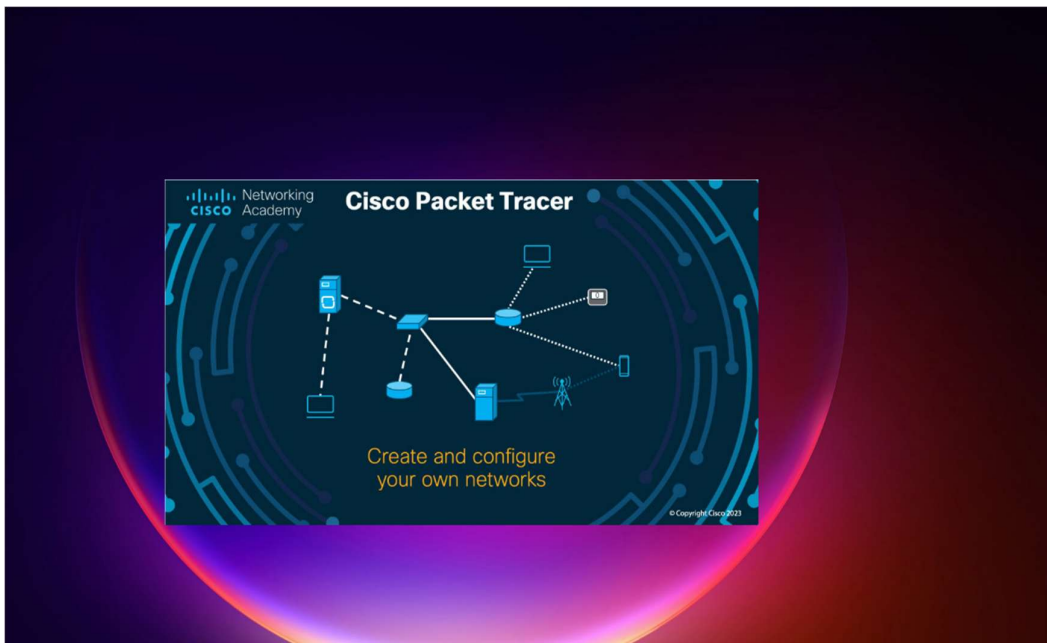
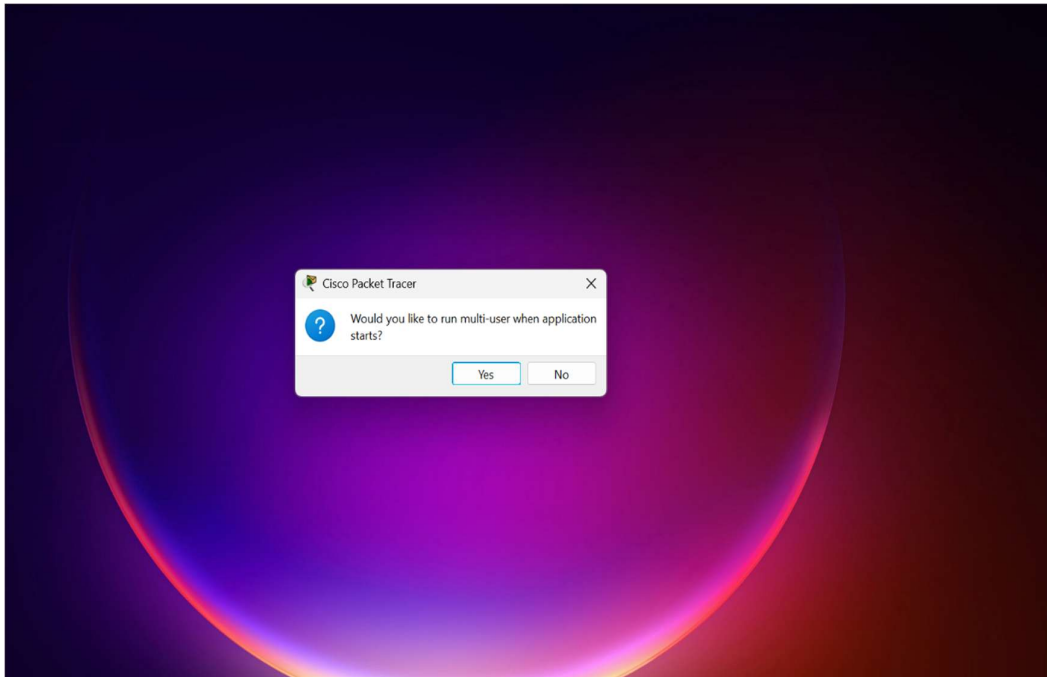
Step 10: After accepting the agreement the download process will start automatically.



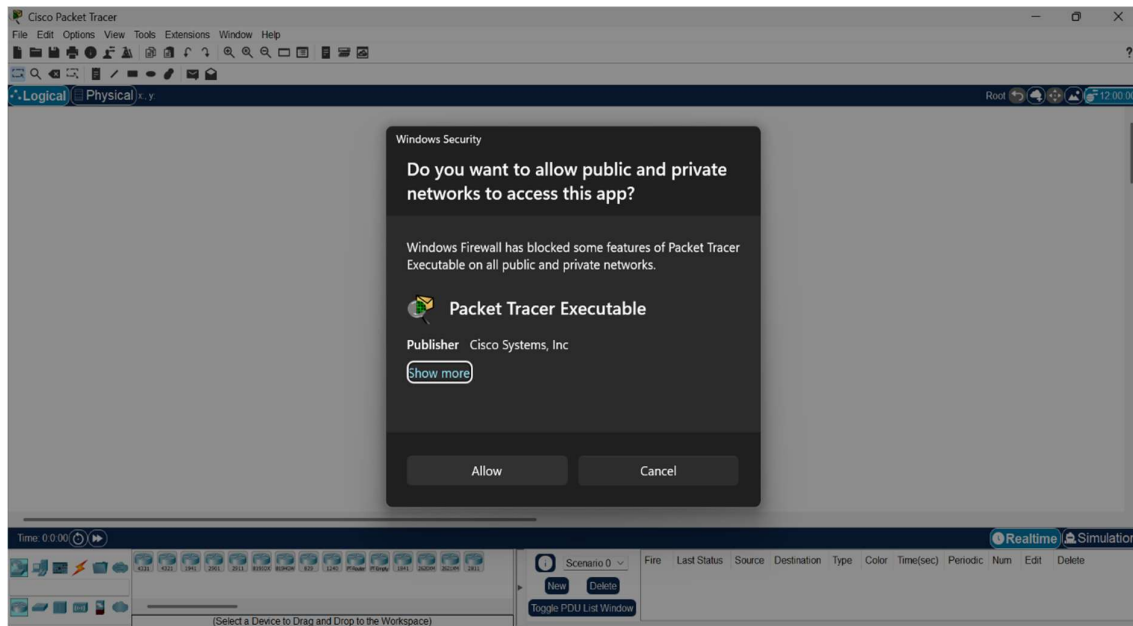
Step 11: Now click on“finish”option.



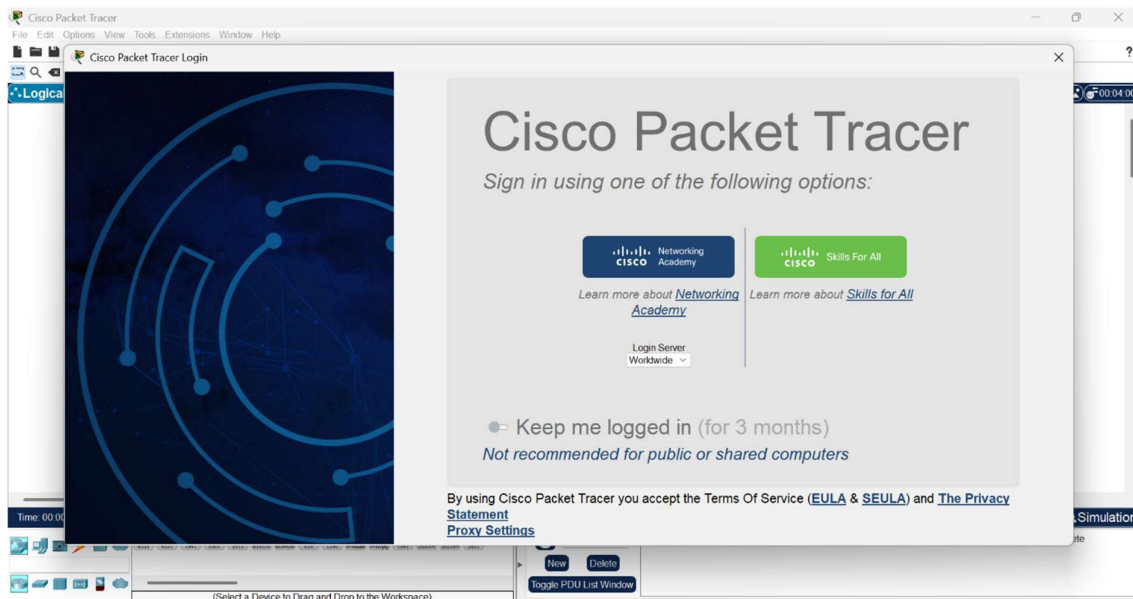
Step 12: Now click on “yes” option.



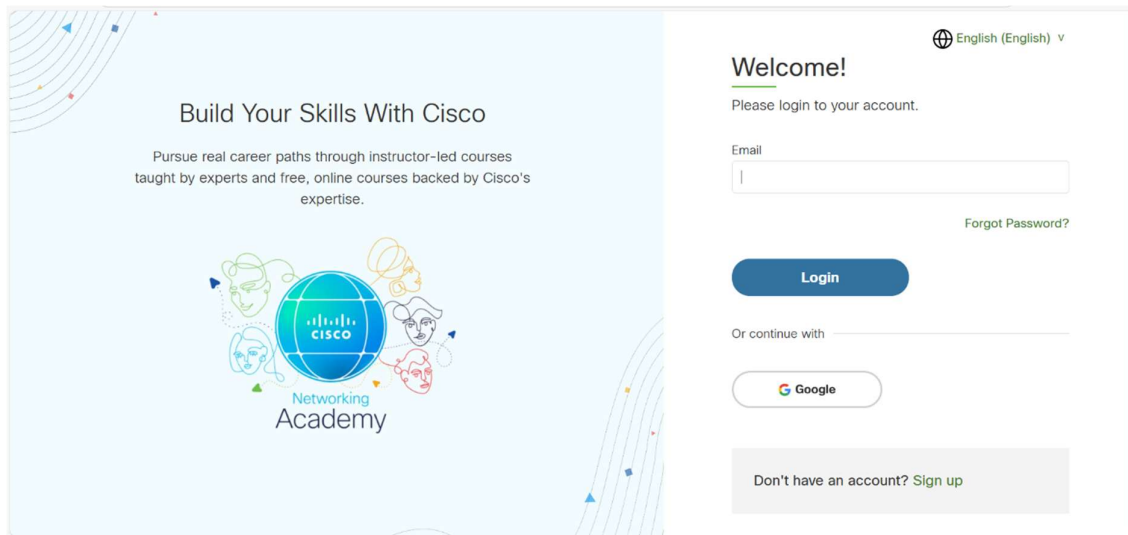
Step 13: Now click on “yes” option.



Step 14: Now select the “Skills for all” option to get start with the cisco packet tracer.



Step 15: To start working with cisco packet tracer we need to login in account.



Step 16: Here we can see we have successfully downloaded the cisco packet tracer.



Practical No. 6

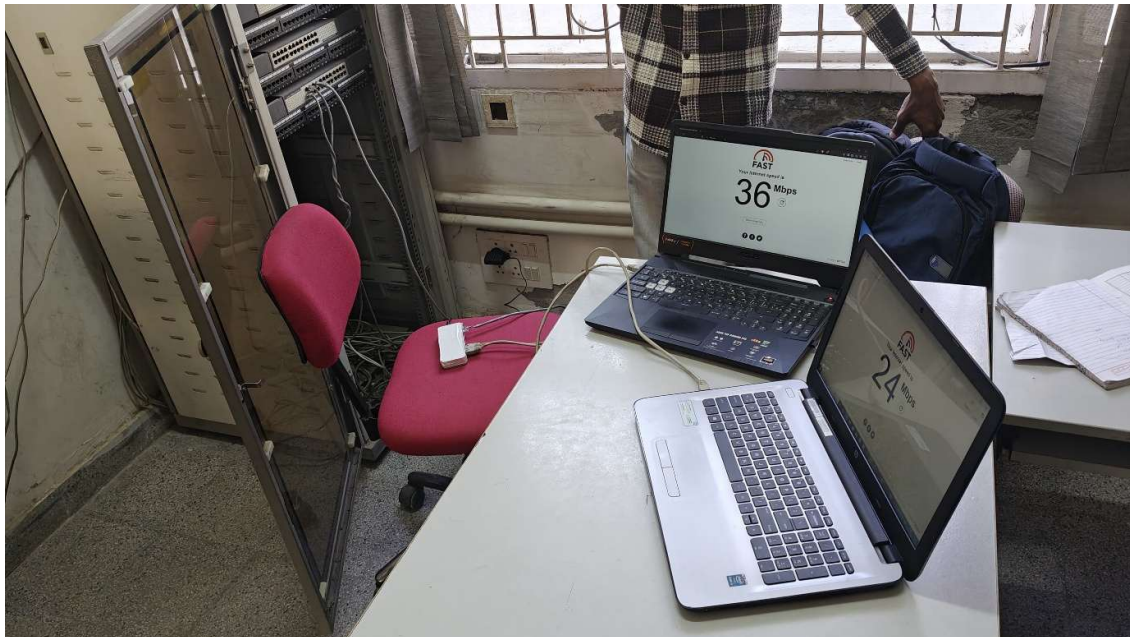
Aim:- Study of various LAN topologies and their creation using network devices, cables and Computer.

Topology:-

Topology is derived from two Greek words topo and logy, where topo means 'place' and logy means 'study'. Network topology describes the physical and logical structure of a computer network. It shows how devices and nodes are connected, and how data flows between them.

There are two major categories of Network Topology:

1. Physical Network topology - Physical Network Topology refers to the actual structure of the physical medium for the transmission of data.



2. Logical Network Topology- Logical network Topology refers to the transmission of data between devices present in the network irrespective of the way devices are connected. The structure of the network is important for the proper functioning of the network.

Network topology defines the layout, virtual shape, or structure of the network, not only physically but also logically. A network can have one physical topology and multiple logical topologies at the same time.

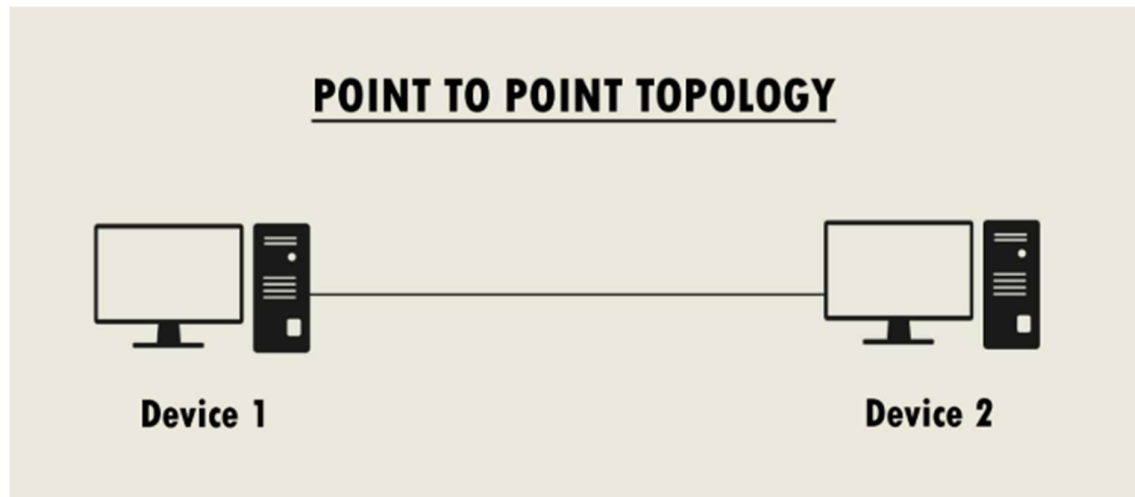
Types of Network Topology:-

Below mentioned are the types of Network Topology

- Point to point topology
- Bus topology
- Star topology
- Ring topology
- Tree topology
- Mesh topology
- Hybrid topology

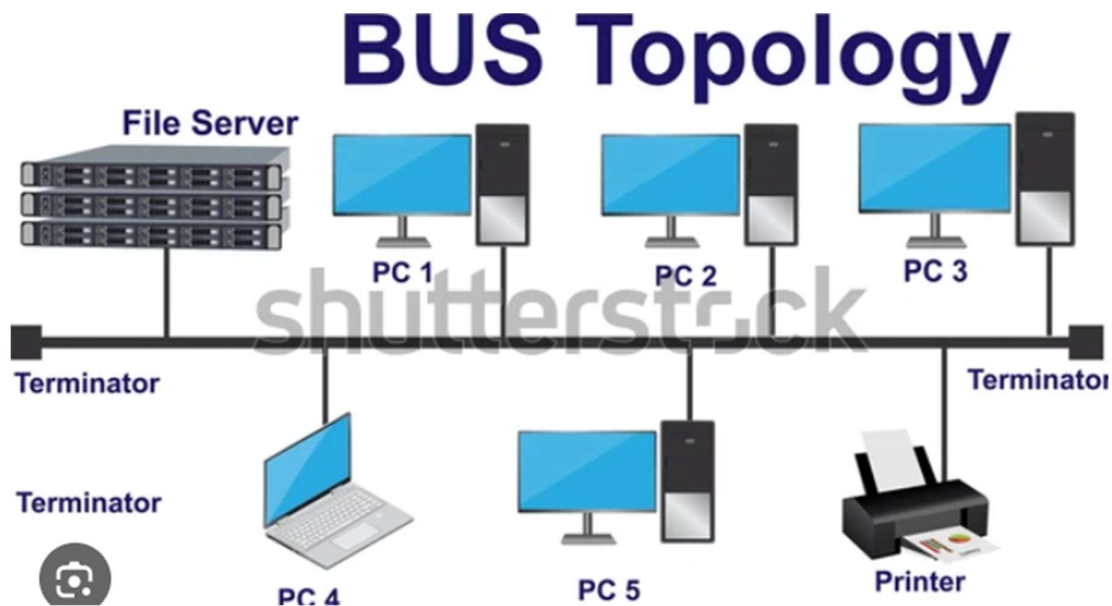
- **Point to Point Topology-**

Point-to-point topology is a type of topology that works on the functionality of the sender and receiver. It is the simplest communication between two nodes, in which one is the sender and the other one is the receiver. Point-to-Point provides high bandwidth.



- **Bus topology-**

Bus Topology is a network type in which every computer and network device is connected to a single cable. It is bi-directional. It is a multi-point connection and a non-robust topology because if the backbone fails the topology crashes. In Bus Topology, various MAC(Media Access Control) protocols are followed by LAN ethernet connections like TDMA, Pure Aloha, CDMA, Slotted Aloha, etc.



Advantages of Bus Topology

- If N devices are connected to each other in a bus topology, then the number of cables required to connect them is 1, known as backbone cable, and N drop lines are required.
- Coaxial or twisted pair cables are mainly used in bus-based networks that support up to 10 Mbps.
- The cost of the cable is less compared to other topologies, but it is used to build small networks.

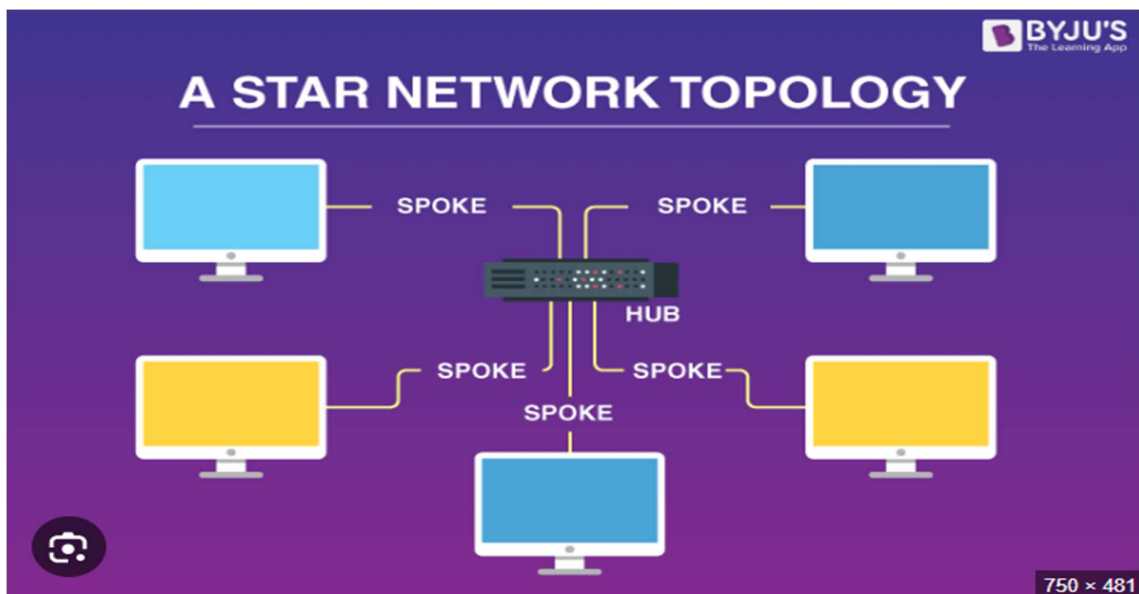
- Bus topology is familiar technology as installation and troubleshooting techniques are well known.
- CSMA is the most common method for this type of topology.

Disadvantages of Bus Topology

- A bus topology is quite simpler, but still, it requires a lot of cabling.
- If the common cable fails, then the whole system will crash down.
- If the network traffic is heavy, it increases collisions in the network. To avoid this, various protocols are used in the MAC layer known as Pure Aloha, Slotted Aloha, CSMA/CD, etc.
- Adding new devices to the network would slow down networks.
- Security is very low.

A common example of bus topology is the Ethernet LAN, where all devices are connected to a single coaxial cable or twisted pair cable. This topology is also used in cable television networks.

- **Star topology-**



In Star Topology, all the devices are connected to a single hub through a cable. This hub is the central node and all other nodes are connected to the central node. The hub can be passive in nature i.e., not an intelligent hub such as broadcasting devices, at the same time the hub can be intelligent known as an active hub. Active hubs have repeaters in them. Coaxial cables or RJ-45 cables are used to connect the computers. In Star Topology, many popular ethernet LAN protocols are used as CD(Collision Detection), CSMA(Carrier Sense Multiple Access), etc.

Advantages of Star Topology

- If N devices are connected to each other in a star topology, then the number of cables required to connect them is N. So, it is easy to set up.
- Each device requires only 1 port i.e. to connect to the hub, therefore the total number of ports required is N.
- It is Robust. If one link fails only that link will affect and not other than that.
- Easy to fault identification and fault isolation.

- Star topology is cost-effective as it uses inexpensive coaxial cable.

Disadvantages of Star Topology

- If the concentrator (hub) on which the whole topology relies fails, the whole system will crash down.
- The cost of installation is high.
- Performance is based on the single concentrator i.e. hub.

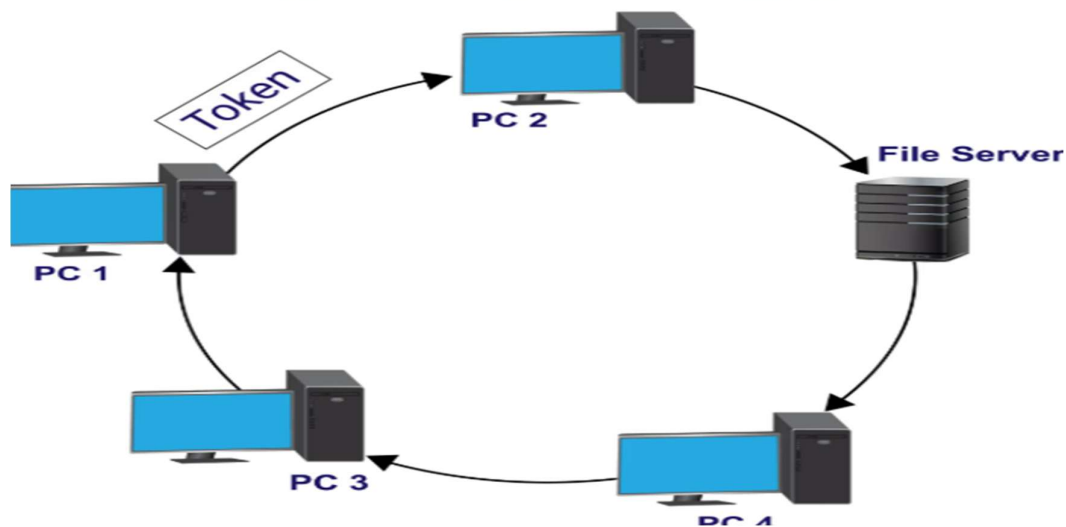
A common example of star topology is a **local area network (LAN)** in an office where all computers are connected to a central hub. This topology is also used in wireless networks where all devices are connected to a wireless access point.

- **Ring topology-**

In a Ring Topology, it forms a ring connecting devices with exactly two neighboring devices. A number of repeaters are used for Ring topology with a large number of nodes, because if someone wants to send some data to the last node in the ring topology with 100 nodes, then the data will have to pass through 99 nodes to reach the 100th node. Hence to prevent data loss repeaters are used in the network.

The data flows in one direction, i.e. it is unidirectional, but it can be made bidirectional by having 2 connections between each Network Node, it is called Dual Ring Topology. In-Ring Topology, the Token Ring Passing protocol is used by the workstations to transmit the data.

Ring Topology



The most common access method of ring topology is token passing.

- **Token passing:** It is a network access method in which a token is passed from one node to another node.
- **Token:** It is a frame that circulates around the network.

Operations of Ring Topology

- One station is known as a monitor station which takes all the responsibility for performing the operations.
- To transmit the data, the station has to hold the token. After the transmission is done, the token is to be released for other stations to use.

- When no station is transmitting the data, then the token will circulate in the ring.
- There are two types of token release techniques: Early token release releases the token just after transmitting the data and Delayed token release releases the token after the acknowledgment is received from the receiver.

Advantages of Ring Topology

- The data transmission is high-speed.
- The possibility of collision is minimum in this type of topology.
- Cheap to install and expand.
- It is less costly than a star topology.

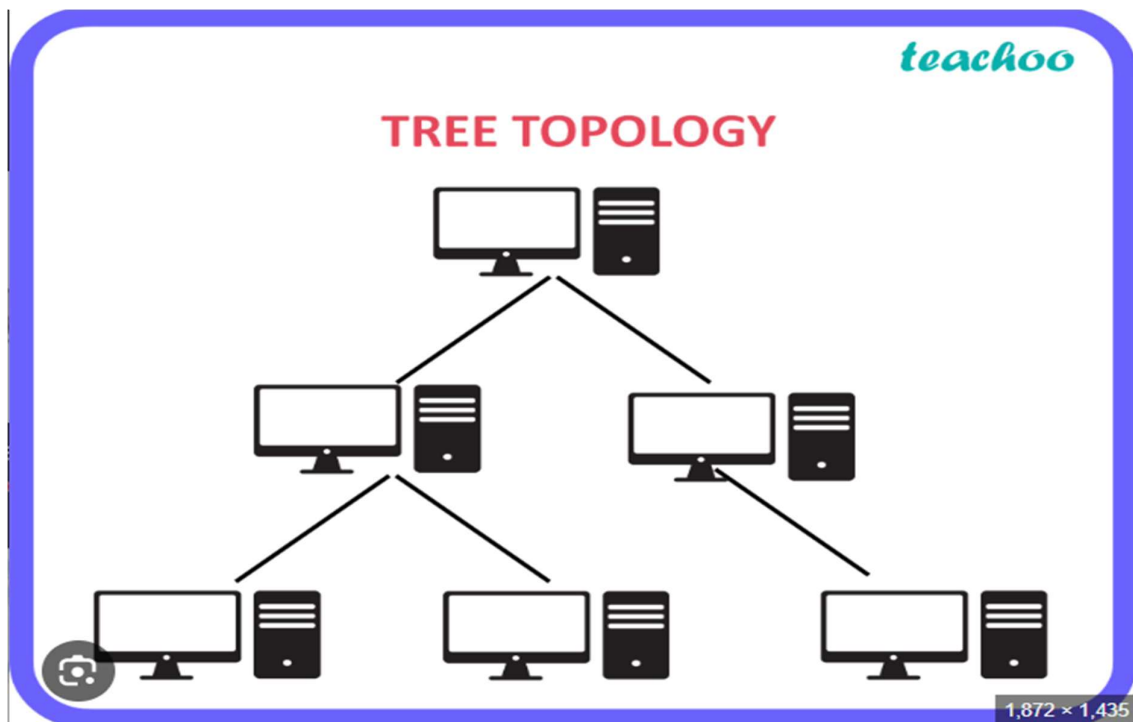
Disadvantages of Ring Topology

- The failure of a single node in the network can cause the entire network to fail.
- Troubleshooting is difficult in this topology.
- The addition of stations in between or the removal of stations can disturb the whole topology.
- Less secure.
- **Tree topology**

Tree topology is the variation of the Star topology. This topology has a hierarchical flow of data. In tree Topology, protocols like DHCP and SAC (**Standard Automatic Configuration**) are used. In tree topology, the various secondary hubs are connected to the central hub which contains the repeater. This data flow from top to bottom i.e. from the central hub to the secondary and then to the devices or from bottom to top i.e. devices to the secondary hub and then to the central hub. It is a multi point connection and a non-robust topology because if the backbone fails the topology crashes.

Advantages of Tree Topology

- It allows more devices to be attached to a single central hub thus it decreases the distance that is traveled by the signal to come to the devices.
- It allows the network to get isolated and also prioritize from different computers.
- We can add new devices to the existing network.
- Error detection and error correction are very easy in a tree topology.



Disadvantages of Tree Topology

- If the central hub gets fails the entire system fails.
- The cost is high because of the cabling.
- If new devices are added, it becomes difficult to reconfigure.

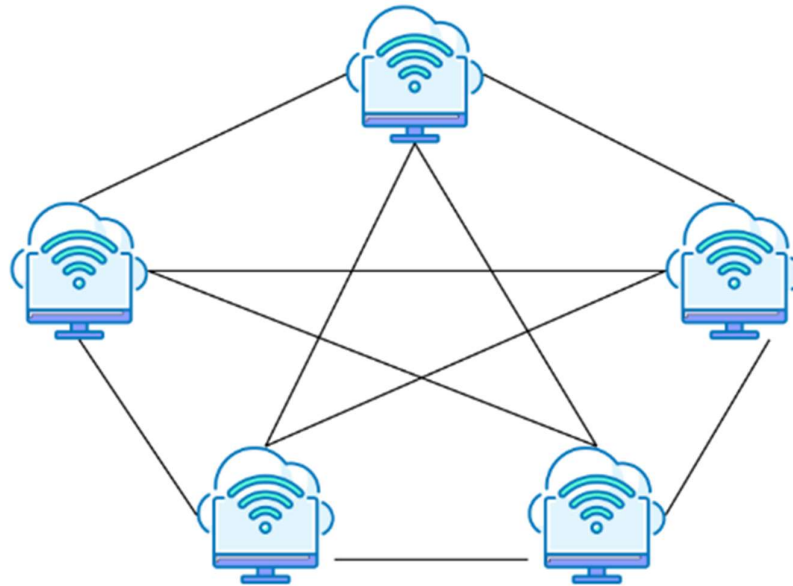
A common example of a tree topology is the hierarchy in a large organization. At the top of the tree is the CEO, who is connected to the different departments or divisions (child nodes) of the company. Each department has its own hierarchy, with managers overseeing different teams (grandchild nodes). The team members (leaf nodes) are at the bottom of the hierarchy, connected to their respective managers and departments.

- **Mesh topology-**

In a mesh topology, every device is connected to another device via a particular channel. Every device is connected to another via dedicated channels. These channels are known as links. In Mesh Topology, the protocols used are AHCP (Ad Hoc Configuration Protocols), DHCP (Dynamic Host Configuration Protocol), etc.

- Suppose, the N number of devices are connected with each other in a mesh topology, the total number of ports that are required by each device is $N-1$. In Figure 1, there are 5 devices connected to each other, hence the total number of ports required by each device is 4. The total number of ports required = $N * (N-1)$.
- Suppose, N number of devices are connected with each other in a mesh topology, then the total number of dedicated links required to connect them is $N C 2$ i.e. $N(N-1)/2$. In Figure 1, there are 5 devices connected to each other, hence the total number of links required is $5*4/2 = 10$.

Mesh network topology



Advantages of Mesh Topology

- Communication is very fast between the nodes.
- Mesh Topology is robust.
- The fault is diagnosed easily. Data is reliable because data is transferred among the devices through dedicated channels or links.
- Provides security and privacy.

Disadvantages of Mesh Topology

- Installation and configuration are difficult.
- The cost of cables is high as bulk wiring is required, hence suitable for less number of devices.
- The cost of maintenance is high.

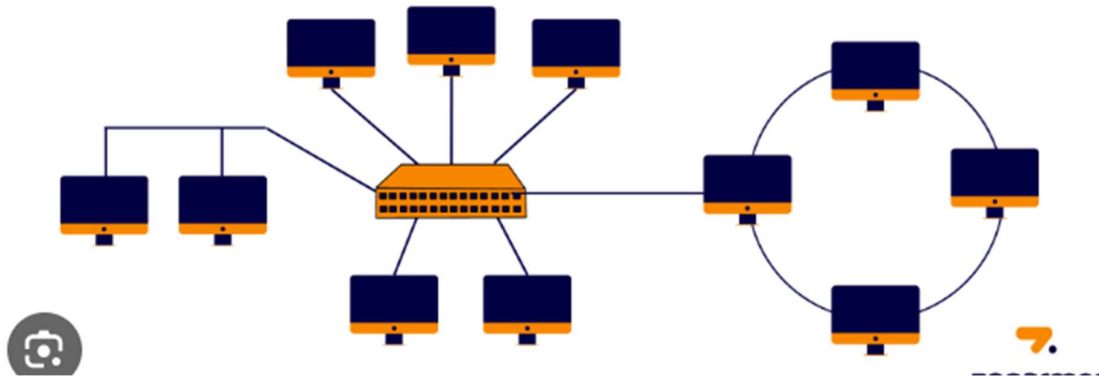
A common example of mesh topology is the internet backbone, where various internet service providers are connected to each other via dedicated channels. This topology is also used in military communication systems and aircraft navigation systems.

- **Hybrid topology-**

Hybrid Topology is the combination of all the various types of topologies we have studied above. Hybrid Topology is used when the nodes are free to take any form. It means these can be individuals such as Ring or Star topology or can be a combination of various types of topologies seen above. Each individual topology uses the protocol that has been discussed earlier.

HYBRID NETWORK TOPOLOGY

A hybrid topology is a type of network topology that combines two or more network topologies, including ring, bus, and mesh topologies



Advantages of Hybrid Topology

- This topology is very flexible .
- The size of the network can be easily expanded by adding new devices.

Disadvantages of Hybrid Topology

- It is challenging to design the architecture of the Hybrid Network.
- Hubs used in this topology are very expensive.
- The infrastructure cost is very high as a hybrid network requires a lot of cabling and network devices .

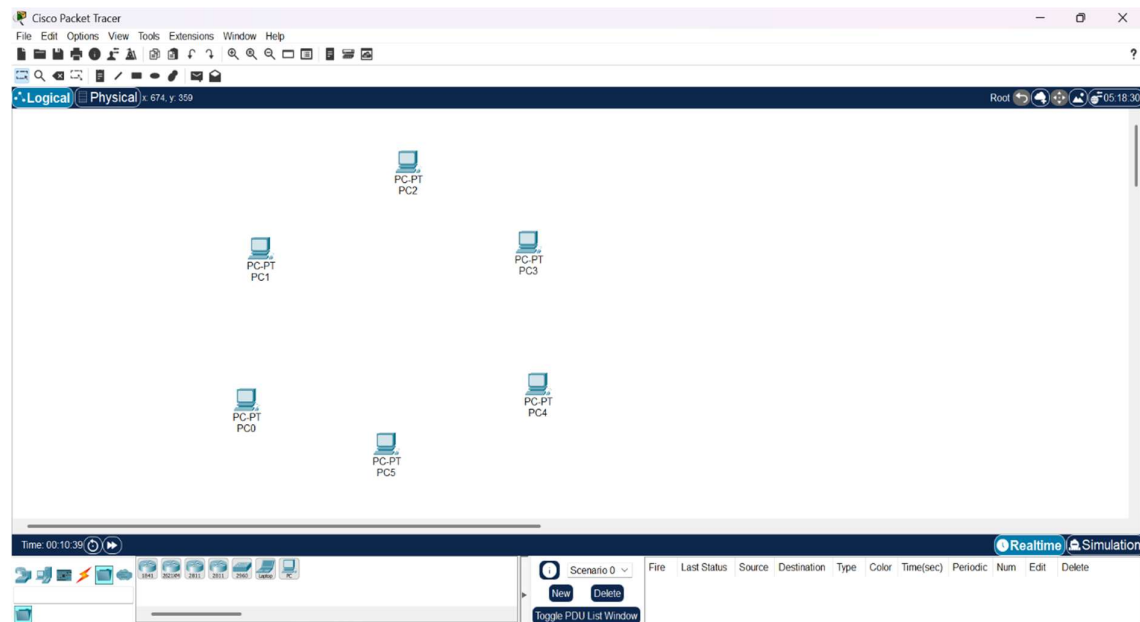
A common example of a hybrid topology is a university campus network. The network may have a backbone of a star topology, with each building connected to the backbone through a switch or router. Within each building, there may be a bus or ring topology connecting the different rooms and offices. The wireless access points also create a mesh topology for wireless devices. This hybrid topology allows for efficient communication between different buildings while providing flexibility and redundancy within each building.

Practical No. 7

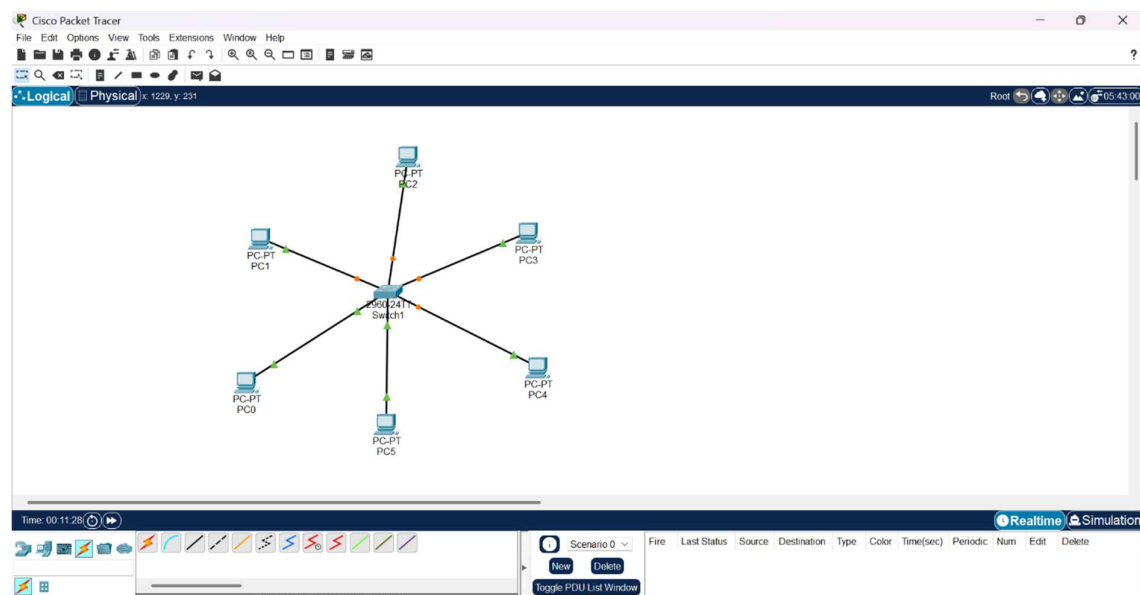
Aim:-Study of various Lan topologies and their creation using Cisco Packet Tracer.

➤ **Demonstration of a star topology by using ciscopacket tracer**

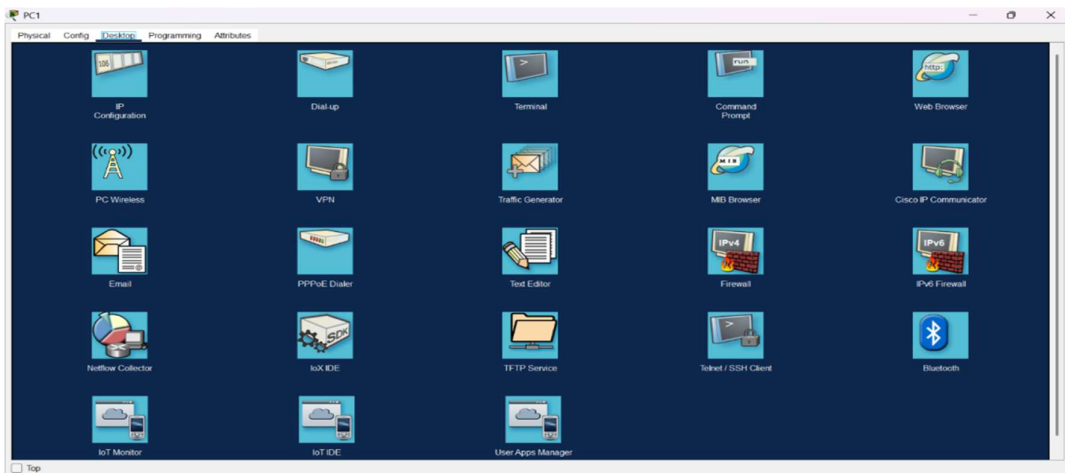
STEP 1: Open cisco packet tracer and choose PC with name PC0,PC1,PC2,PC3,PC4,PC5 and switch name SWITCH1.



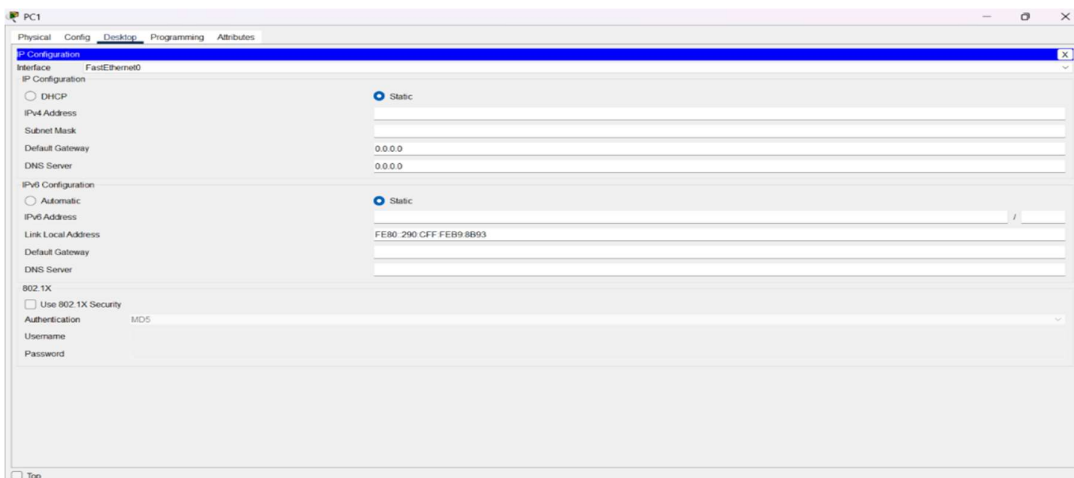
Now connect all these PC with Switch.



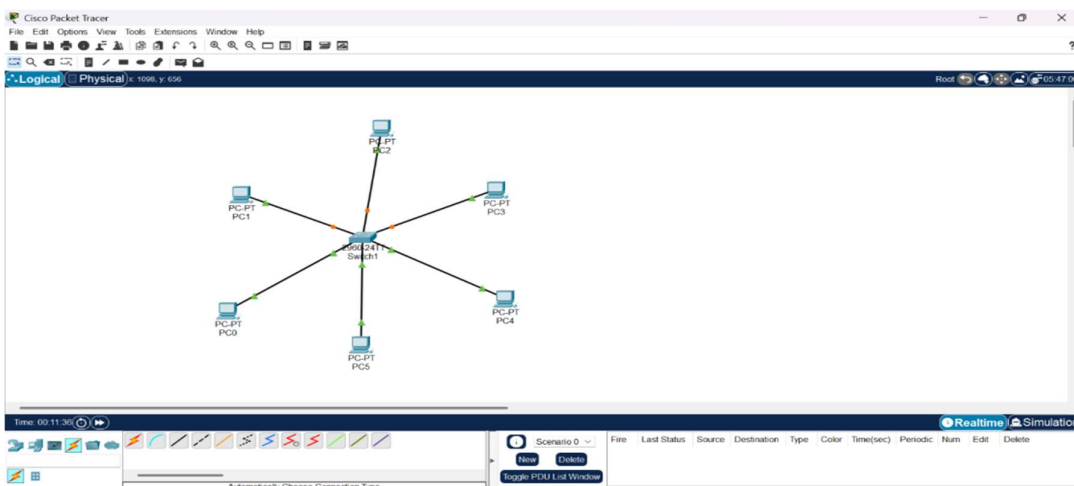
After click on PC and now click on desktop.



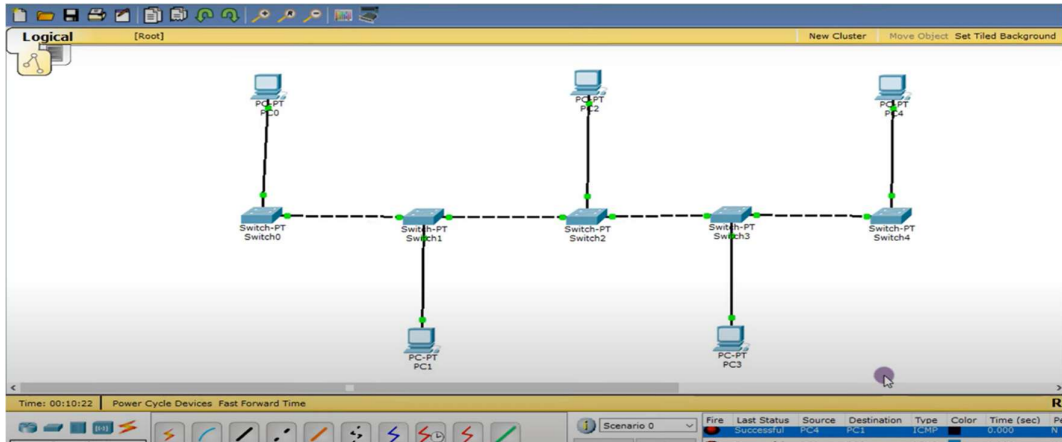
Now select IP configuration and put configurations of it ,perform this step for all PC.



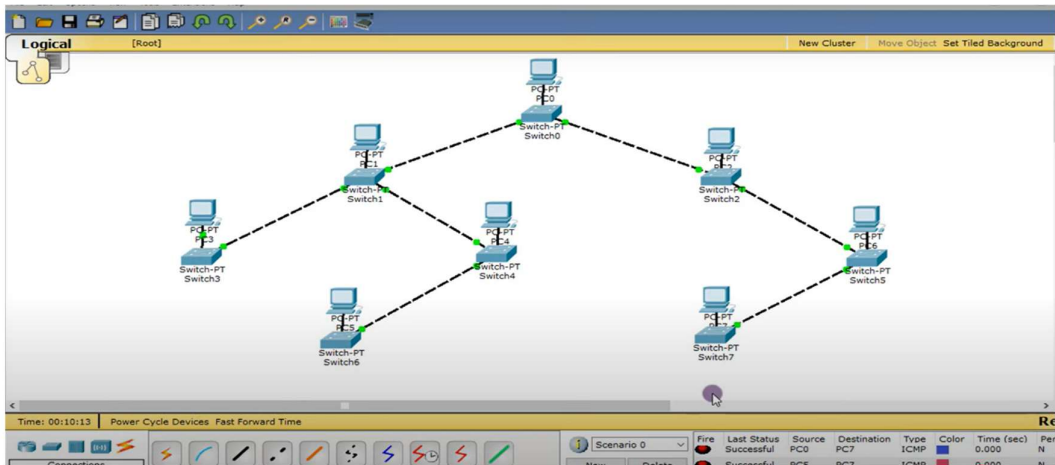
Now, star topology is completed.



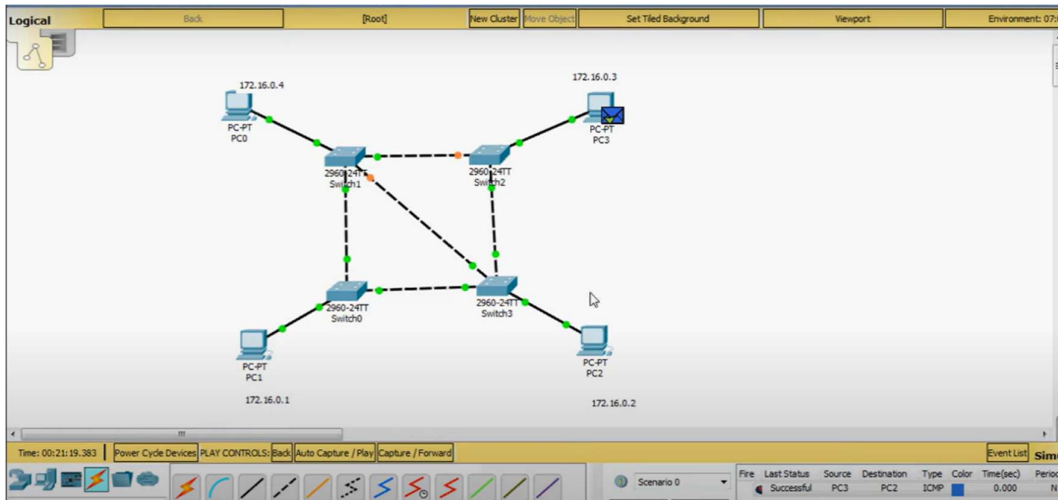
➤ **Demonstration of a Bus topology by using ciscopacket tracer**



➤ **Demonstration of a tree topology by using ciscopacket tracer**



➤ **Demonstration of a mesh topology by using ciscopacket tracer**



Practical No. 8

Aim:- Configuration of TCP/IP protocols in Window/LINUX.

❖ Open command prompt then type ipconfig /all and press enter.

```
Microsoft Windows [Version 10.0.26200.8037]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Piyush Gupta>ipconfig /all

Windows IP Configuration

Host Name . . . . . : PiyushGupta
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No

Ethernet adapter Ethernet:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . . . . :
Description . . . . . : Intel(R) Ethernet Connection (23) I219-V
Physical Address. . . . . : 84-BA-59-3B-FE-7A
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes

Wireless LAN adapter Local Area Connection* 1:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . . . . :
Description . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
Physical Address. . . . . : 98-BD-80-6A-45-C9
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes

Wireless LAN adapter Local Area Connection* 2:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . . . . :
Description . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #2
Physical Address. . . . . : 9A-BD-80-6A-45-C8
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes

Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . . . . . :
Description . . . . . : Intel(R) Wi-Fi 6E AX211 160MHz
Physical Address. . . . . : 98-BD-80-6A-45-C8
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes
IPv6 Address. . . . . : 2402:3a80:9d:ffda:a537:bcdf:1612:86b7(Preferred)
Temporary IPv6 Address. . . . . : 2402:3a80:9d:ffda:6d61:9933:542:1b02(Preferred)
Link-local IPv6 Address . . . . . : fe80::f123:a790:9c11:cbcf%4(Preferred)
IPv4 Address. . . . . : 192.168.217.76(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : 17 March 2026 14:57:25
Lease Expires . . . . . : 17 March 2026 16:27:26
Default Gateway . . . . . : fe80::929:9836:c3d2:ed12%4
                             192.168.217.89
DHCP Server . . . . . : 192.168.217.89
DHCPv6 IAID . . . . . : 77118848
DHCPv6 Client DUID. . . . . : 00-01-00-01-2E-25-ED-9D-84-BA-59-3B-FE-7A
DNS Servers . . . . . : 192.168.217.89
                             2402:3a80:9d:ffda::d6
NetBIOS over Tcpip. . . . . : Enabled

Ethernet adapter Bluetooth Network Connection:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . . . . :
Description . . . . . : Bluetooth Device (Personal Area Network)
Physical Address. . . . . : 98-BD-80-6A-45-CC
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes

C:\Users\Piyush Gupta>
```

❖ **Open command prompt then type ipconfig /release and press enter.**

```
C:\Users\Piyush Gupta>ipconfig /release

Windows IP Configuration

No operation can be performed on Ethernet while it has its media disconnected.
No operation can be performed on Local Area Connection* 1 while it has its media disconnected.
No operation can be performed on Local Area Connection* 2 while it has its media disconnected.
No operation can be performed on Bluetooth Network Connection while it has its media disconnected.

Ethernet adapter Ethernet:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 1:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 2:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . :
    IPv6 Address. . . . . : 2402:3a80:9d:ffda:a537:bcdf:1612:86b7
    Temporary IPv6 Address. . . . . : 2402:3a80:9d:ffda:6d61:9933:542:1b02
    Link-local IPv6 Address . . . . . : fe80::f123:a790:9c11:cbcf%4
    Default Gateway . . . . . : fe80::929:9836:c3d2:ed12%4

Ethernet adapter Bluetooth Network Connection:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

C:\Users\Piyush Gupta>
```

Practical No. 9

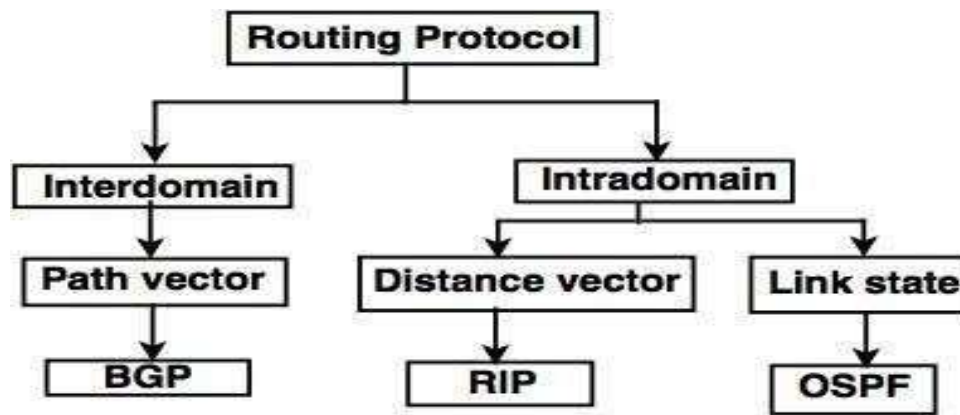
Aim: Introduction to various Interior and Exterior routing Protocols.

Routing Protocol:

A routing protocol is a set of rules and algorithms used by routers to determine the best path for forwarding data packets across a network. These protocols enable routers to share information about network topology and make dynamic decisions on how to route traffic based on current network conditions.

Types of routing protocols:-

There are different types of routing protocols, and they can generally be categorized into two main types:



Classification of routing protocol

1. Interior Gateway Protocols (IGPs)

These protocols operate within a single autonomous system (AS), which is a collection of IP networks and routers under the control of a single entity. Common IGPs include:

RIP (Routing Information Protocol): A distance-vector protocol that uses hop count as its metric. It's simple but limited in scalability.

OSPF (Open Shortest Path First): A link-state protocol that uses the Dijkstra algorithm to determine the shortest path and is scalable for large networks.

EIGRP (Enhanced Interior Gateway Routing Protocol): A Cisco proprietary protocol that combines features of both distance-vector and link-state protocols.

2. Exterior Gateway Protocols (EGPs):-

These protocols are used to route data between different autonomous systems. The most widely used EGP is:

BGP (Border Gateway Protocol): The main protocol used on the Internet to exchange routing information between different autonomous systems. BGP is a path-vector protocol and is very scalable, but it can be complex to configure.

Key Concepts in Routing Protocols:

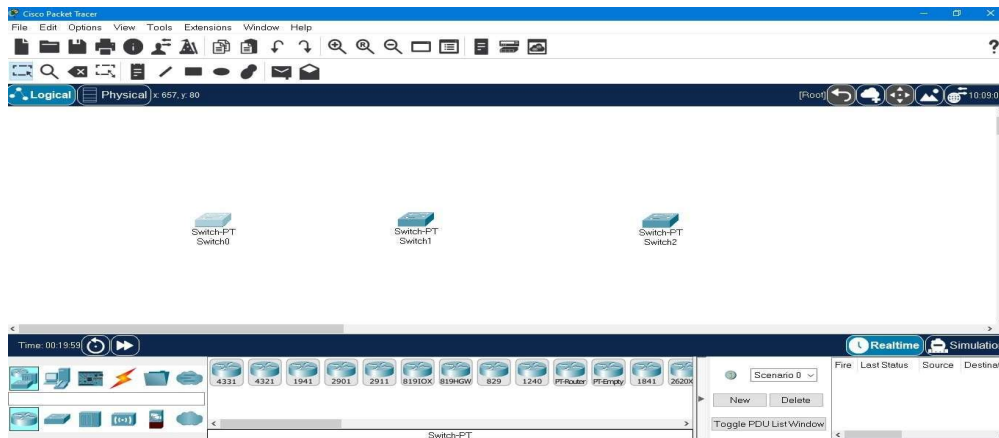
Metric: A value used to determine the "best" path. Common metrics include hop count, bandwidth, delay, and cost.

Convergence: The time it takes for a routing protocol to reach a stable state after a network change (e.g., a link failure).

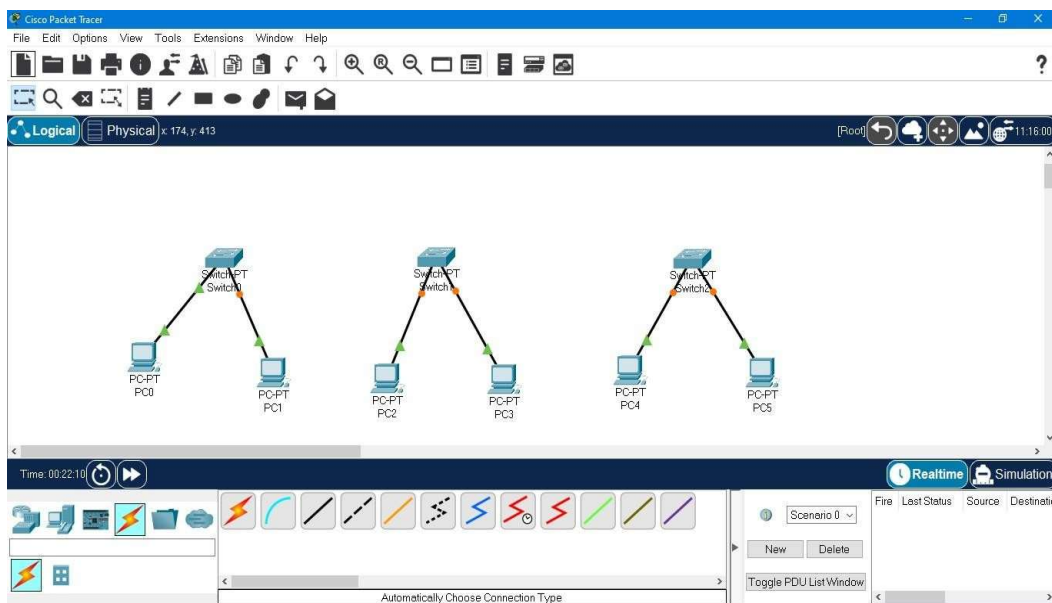
Routing Table: A table stored in each router that contains information about the best paths to reach various destinations in the network.

Configuration of Routing Information Protocol (RIP) Using Cisco Packet Tracer:-

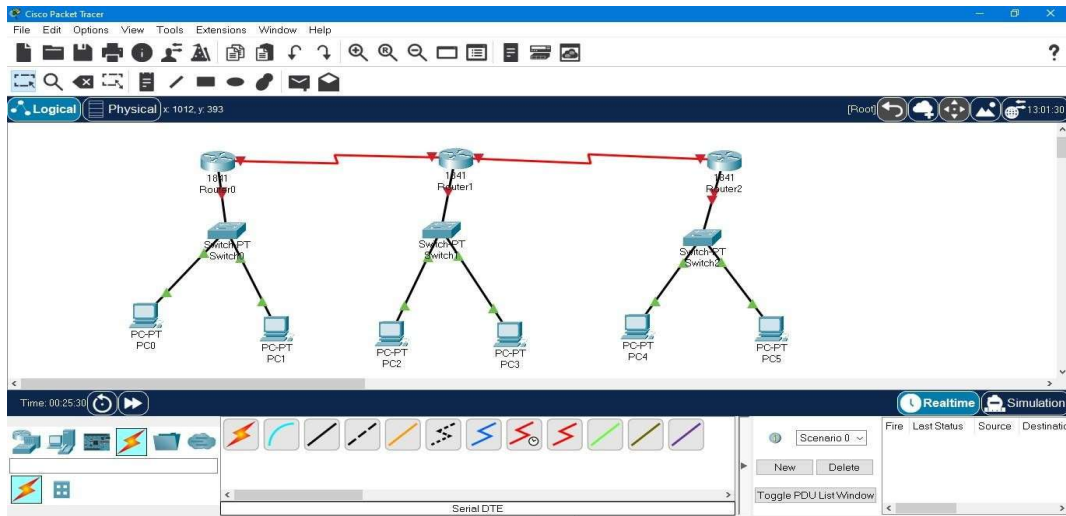
Step1.Choose Switch and select 3 Switch-PT. As shown:



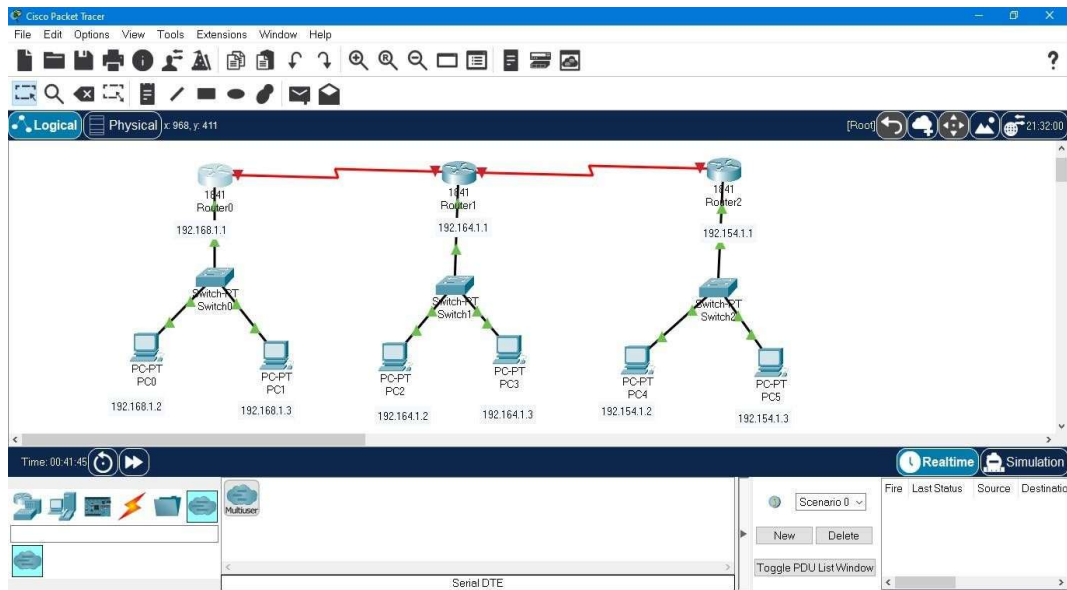
Step2.Choose PC and select 6PCs to connect with Switches.Connect each pair of 2 PCs with Switches using Automatic type connection. As shown:



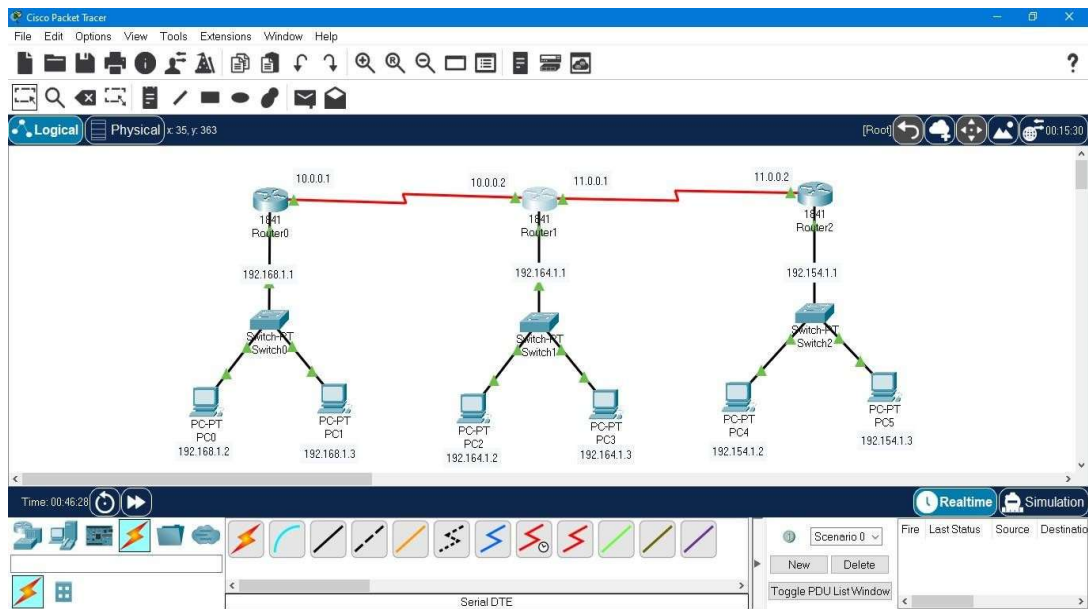
Step 3. Now choose 3 Routers (1841) and connect these with switches using Automatic connection type. Connect router with each other by DTE cable. As shown:



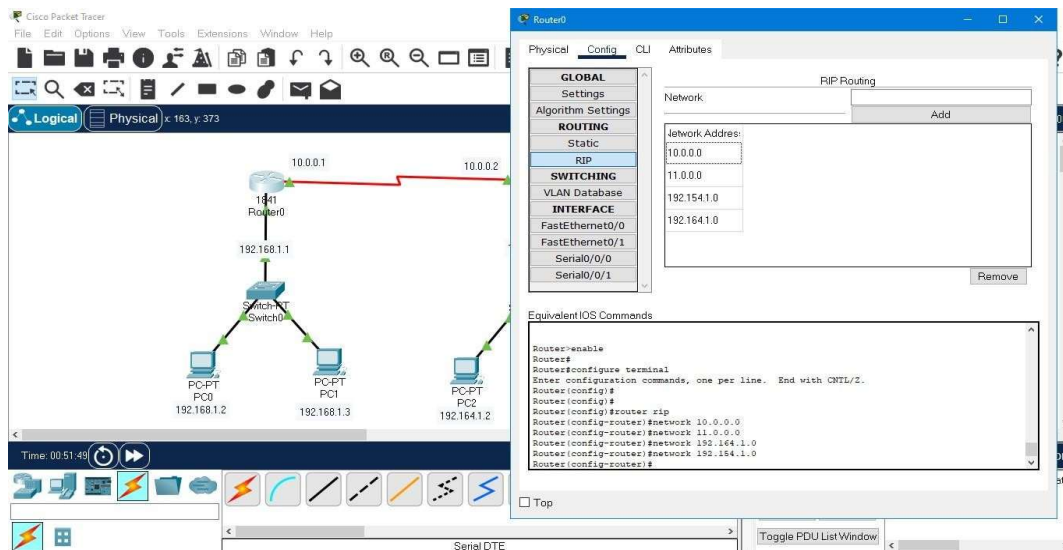
Step 4. Now Assign IP to Routers and PCs connected.



Step 5. Give Serial IPs to router to connect them together. As shown:



Step6. Updating RIP table of ROUTER . As shown:



Step 7. Now Transfer the message from PC0

The screenshot displays the Cisco Packet Tracer interface. The main workspace shows a network topology with the following components:

- Router0:** 1841, Serial0/0/0 (10.0.0.1), connected to Router1.
- Router1:** 1841, Serial0/0/0 (10.0.0.2), connected to Router0 and Serial0/0/1 (11.0.0.1), connected to Router2.
- Router2:** 1841, Serial0/0/0 (11.0.0.2), connected to Router1.
- Switch0:** 192.168.1.1, connected to Router0 and PC0 (192.168.1.2) and PC1 (192.168.1.3).
- Switch1:** 192.168.2.1, connected to Router1 and PC2 (192.168.2.2) and PC3 (192.168.2.3).
- Switch2:** 192.168.3.1, connected to Router2 and PC4 (192.168.3.2).

The interface includes a menu bar (File, Edit, Options, View, Tools, Extensions, Window, Help), a toolbar with various icons, and a Simulation Panel on the right. The Simulation Panel shows the Event List, Play Controls, and Event List Filters. The Event List is currently empty. The Play Controls include a time display (01:03:29.204), play/pause buttons, and a simulation mode selector (Realtime). The Event List Filters show a list of visible events including ACL, ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPoL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPSec, ISAKMP, IoT, IoT TCP, LACP, LLDP, Meraki, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAP, POP3, PPP, PPPoE, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, USB, VTP.

Practical No. 10

Aim:-Configuration of TELNET protocols on router for remote access.

Telnet protocol: TELNET is a type of protocol that enables one computer to connect to the local computer. It is used as a standard TCP/IP protocol for virtual terminal service which is provided by ISO. The computer which starts the connection is known as the local computer. The computer which is being connected to i.e. which accepts the connection known as the remote computer. During telnet operation, whatever is being performed on the remote computer will be displayed by the local computer. Telnet operates on a client/server principle.

Steps to Configure Telnet on Cisco Router

1. First of all, execute the following command to change the current hostname as Switch1.

```
Switch(config)#hostname Switch1
```

2. configure an IP address on the switch. Unlike the routers, typically switch does not require to be configured with an IP address. However, we need to configure an IP address on the switch's VLAN 1 interface.

The following commands will configure 10.0.0.1/8 IP address on the VLAN 1 interface.

```
Switch1(config)#interface vlan 1
```

```
Switch1(config-if)#ip address 10.0.0.1 255.0.0.0
```

```
Switch1(config-if)#no shutdown
```

```
Switch1(config-if)#exit
```

3. Once you have configured the appropriate hostname and IP address on the switch, execute the following commands to enable the Telnet protocol.

```
Switch1(config)#line vty 0 4
```

```
Switch1(config-line)#password 123456
```

```
Switch1(config-line)#login
```

```
Switch1(config-line)#exit
```

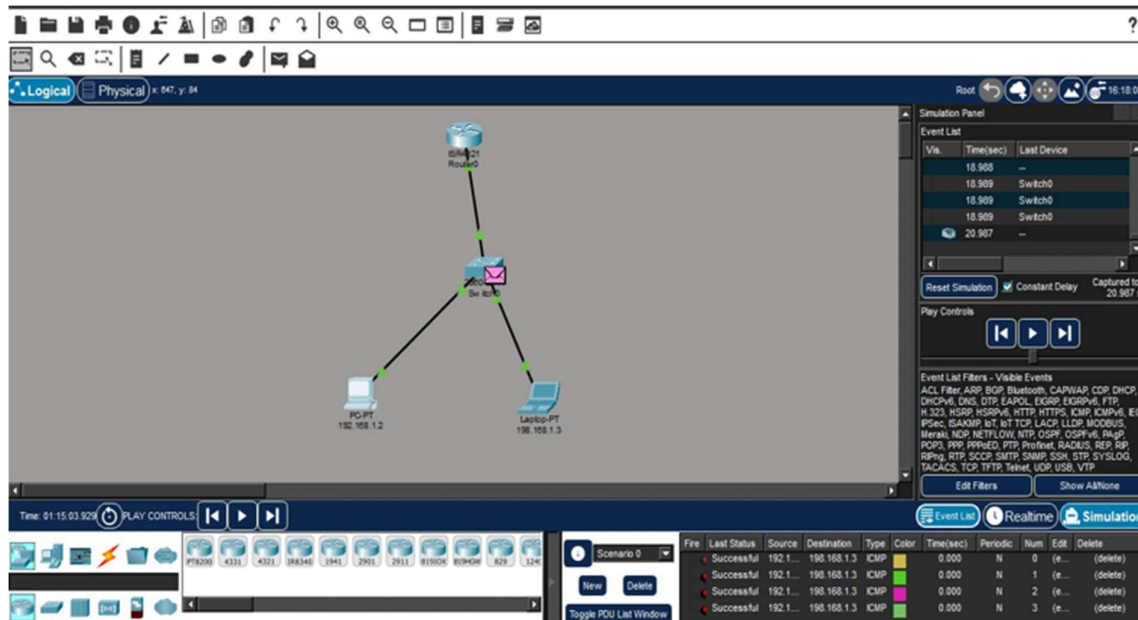
4. The following figure shows the Telnet configuration on Switch1

5. In the preceding commands, vty —means virtual terminal and 0 4 means —total five mm(0 to 4) users can access the switch remotely at a time. 123456 is the password that the remote users need to know in order to connect to the switch.

6. Once you have done your configuration on switch1, move on to PC0. Configure 10.0.0.1/8 IP address on PC0.

7. After configuring the appropriate IP address on the PC, open the Command Prompt window of the PC, type telnet 10.0.0.100 and press Enter.
8. At the Password: prompt, type your telnet password (123456) and verify that you are able to connect to switch's console remotely.

Consider the following example:



The network administrator wants to use his computer (Host A) to access and manage the router (R1). The administrator will start a Telnet client program on Host A and enter the IP address of the router R1 (telnet 10.0.0.1): The administrator can now manage the remote device (R1) from his own computer. Although Telnet is simple and easy to use, it is not widely used anymore, especially in production environments. This is because Telnet sends all data in clear-text, including usernames and passwords! SSH is commonly used today instead of Telnet. Telnet is only used if SSH is not available on the device, for example on some older Cisco equipment.