Chapter 7:
Computer Network and Internet

Computer Network

- **Computer network** is a series of computer systems that are linked together to enable them to share data as well as resources stored in one computer with another.
- Computers on network may be Servers or Workstations.
- Data communication refers the transferring of data from one computer to another.

Server computers

- **Server computer** is a computer on the network that controls and manages other computers on the network.
- It provides resources to the other computers on the network.
- The important data or information can be stored on the server computer.
- It uses the network operating system software like Windows Advance Server 2003, Novell Netware Server, Windows Server 13, etc..

Workstation computers

- **Workstation computer** is a computer on the network that uses the resources provided by the server computers or other computers.
- It is used by client in order to perform application tasks and data communication.
- It is also known as Client Computer.
- It uses the workstation operating system like Windows NT Workstation, Windows 2003, Windows XP/Vista, Windows 7/8/10, etc..

Advantage of computer network

- They can share data and information among them.
- They can share programs.
- They can share their hardware resources like hard disk, DVD drive, Scanner, Printer, etc.
- They can transfer or receive data from one computer to another.
- They can communicate with each other through E-mail, Chat, and Video Conference.

Network Components

- All computer networks are made up of basic hardware and software components to interconnect network nodes.
- **Hardware components** are: Servers or Clients, Connectors, Network cables, Network Interface Card (NIC).
- **Software components** are: Networking Operating System, Communication Protocol.

Hardware Components - 1
Servers or Clients

- **Server** is a network computer, computer program, or device that processes requests from a client.
- The function of computer system is to store, retrieve and send or “serve” files and data to other computers on its network.
- **Client** is an application or system that accesses a remote service on another computer system, known as a server, by way of a network.

Hardware Components - 2
Connectors

- **Connectors** are used to connect network cables to terminals or other devices.

Hardware Components - 3
Network Cables

- **Network cables** are used to connect one network device to other or to connect two or more computers to share printer, scanner, etc.
- Different **types of network cables** are: Twisted pair cables, Coaxial cables and Fiber optic cables are used depending on the network's topology, protocol and size.

Hardware Components - 4
Network Interface Card (NIC)

- **Network interface card** is a computer component that will slot into a socket on a PC motherboard with the back of the card providing one or more Ethernet connection sockets.
- It allows computers to communicate over a computer network.
- Modern PCs can also connect to the Internet wirelessly via a PC bus card or USB device connection – these devices could also be called **NICs**.

Software Components - 1
Network Operating System (NOS)

- **Network operating system** is an operating system designed to allow shared file and printer access among computers in a network
- It provides printer sharing, common file system and database sharing, application sharing, and the ability to manage a network name directory, security, and other housekeeping aspects of a network.
- Unix, Linux and the server versions of Windows are common **NOSs**.

Software Components - 2
Communication Protocol

- **Communication protocol** defines the rules for sending blocks of data (each known as a Protocol Data Unit (PDU)) from one node in a network to another node.
- It is necessary for all computers on a network to use the same protocol in order to communicate.
- Protocols may include signaling, authentication, and error detection and correction capabilities.
- **Popular protocols are**: Transmission Control Protocol/Internet Protocol (TCP/IP), Simple Mail Transfer Protocol (SMTP) and Post Office Protocol (POP).

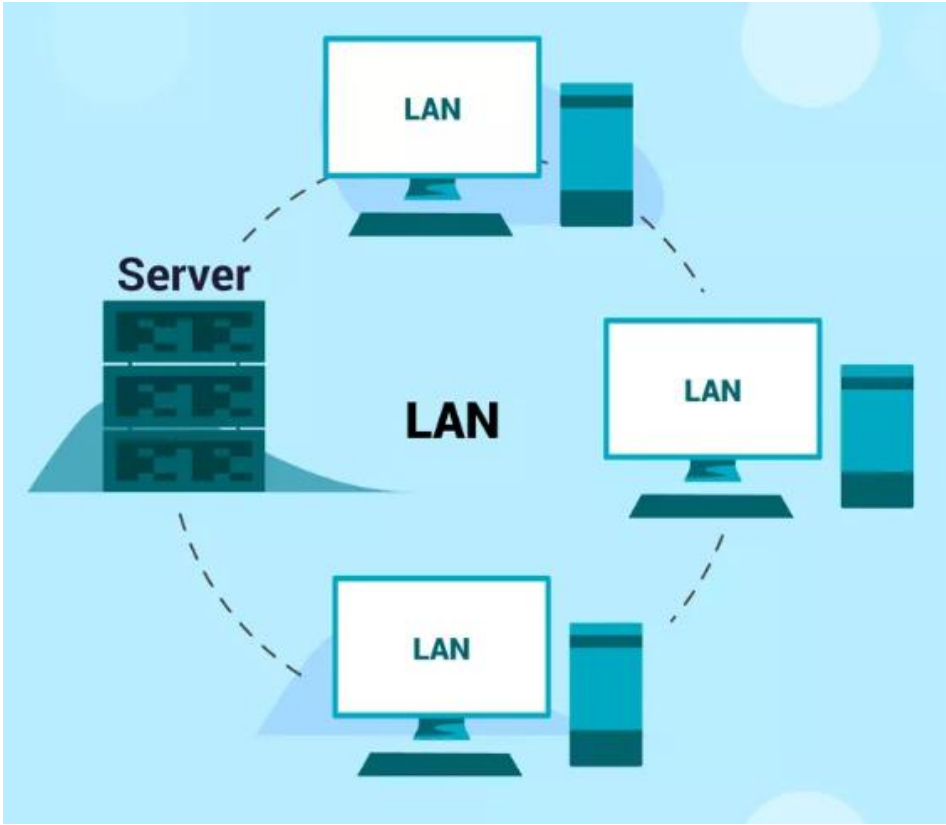
Classification Based on Geographical Spread of Network

- Networks vary in size, complexity, and geographical spread.
- There are three types of networks on the basis of geographical spread. They are:
  - **Local Area Network (LAN)**
  - **Metropolitan Area Network (MAN)**
  - **Wide Area Network (WAN)**

Classification Based on Geographical Spread of Network – 1

Local Area Network (LAN)

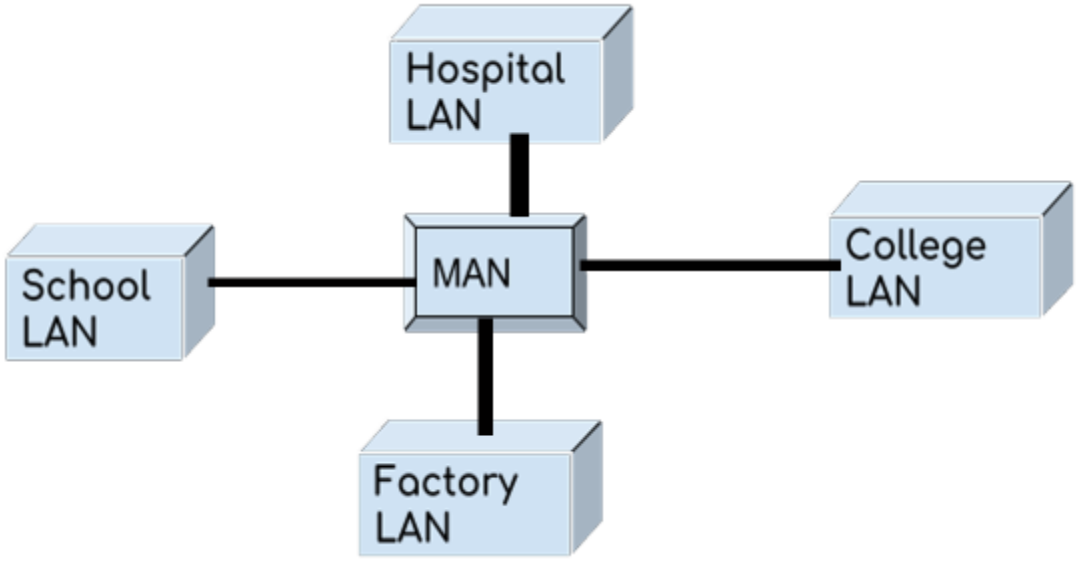
- A combination of hardware, software and communications channels that connect two or more computers within a limited area.
- A typical example is a college or university computer network.
- Users in a LAN can share both hardware and sharable software resources. For example, hardware resources include expensive laser printer, plotter, fax machines, modem, etc.
- Cabling system connecting the components, created with twisted pair wire or coaxial cable.
- It restricted to a limited area.



Classification Based on Geographical Spread of Network – 2

Metropolitan Area Network (MAN)

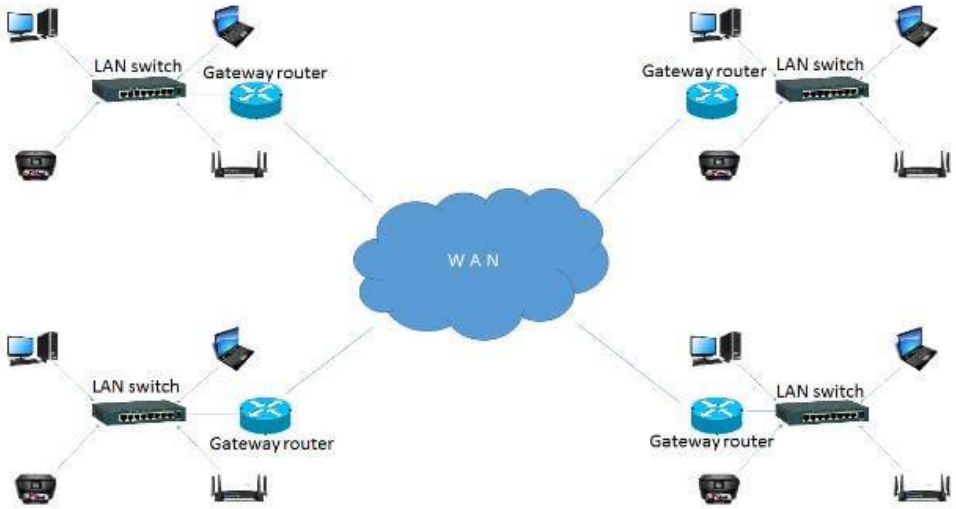
- A network that interconnects users with computer resources in a graphical area or region larger than that covered by even a large LAN but smaller than the area covered by WAN.
- For example: Cable TV networks that spread over a city, can be termed as MAN.
- Restricted within a city or municipality or district.



Classification Based on Geographical Spread of Network – 2

Wide Area Network (WAN)

- Computer network that covers a large geographical area, often a country or continent.
- WANs can be used to connect cities, states, or even countries.
- Computer connected to WAN are often connected through public networks such as the telephone system.
- Sometimes they can be connected through leased lines.



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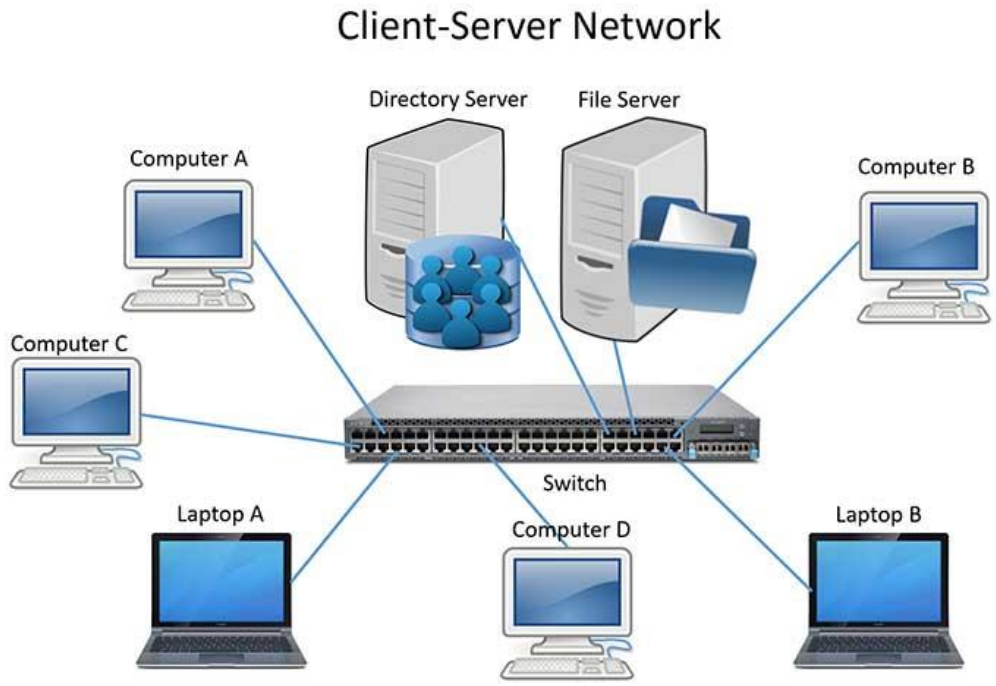
Name	Expansion	Description
LAN	Local Area Network	Least expensive; spans a single room or a single building
MAN	Metropolitan Area Network	Medium expense; spans a major city or a metroplex
WAN	Wide Area Network	Most expensive; spans sites in multiple cities

Classification Based on Services in a network

- There are two types of network based on their services in a network. They are:
  - **Client/Server Network**
  - **Peer-to-Peer Network**

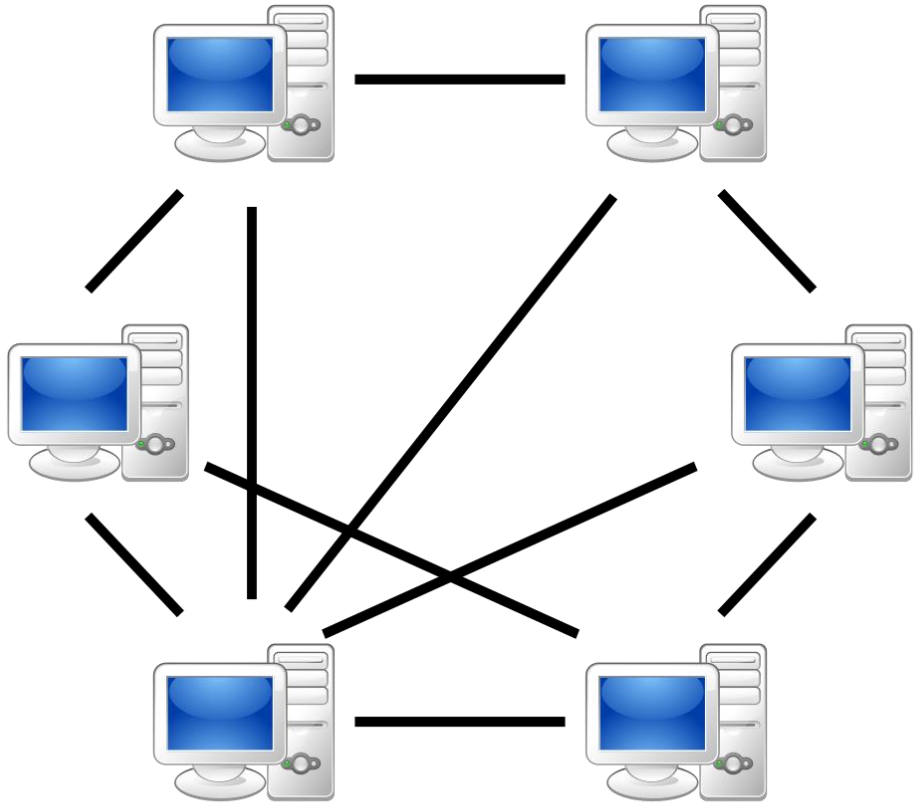
Classification Based on Services in a network – 1
Client / Server Network

- A network in which servers provide services to clients.
- There is at least one server providing central authentication services.
- Servers also provide access to shared files, printers, hardware, and applications.
- Processing power, management services and administrative functions can be concentrated where needed, while clients can perform many basic end-user tasks on their own.



Classification Based on Services in a network – 2
Peer-to-Peer Network

- A network in which resource sharing processing and communications control are completely decentralized.
- All clients on the network are equal in terms of providing and using resources and users are authenticated by each individual workstation.
- Computers in a peer to peer network run the same networking protocols and software.
- Peer are also often situated physically near each other, typically in homes, small businesses or schools.
- P2P networks are easy and inexpensive to implement.



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PEER TO PEER NETWORK	CLIENT SERVER NETWORK
A distributed application architecture that partitions tasks or workloads between peers	A distributed application structure based on resource or service providers called servers and service requesters called clients
Each node can request for services and provide services	Client requests for service and server responds with a service
A decentralized network	A centralized network
Reliable as there are multiple service providing nodes	Clients depend on the server - failure in the server will disrupt the functioning of all clients
Service requesting node does not need to wait long	Access time for a service is higher
Expensive to implement	Does not require extensive hardware to set up the network
Comparatively less stable	More stable and secure

Communication Media

- **Communication media** are the electronic roadways along which the signals are transferred. There are two types of communication media. They are:
  - **Guided Media** uses a cabling system that guides the data signals along a specific path .
    - The data signals are bound by the cabling system. Guided Media is also known as **Bound Media** or **Wired media**.
  - **Unguided Media:** Here information is transmitted by sending electromagnetic signals through free space and hence the name **unguided media**, as the signals are not guided in any specific direction or inside any specific medium.
    - All unguided media transmission are classified as wireless transmission.
    - Wireless transmission can be used as the medium in both LAN and WAN environments.

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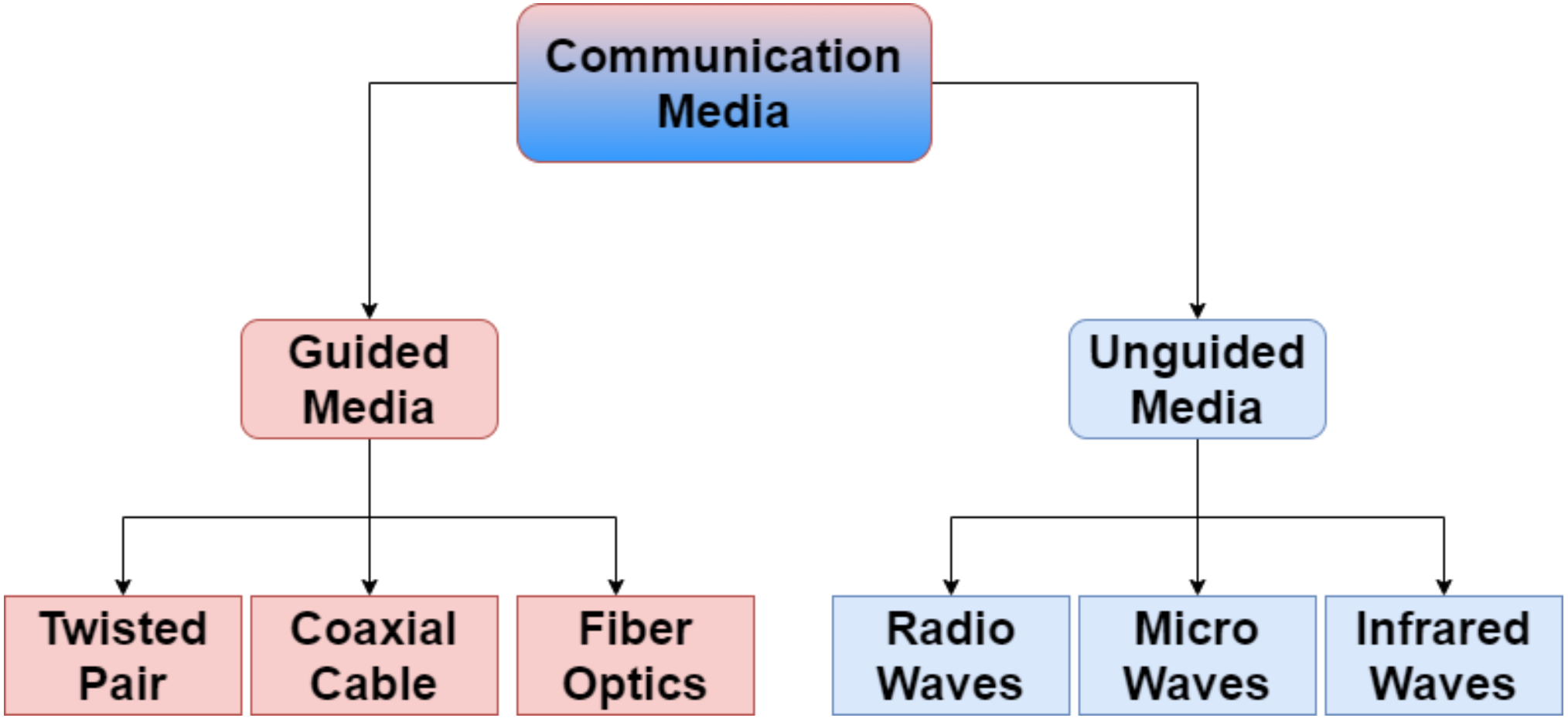
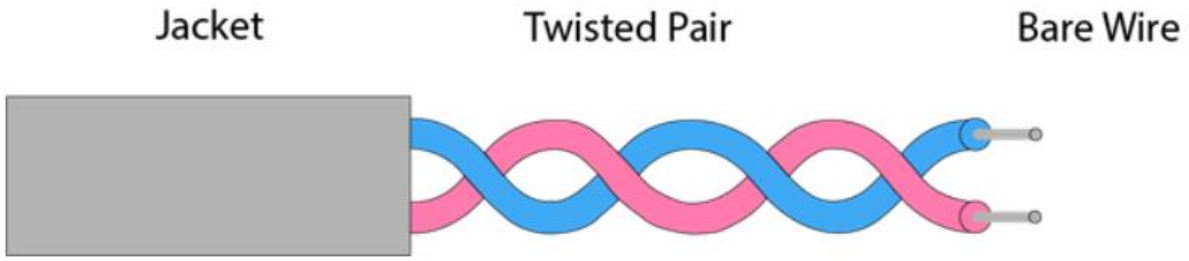

Communication Media
Guided Media
Unguided Media
Twisted Pair
Coaxial Cable
Fiber Optics
Radio Waves
Micro Waves
Infrared Waves

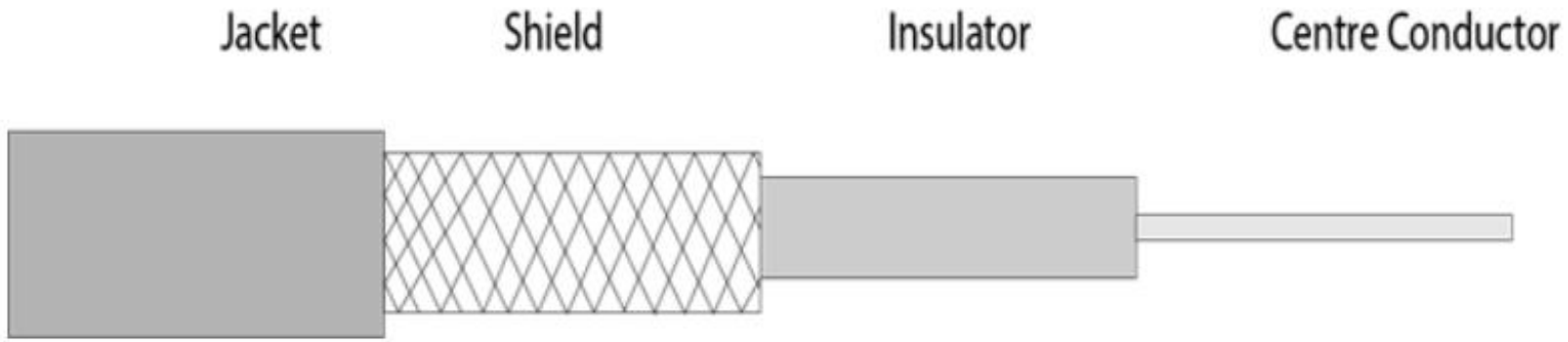
Communication Media – 1
Guided Media - 1

- **Twisted Pair Cable (TPC)** is a type of cable made by putting two separate insulated wires together in a twisted pattern and running them parallel to each other.
  - Two types of TPC:
    1. **Unshielded Twisted Pair (UTP)** is common in Ethernet installations.
    2. **Shielded Twisted Pair (STP)** is used in various kinds of networks to prevent crosstalk and electromagnetic interference.



Communication Media – 1
Guided Media - 2

- **Coaxial Cable** is a cable that consists of an insulated conducting tube through which a central, insulated conductor runs, used for transmitting high-frequency telephone, telegraph, digital, or television signals.



Communication Media – 1
Guided Media - 3

- **Optical Fiber** is a flexible, transparent fiber made by drawing glass (silica) or plastic to a diameter slightly thicker than that of a human hair.

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Twisted pair cable	Co-axial cable	Optical fiber
1. Transmission of signals takes place in the electrical form over the metallic conducting wires.	1. Transmission of signals takes place in the electrical form over the inner conductor of the cable.	1. Signal transmission takes place in an optical forms over a glass fiber.
2. In this medium the noise immunity is low.	2. Coaxial having higher noise immunity than twisted pair cable.	2. Optical fiber has highest noise immunity as the light rays are unaffected by the electrical noise.
3. Twisted pair cable can be affected due to external magnetic field.	3. Coaxial cable is less affected due to external magnetic field.	3. Not affected by the external magnetic field.
4. Cheapest medium.	4. Moderate Expensive.	4. Expensive
5. Low Bandwidth.	5. Moderately high bandwidth.	5. Very high bandwidth
6. Attenuation is very high.	6. Attenuation is low.	6. Attenuation is very low.
7. Installation is easy.	7. Installation is fairly easy.	7. Installation is difficult.

Communication Media – 2
Unguided Media - 1

- **Radio Waves** are the electromagnetic waves that are transmitted in all the directions of free space.
- **Micro Waves** signals are used to transmit data without the use of cables, similar to that of radio and television signals but at different frequency range.
- **Infrared Waves** is a wireless technology used for communication over short ranges.

Internet - History

- It is the network of networks.
- It is worldwide network of computers.
- Evolved in 1969.
- United States Department of Defense started a network called **ARPANET (Advanced Research Projects Administration Network).**
- Began with only one computer in California and three in Utah.
- To connect the computers of US defense with US universities.
- Joined by the **NSFNet (National Science Foundation Network)** and linked other private networks, to allow commercial and governmental activities.

Advantages

- Information, knowledge, and learning
- Connectivity, communication, and sharing
- Address, mapping, and contact information
- Banking, bills, and shopping
- Selling and making money
- Collaboration, work from home, and access to a global workforce
- Donations and funding
- Entertainment
- Cloud computing and cloud storage
- Internet of Things

Disadvantages

- Information loss
- Spam
- Virus Attacks
- Social Isolation

Essential Requirements for the Internet Connection:

- Computer Network
- Telephone line connection
- Modem
- Browser Software such as Internet Explorer, Chrome and Mozilla Firefox
- An account with an Internet Service Provider (ISP)

Getting online

- Switch on your **computer** and the modem (if external)
- Find the icon for **Internet** and double click on it. '**A Connect To**' window appears on the screen.
- Enter your **username**, **password** and the **telephone number** of the ISP. Then click the **Dial button**.
- Your username and password are then verified.
- After verification, you are connected to the Internet. You will see an icon moving down to the bottom-right corner of the screen. You are now logged on to the Internet.
- Start the **browser software** on your computer to surf the net.

Components of Web

- **Website**
- **Web Page**
- **Web Server**
- **Web Browser**
- **Hypertext Transfer Protocol (HTTP)**
- **Uniform Resources Locator (URL)**
- **Transmission Control Protocol/Internet Protocol (TCP/IP)**
- **Home Page**

Components of Web - 1
Website

- **Website** is a collection of Web pages belonging to a particular person or organization.
- Each document on the Website, which may contain only text or a combination of text, images and multimedia.
- **Examples:** www.google.com , www.yahoo.com

Components of Web - 2
Web Page

- **Web Page** (or webpage) is a specific collection of information provided by a website and displayed to a user in a web browser.

Components of Web - 3
Web Server

- **Web Server** is a computer with an Internet connection that runs software designed to send out HTML pages and other file formats (such as multimedia files).
- It is a server software, or hardware dedicated to running this software, that can satisfy client requests on the World Wide Web.
- A web server can, in general, contain one or more websites.
- A web server processes incoming network requests over HTTP and several other related protocols.

Components of Web - 4
Web Browser

- **Web Browser** (commonly referred to as a browser) is a software application for accessing information on the World Wide Web.
- When a user requests a web page from a particular website, the web browser retrieves the necessary content from a web server and then displays the page on the user's device.
- **Examples:** Google Chrome, Microsoft Edge, Mozilla Firefox, Opera, etc.

Components of Web - 5
Hypertext Transfer Protocol

- **Hypertext Transfer Protocol** is an access method (method to access the web pages) used on Internet.
- It is an application protocol for distributed, collaborative, hypermedia information systems.
- HTTP generally works in combination with www.
- HTTP is the foundation of data communication for the World Wide Web, where hypertext documents include hyperlinks to other resources that the user can easily access, for example by a mouse click or by tapping the screen in a web browser.

Components of Web - 6
Uniform Resource Locator

- **Uniform Resource Locator** is a uniform way to locate a resource (file or document) on the Internet.
- It specifies the address of a file, and every file on the Internet has a unique address.
- Web software use the URL to retrieve a file from the computer on which it resides.
- It provides an addressing scheme which allows the browser to request just about any document or web page, located anywhere on the Internet.

Components of Web - 7
TCP/IP

- **TCP/IP** is a protocol used to exchange information between clients and web servers.
- It is also known as the standard set of protocols used for conducting communication on the Internet.
- TCP/IP is the most popular and widely accepted protocol available on the Internet today.

Components of Web - 8
Home Page

- **Home Page** is the first page of a website.
- Most important page of any website.
- It contains number of hyperlinks to other web pages.

Services of Internet

- **World Wide Web (WWW)**
- **Electronic Mail (E-mail)**
- **Electronic Commerce (E-commerce)**
- **Chatting**
- **Video Conferencing**

Services of Internet - 1
WWW

- **WWW** is the most popular online resources on the Internet.
- It is the ocean of information where we can get almost all the information.
- It was created by Timothy Berners-Lee and his colleagues at CERN and introduced to the world in 1991.
- It contains linked text, images, sound, and video documents.
- **It allows user to view images, look at film clips, listen to sound recordings, and find valuable and interesting information about a wide variety of subjects.**

Services of Internet - 2
E-mail

- **E-mail** is an electronic message sent from one computer to another.
- In the form of text, images, sound or an application.
- It acts as a communication tool.
- Permit users to attach data files and program files to messages.
- **Popular web-based email services** are Gmail from Google, Outlook from Microsoft, Yahoo! Mail from Yahoo!.

Services of Internet - 3
E-commerce

- **E-commerce** is the buying and selling of goods and services on the Internet.
- Electronic commerce can be between two businesses transmitting funds, goods, services and/or data or between a business and a customer.
- Products chosen on the Internet will be delivered right at your door.
- Payment can also be made online.

Services of Internet - 4
Chatting

- **Chatting** is the way of online conversation with another person over the Internet.
- People can chat with their relatives far and near, in any corner of the world.
- They can even join general chat groups to share knowledge.
- Students use chatting to learn from their instructors.
- Chatting is also used for entertainment and relaxation.

Services of Internet - 5
Video Conferencing

- **Video Conferencing** is a technology that allows users in different locations to hold face-to-face meetings without having to move to a single location together.
- This technology is particularly convenient for business users in different cities or even different countries because it saves time, expenses, and hassles associated with business travel.
- Uses for video conferencing include holding routine meetings, negotiating business deals, and interviewing job candidates.

Netiquette

- It stands for "**Internet Etiquette**", refers to the set of practices developed over the years to make the Internet experience pleasant for everyone.
- Good netiquette involves respecting other's privacy and not doing anything online that will annoy or irritate other people.
- It is important to keep in mind the following rules of communication while using Internet:
  - **Respect the privacy of other people.**
  - **You must be careful and sensitive in expressing yourself so that you do not hurt other people. Respect other people online.**
  - **Do not give out personal information without your parent's permission.**
  - **Do not send anything you don't want to send.**