

COMPUTER NETWORKS

Computer network is a connection of two or more computers for data and resource sharing purpose.

13.1 Advantages of networking computers

- **Eases file sharing:** it allows file sharing and remote file access.
- **It allows Sharing of peripheral devices:** all computers in the network can share devices such as printers, fax machines, modems, scanners etc.
- **It facilitates software sharing:** software can be installed in one server computer and used by different work stations.
- **It allows Communication:** people on the network can communicate easily with each other through electronic mail.
- **It facilitates workgroup computing:** workgroup software enables many users to contribute to a document concurrently.

Disadvantages of using a network

- The hardware, software, and expertise required to set up a network can be expensive.
- Networks are vulnerable to security problems.
- If the server fails to work, the complete network may also fail to work.
- Network can lead to rapid spread of computer viruses

13.2 Types of Networks

Networks classified by spatial distance are of four types among which include the following:

- *Local Area Network (LAN),*
- *Wide Area Network (WAN),*
- *Metropolitan Area Network (MAN) and Virtual Private Network (VPN).*

Local Area Network

A local area network (LAN) is a network that connects computers in a small geographic area such as a building like a computer laboratory, or an office.

13.2.1 Advantages of LAN

Local Area Network (LAN), has many advantages, but the main ones include:

- The resources can be shared among different users
- LAN is not very expensive and the small businesses, firms and educational institutes can afford and easily design the LAN.
- Users can share messages and communicate with each other through e-mails and chatting.

- All the data is stored and updated on the central server through nodes. So it becomes very easy to take backup of database at regular interval.
- Multiple users can access the Internet using a single Internet connection established at the central server.
- Data security can be implemented very easily, because authorised users are granted data access rights.

13.2.2 Disadvantages of LAN

Although, LAN has many advantages, but it also has some disadvantages. The main disadvantages are:

- If central server is infected by virus, then the important data stored on server may be corrupted and the entire network may also be held.
- All nodes depend on the central computer (or Hub), if any component of the server fails, then entire network will stop working.
- A trained and competent network manager is required to run the LAN.
- Mostly in a LAN, one or two printers are shared among several users. In this way, lengthy print queues are created, so the users have to wait for a long period of time to take print on the printer.

Types of Local Area Network

- Peer-to-peer network
- Client/server network

Peer-To-Peer Network

A peer-to-peer (P2P) computer network is one in which each computer in the network can act as a client or server for the other computers in the network

Advantages of a Peer to Peer Network (P2P)

- A peer-to-peer network is simple to setup i.e. does not require too much configuring
- It is not expensive to set up
- It does not require a dedicated server to control the network
- It is perfect for home and small business users.

Disadvantages of peer to peer network

- The system is not centralized, making administration difficult.
- Lack of security i.e. files can be accessed by any one on the network

Client/Server Network

A client/server network has one or more computers acting as a server while the other computers act as clients.

Advantages of a Client/Server Network

- All Resources are centralized and easier to access.
- Easy management and administration of the network.
- More data security since all network access is controlled through the server.
- The network is flexible, because changes and new technology can be easily included into system.

Disadvantages of a Client /Server Network

- It is expensive to set up as compared to a P2P network.
- It requires an extra computer to serve as a dedicated server.
- Maintenance – large networks will require an administrator staff to ensure efficient operation
- Dependence – When the server goes down, operations will cease across the network
- Server can get overloaded since all the processing is controlled at one point.

Wide Area Network

A Wide Area Network (WAN) is a network system that covers a large (wide) geographical area such as different cities of country or different countries of the world.

Advantages of WAN

- Covers a large geographical area so long distance businesses can connect on the one network Shares software and resources with connecting workstations
- Messages can be sent very quickly to anyone else on the network.
- Expensive things (such as printers or phone lines to the internet) can be shared by all the computers on the network without having to buy a different peripheral for each computer.
- Everyone on the network can use the same data. This avoids problems where some users may have older information than others.
- Information/files can be shared over a larger area

Disadvantages of WAN

- Are expensive and generally slow
- Need a good firewall to restrict outsiders from entering and disrupting the network which is expensive to set up.
- Protection against hackers and viruses adds more complexity and expense.
- Once set up, maintaining a network is a full-time job which requires network supervisors and technicians to be employed.
- Information may not meet local needs or interests

- Vulnerable to hackers or other outside threats

Metropolitan Area Network (MAN)

A Metropolitan Area Network (MAN) is a network system that covers area of a single city.

Virtual Private Network (VPN)

A virtual private network (VPN) is a network that uses a public telecommunication infrastructure and their technology such as the Internet, to provide remote offices or individual users with secure access to their organization's network.

PERSONAL AREA NETWORK (PAN)

A personal area network (PAN) is the interconnection of computer devices within the range of an individual person, typically within a range of 10 meters

Intranet, Extranet and Internet

Intranet refers to a connection of private computer networks within an organization. An example of an intranet is a school network.

Advantages of Installing a School Network

- Networks provide a very rapid method for sharing and transferring files.
- Networkable versions of many popular software programs are available at considerable savings when compared to buying individually licensed copies.
- Files and programs on a network can be safe through setting passwords for authorised users.
- Sharing resources such as laser printers, fax machines, modems, scanners, etc. is simplified
- Electronic mail on a LAN can enable students to communicate with teachers and peers at their own school.

Disadvantages of Installing a School Network

- Expensive to Install
- Requires Administrative Time since it requires proper maintenance of a network. Must Monitor Security Issues.
- Wireless networks are becoming increasingly common; however, security can be an issue with wireless networks

13.4 The Extranet

An **extranet** is a computer network that allows authorised access from within and outside of the organisations, for specific business or educational purposes.

13.4.1 Advantages

- It facilitates Exchange of large volumes of data using Electronic Data Interchange (EDI)
- It eases sharing of product catalogs exclusively with trade partners
- It facilitates collaboration with other companies on joint development efforts
- Different companies can jointly develop and use training programs with other companies

13.4.2 Disadvantages

- Extranets can be expensive to implement and maintain.
- Security of extranets can be a concern when hosting valuable or proprietary information.

INTERNET

The internet is a global interconnection of computer networks.

Advantages of getting connected to the internet

- Internet aids access to a wealth of information, such as news, weather reports, and airline schedules becomes easier.
- It facilitates shopping for goods and services through E – commerce
- The use of internet facilitates online banking services such as cash deposits.
- Internet can be used for research as well as online training courses.
- People use internet to download files, software etc.
- People use internet to publish information about themselves or their work
- People use internet to make cheap internet calls
- Internet help people to Send and receive email to and from other connected users

Disadvantages of internet

- Computer viruses these can be downloaded and spread across machines and have destructive effects.
- Internet provides unsuitable material such as Pornography, the biggest threat related to healthy mental life.
- The use of internet can lead to theft of Personal information
- **The use of internet can lead to Spamming:** *Spamming refers to sending unwanted e-mails in bulk, which provide no purpose and needlessly obstruct the entire system.*
- The initial cost of connecting to the internet is high. e.g. buying computers.
- Many people are computer illiterate and so cannot use internet.
- There is a lot of wrong information on the internet. Anyone can post anything, and much of it is deceit/garbage

Internet connection requirements

- A fully functioning Computer
- Modem: *This converts your digital computer information into analogue telephone signals and vice-versa.*
- Phone Line
- Required Software
- Contract with an Internet Service Provider

Internet service Provider

An Internet Service Provider is the company that takes care of the technical aspects of connecting your computer(s) to the internet

Factors to consider when choosing ISPs

- **The available services provided by the internet service provider**
- **Speed/Performance:** You should select an ISP that offers greater internet speed.
- **Security Levels:** Select a service that will not compromise the privacy of your information
- **Price:** Choose an ISP with affordable rates after agreeing with the terms and conditions.

- **Compatibility** – That the speed of their modems and their software matches the speed of yours
- **Reliability** – you should choose an ISP that has been in business for long.

Services offered by Internet service Providers

- **Internet access:** ISP connect individual computer terminals and computer networks to the internet, enabling users to access internet services like emails.
- **Domain name registration:** ISP registers domain name which identifies one or more IP addresses with a name that's easier to remember.
- **Domain hosting:** this refers to the business that specialize in hosting domain name for individuals and companies.
- **Web hosting:** Web hosting is a service that allows individual and organisations to make their website accessible via world wide web
- **Internet transit:** ISP usually sells access to the global access.

ISP Connection Types

There are many ways to connect to an Internet service provider (ISP). There are three main considerations for an Internet connection which include speed, reliability, and availability.

POTS - A plain old telephone system (POTS) connection is extremely slow but it is available wherever there is a telephone. The modem uses the telephone line to transmit and receive data.

ISDN - The Integrated Services Digital Network (ISDN) offers faster connection times and has faster speeds than dial-up, and allows multiple devices to share a single telephone line.

DSL- Digital Subscriber Line (DSL), like ISDN, allows multiple devices to share a single telephone line. DSL speeds are generally higher than ISDN.

Cable - Cable Internet connection does not use telephone lines. Cable uses coaxial cable lines originally designed to carry cable television.

Satellite – For people that live in rural areas, broadband satellite Internet connections provide a high-speed connection that is always on.

Wireless – Many types of wireless Internet services are available. The same companies that offer cellular service may offer Internet service.

Examples of Internet Service Providers in Uganda

- MTN Uganda
- Airtel Uganda
- Africell Uganda
- Uganda Telecom
- Vodafone Uganda
- Smile telecom

Factors that affect the speed of an internet

- Computer processor speed
- Software problems
- Hardware problems
- Modem/ Router positioning
- Natural conditions
- Modem speed
- Heavy traffic on the network
- Distance the data travels

Signal attenuation

Signal attenuation refers to the reduction in the strength of a signal during transmission of signal. This can be as result of bad weather, long travel distance, wire leakage and noise

Internet services

After connecting to the internet, the following are the services that we can utilize online.

- **Telnet** – One of the amazing features of the Internet that lets you use the resources of another computer in another part of the world. This is done by remotely logging to the distant computer which is called the host.
- **Email** – It allows the transfer of messages, documents, and pictures among others, across the Internet.
- **Internet Relay Chat (IRC)** –Allows people to converse in real time by typing questions and responses. Chats are usually organized in what we call chat rooms.
- **File Transfer Protocol** – The standard method for transferring files, whether downloading or uploading, to and from your computer with another computer on the internet.
- **Newsgroups** – This is an Internet equivalent of a discussion group or an electronic bulletin board Internet.
- **World Wide Web** – This refers to the global collection of electronic documents called Webpages stored on computers all over the world

14.3.1 The Internet Protocols

The Internet Protocols are set of defined rules and procedures (or software programs) used for communication through which Internet users exchange information on the network.

The common internet protocols

- **TCP/IP - TCP/IP stands for Transmission Control Protocol / Internet Protocol.**

This protocol enables Users (or provides connectivity between browsers and servers) for data communication on the Internet.

- **HTTP– stands for Hypertext Transfer Protocol**
It is the latest protocol used for accessing web pages or documents to and from the Web servers.
- **FTP – FTP stands for File Transfer Protocol.**
This protocol exchanges files between users. A protocol that provides services for file transfer and manipulation.
- **Secure Shell Protocol (SSH)** – A protocol that is used to connect computers together securely.
- **Telnet** – A protocol that uses a text-based connection to a remote computer.
- **POP** – This stands for Post office Protocol. A protocol used to download email messages from an email server.
- **IMAP** – Internet Mail Access Protocol. A protocol used to download email messages from an email server.
- **Simple Mail Transfer Protocol (SMTP)**
- **Internet Protocol (IP)** – IP provides source and destination addressing.

The Web Pages

These are documents written in Hypertext Markup Language and stored on web servers.

The Web Site

A collection of related Web pages stored on a Web server.

URL Address

URL stands for Uniform Resource Locator.

It is a unique address of web page used to identify the location of files on the Internet

Following are some important URL addresses:

<http://www.hotmail.com/document>

- **http**- protocol identifier
- **www.hotmail.com**- domain name
- **document** – document path.

Domain Name System (DNS)

A domain name system (DNS) is the method that the Internet uses to store domain names and their corresponding IP addresses.

The Hyperlinks

This is the word or group of words that you can click on to jump to another page.

The World Wide Web(WWW)

This is the collection of host computers that deliver documents, graphics and multimedia to users via internet

Some important uses of WWW are as follows:

- **Advertisement** - Manufacturers use WWW to provide information of their products.
- **Shopping** - It is possible for user to buy an item using WWW. You can see products and prices, and even order them by using your credit card etc.
- **Flight Information** - It is used to provide the latest information on flights arrivals and departures.

- **Television Station** - WWW is used to provide information about the programs, latest news and special events. Some television show different events live on their websites.
- **News** - Most newspapers have their website. Latest news and interviews are provided on these websites.

14.5 E-MAIL

Electronic mail, commonly referred to as email or e-mail, is a method of exchanging digital messages from an author to one or more recipients.

E-mail Address

E-mail is sent and received with the reference of e-mail address. Therefore, each Internet user must have a unique e-mail account on an e-mail server, to send and receive e-mails.

E-mail address consists of username and address on the Internet. The general format of an e-mail address is:

username @ domain_name Where username - Specifies the name of user or organization.

Domain name - Specifies the name of server or ISP of which the user is member.

An email address usually has two parts:

These two parts are separated by the symbol @ e.g. lakot@email.info.

In this example, lakot is called user ID. It is used to sign into email service. The symbol @ is called "at" sign. It separates the account ID from the name of the e-mail service provider email.info indicates the email service provider.

E-Mail Attachment

Attachment is a powerful feature of e-mail, which enables you to send additional files with your e-mail message.

Advantages of E-mail

There are several advantages of the e-mail facility available on the Internet. The main advantages of e-mail are:

- It is extremely fast and reaches to the destination in a few minutes or even in few seconds.
- Its cost is very low. It is almost free.
- One message can be sent to many persons with a single e-mail.
- It is available round the clock and round the globe.
- You can send and receive e-mail from anywhere in the world provided there is internet connection.
- You can attach and send any type of files.
- It is also possible to send or receive e-mail messages through a mobile phone.

Limitations of E-Mail

Although e-mail, provides the fast and efficient way to send and receive messages. It also has some limitations. These are described below:

- **Lack of Privacy: Email** does not provide high privacy. An email passes from one system another through different networks.
- **Junk Email:** Junk email is an unwanted email. It is also known as spam. A person may send such email that the receiver does not want to read.
- **No Emotions: An** email message cannot express your emotions properly. The receiver cannot view the facial expression or voice of the sender
- **Possible Delay: Email** is read when the user connects to the Internet and checks email account. An urgent message may be ignored or delayed if a person does not check his email account soon.
- **Communication Problems: Email** may not be delivered successfully due to communication errors.

Components of an email

To - It is a text box used to enter the e-mail address of person to whom you want to send mail. More than one e-mail addresses separated with commas can be entered into this box.

Subject - In this textbox the subject or title for the e-mail is written.

CC - CC stands for carbon copy. It is used to write e-mail address of another person.

BCC - BCC stands for blind carbon copy. It is same as CC but email address given in this field is not shown to the other recipients.

Message Box - The main message is typed in this main box.

Send Button - Used to send the e-mail.

Delete Button - Used to delete the e-mail.

Attaching File: You can attach files of any type with message you compose and send via e-mail.

Forwarding E-mail: Sending an e-mail message that one has received to another person is called forwarding e-mail.

14.6 Search Engine

Search engines are the special programs that provide facility to Internet users to find information on the Internet using leading statements or keywords.

The commonly used search engines and their URL addresses are:

- GOOGLE <http://www.google.com>
- YAHOO <http://www.yahoo.com>
- ASK <http://www.ask.com>
- MSN <http://www.msn.com>
- HOTBOT <http://www.hotbot.com>

14.7 Web Browsers

A web browser is a software for retrieving and presenting information resources on the World Wide Web.

The major web browsers are:

- Firefox,
- Google Chrome,
- Internet Explorer,
- Opera, and
- Safari.

COMPUTER COMMUNICATION

Computer communication is the transmission of data and information over a channel between two computers or communicating devices.

Definition of terminologies

- **Encoding:** This is the process through which Information (e.g. data, text, voice or video) from the sending device is converted into signals which the communication medium can carry.
- **Transmission:** This is the process through which the signals are broad cast/ sent out through the medium to the receiving device.
- **Decoding:** This is the process through which the signals are converted back into the information in its original form in the receiving device.
- **Telecommunication:** refers to transmission of data and information over a long-distance, eg television
- **Teleprocessing:** This refers to access and modification of computer files located elsewhere.
- **Downloading:** To Download is to transfer a file to your computer from another on the internet.
- **Uploading:** means to transfer a file from your computer to another on the internet.
- **Throughput:** refers to the rate of how much data is moved during a certain amount of time.

- **Data Encryption:** Process of converting data into coded form (cyphertext) to prevent it from being read or understood by unauthorized people.

Elements of computer communication

- Sender
- Receiver
- Message
- channel

Importance of computer communication

- It allows sharing of hardware like printers.
- It allows sharing of software between two or more computers, hence reducing on cost.
- It allows sharing and transfer of data and information stored on other computers on the network.
- Facilitate communications between people e.g. through electronic-mail, Mobile phones.
- There is tight control over data access in computer communication.
- It enables online learning and collaborative research.
- It allows access to common databases for example in banks.
- Has enabled improved travel service through e-bookings and e-reservation.
- Provides for online employment e.g. telecommuting.

Limitations of computer communication

- **Data theft.** If a computer is a standalone, physical access becomes necessary for any kind of data theft. However, if a computer is on a network, a computer hacker can get illegal access.
- **Rapid Spread of Computer Viruses:** If any computer system in a network gets affected by computer virus, there is a possible threat of other systems getting affected too.
- **Expensive Set Up:** The initial set up cost of a computer network can be high depending on the number of computers to be connected.
- **Dependency on the Main File Server:** In case the main File Server of a computer network breaks down, the system becomes useless.
- **Exposure to External Exploits.** Someone on a different computer can send data to the computer in such a way as to attack it

13.5 TRANSMISSION MEDIA / Bounded transmission media

Describes the type of physical system used to carry a communication signal from one system to another.

Examples of bounded transmission media include: -

- Twisted-pair cable,
- coaxial cable, and
- Fiber optic cable.



Twisted wire

Twisted pair cable comes in two varieties:

- Shielded and
- Unshielded Twisted Pair (UTP).

UTP is the most popular

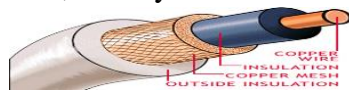
Advantages:

- It is of low cost
- small in size
- easy to install
- It is the most popular and generally the best for schools

Disadvantage:

- Subject to interference
- limited distance, usually less than 100 meters

Coaxial cable



Coaxial cable consists of a single copper wire surrounded by at least three layers of an insulating material, a woven or braided metal and a plastic outer coating. For example; Cable TV wiring.

Advantages

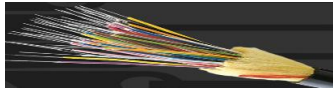
- It is highly resistant to signal interference.
- Used for longer distances (300 – 600 meters)
- Transmits faster than UTP

Disadvantages

- Heavy & bulky
- Needs booster over longer distances

Fiber Optic Cable

Each optical fiber is surrounded by an insulating glass cladding and a protective coating



Advantages:

- Carry significantly more signals than other cables.
- Faster data transmission.
- Less vulnerable to electrical noise from other devices
- Better security for signals during transmission.
- Smaller size, and much thinner and lighter than other cables.

Disadvantages:

- Expensive as compared to other media
- Harder to install and modify.

Wireless Broadcast / unbounded media

Wireless telecommunications technologies transport digital communications signal without cables between communications devices.

Examples

- Microwave
- Satellite
- Infrared and Bluetooth

Microwave

Microwaves are high-frequency radio waves that are sent through the atmosphere and space to deliver telecommunications services, including TV distribution

Satellite

A satellite is basically a microwave station placed in outer space. The satellite receives a signal from the earth, amplifies it, and then rebroadcasts it at a different frequency to any number of earth-based stations.

Infrared

InfraIrDA (Infrared Data Association) ports transmit data via infrared light waves.

Wireless Fidelity (Wi-Fi) Technology

Wi-Fi is a wireless technology that provides a simple connection from anywhere within the range of a base station.

DATA TRANSMISSION

- Telecommunications involves the transmission of data, information, and instructions among computers.
- *Any transmissions sent during these communications can be categorized by a number of characteristics including:*
 - the signal type,
 - transmission mode,
 - transmission direction, and
 - transmission rate.

Signal type:

There are two types of signals; analog and digital

Analog Signals: An analog signal uses variations which are represented by a continuous waveform to convey information.

Digital signal: A digital signal is a series of discrete (discontinuous) bits which are simply the presence or absence of an electric pulse.

13.5.1 Transmission Modes

The **transmission mode** refers to the number of elementary units of information (bits) that can be simultaneously translated by the communications channel.

There are two basic transmission techniques for separating the groups of bits: asynchronous transmission and synchronous transmission

- **Asynchronous transmission**
Asynchronous transmission transmits one byte at a time over a line at random intervals.
- **Synchronous transmission**
Synchronous transmission transmits groups of bytes simultaneously at regular intervals.

Transmission Direction

The direction in which data flows along transmission media is characterized as

- simplex,
 - half-duplex,
 - full-duplex or
 - multiplex
-
- **A simplex connection:** is a connection in which the data flows in only one direction, from the transmitter to the receiver. (for example, from your computer to the printer or from the mouse to your computer, TV station to your TV...).
 - **A half-duplex connection:** is a connection in which the data flows in one direction or the other, but not both at the same time. Example: Two-way radios, police or emergency mobile radios
 - **A full-duplex connection:** is a connection in which the data flow in both directions simultaneously. Broadband technologies, such as digital subscriber line (DSL) and cable, operate in full-duplex mode.
 - **Multiplex connection:** In multiplex transmission, several different types of signals can be carried at once through the same line. E.g. During Video calls where Images

Serial and parallel transmission

The **transmission mode** refers to the number of elementary units of information (bits) that can be simultaneously translated by the communications channel.

Parallel connection

Parallel connection means simultaneous transmission of *number of* bits.

Serial connection

In a serial connection, the data are sent one bit at a time over the transmission channel.

13.6 NETWORK TOPOLOGY

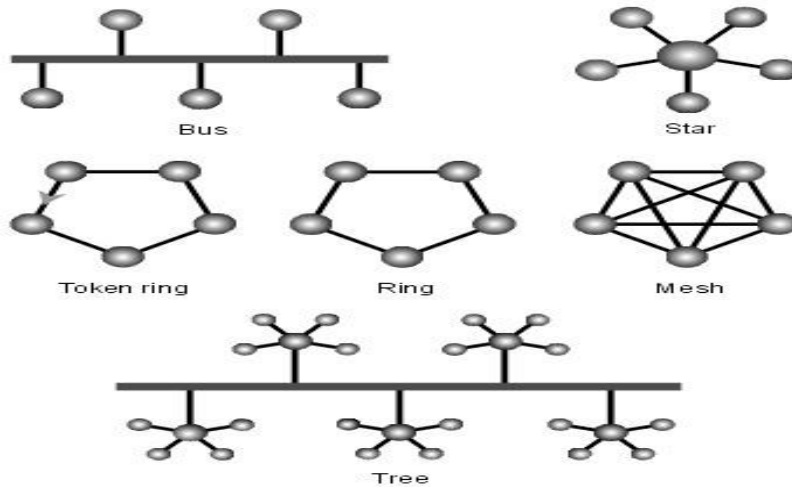
In communication networks, *a topology is a schematic description of the arrangement of a network, including its nodes and connecting lines.* There are two ways of defining network geometry: the **physical topology** and the **logical (or signal) topology**.

The **Network topology** refers to the way in which computers and other devices have been arranged or how data flow is passed from one computer to another in the network.

13.6.1 PHYSICAL TOPOLOGY

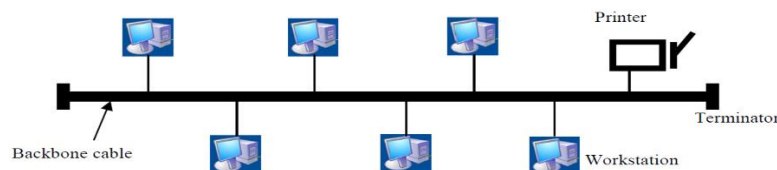
Physical topology is the physical layout of the components on the network. The physical topology of a network is the actual geometric layout of workstations.

There are several common physical topologies, as described below and as shown in the illustration.



The Bus Network Topology

In the bus network topology, every workstation is connected to a main cable called the bus. Therefore, in effect, each workstation is directly connected to every other workstation in the network.



Merits of BUS Topology

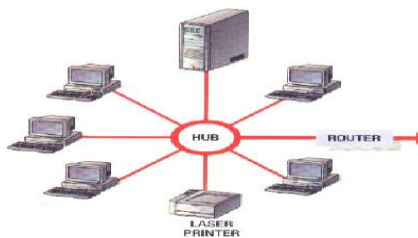
- Easy to implement and extend (quick setup)
- Cheaper than other topologies.
- Computers and devices can be attached and detached at any point on the bus without disturbing the rest of the network.
- Failure of one device usually does not affect the rest of the bus network.
- Data, instructions, and information in a bus network can be transmitted in both directions.
- Cable faults are easily identified.
- Weight reduction due to less wires

Demerits of BUS Topology

- If there is a problem with the cable, the entire network goes down.
- There is no central host computer to control the network.
- Only one device can transfer items at a time.
- If many computers are attached, the amount of data flowing along the cable increases, data collisions occur and the network slows down.
- Limited cable length and number of stations.
- Performance degrades as additional computers are added or on heavy traffic. (shared bandwidth)
- It is slower than the other topologies.

The Star Network Topology

In the star network topology, there is a central computer or server to which all the workstations are directly connected. Every workstation is indirectly connected to every other through the central computer.



Merits of a Star Topology

- Easy to install and maintain.
- Better performance: The star topology prevents the passing of data packets through an excessive number of nodes.

- Computers and devices can be added to or removed from the network with little or no disruption to the network.
- Reliable because each device connects directly to the hub, if one device fails, only that device is affected.

Demerits of a Star Topology

- If the hub fails, the entire network fails
- Lots of cable required so that the installation cost is expensive.
- Network size is limited by the number of connections that can be made to the hub.
- Performance for the entire network depends on the capabilities of the hub.
- Set up of the system can be very complex.

The Ring Network Topology

In the ring network topology, the workstations are connected in a closed loop configuration. Adjacent pairs of workstations are directly connected.



Advantages of Ring Topology

- Ring topology Can cover a larger distance as compared to a bus network and is commonly used in wide area networks (WAN)
- No collisions occur because data takes one direction only
- Very orderly network where every device has access to the token and the opportunity to transmit
- The speed of data transmission is faster than in a bus topology.

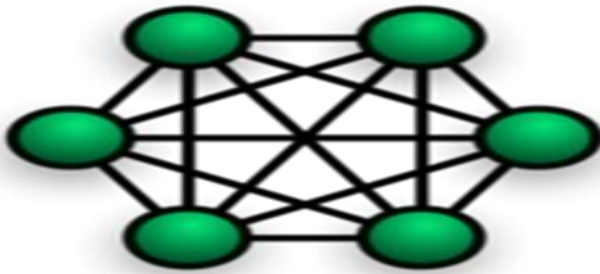
Demerits of a Ring Topology

- Ring Topology Network is More difficult to establish.
- If the cable fails, the whole network goes down.
- Data messages travel in only one direction from device to device around the entire ring
- If a node on a ring network fails, all nodes after the failed nodes cannot function.
- There is no central host computer to control the network.

- Moves, adds and changes of devices can affect the network

The Mesh Network Topology

This is the type of network topology in which each of the nodes of the network is connected to each of the other nodes in the network.



Merits of Mesh Topology

- Data will always be delivered.
- All of the data that is transmitted between nodes in the network takes the shortest path between nodes.
- In the case of a failure or break in one of the links, the data takes an alternate path to the destination.

Demerits of Mesh Topology

- Mesh topology is generally too costly and complex for practical networks, and very hard to setup.
- Lots of cable required so that the installation cost is expensive.
- Network size is limited by the number of interconnections that can be made between the computers.
- It requires that the nodes of the network possess some type of logical 'routing' algorithm to determine the correct path to use at any particular time

The Tree Network Topology / Hierarchical network topology

The tree network topology uses two or more star networks connected together. The central computers of the star networks are connected to a main bus. Thus, a tree network is a bus network of star networks.



13.6.2 LOGICAL (OR SIGNAL) TOPOLOGY

Logical topology is one that determines how the hosts access the medium to communicate across the network

Factors to consider When Choosing a Topology

- Cost.
- Future growth:
- Length of cable needed.
- Number of computers to be connected
- Level of security required

13.7 Networking Hardware Devices

Networking devices are used to connect computers and peripheral devices so they can communicate. These include NIC, hubs, bridges, and switches.

Network Interface Card



The *Network Interface Card* (NIC) has interfaces for twisted pair, thicknet and thinnet connectors.

Often abbreviated as *NIC*, an *expansion board* you insert into a computer so the computer can be connected to a network.

Repeater

Wireless repeater is a device usually used to extend wireless coverage in wireless network by repeating the wireless signal generated by wireless router/access point.

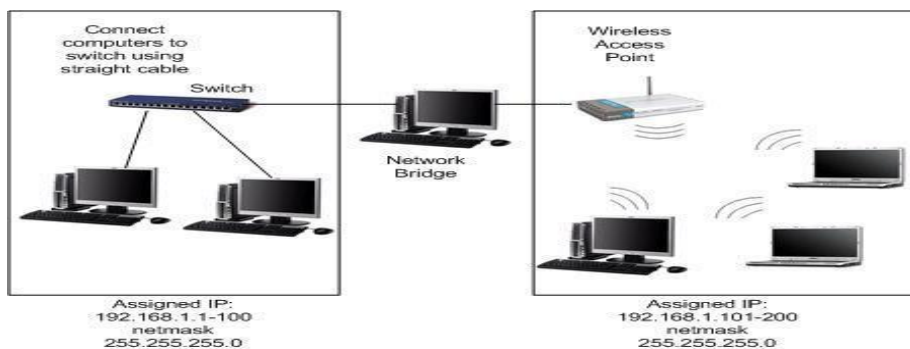
Hub

Hubs regenerate and retime network signals. Hubs propagate signals through the network and they cannot filter network traffic.

Network Repeater

A repeater connects two segments of your network cable. It retimes and regenerates the signals to proper amplitudes and sends them to the other segments.

Bridge



A bridge reads the outermost section of data on the data packet, to tell where the message is going. It reduces the traffic on other network segments, since it does not send all packets.

Network Router

A router is used to route data packets between two networks. It reads the information in each packet to tell where it is going.

Gateway

A gateway can translate information between different network data formats or network architectures.

Switch

Switches are sometimes called multiport bridges. A typical bridge may have just two ports, linking two segments of the same network. A switch has several ports, depending on how many network segments are to be linked.



Networking Operating System

A network operating system (NOS) is the system software that organizes and coordinates the activities on a network.

Examples of NOSs include:

- Novell NetWare
- Microsoft Windows server 2003 and 2008.
- AppleShare
- Unix /NFS
- Sun Solaris

Some important terms in networking

Packets and Packet Switching

Packets are data divided into smaller pieces and sent over the internet

Packet switching

This is the technique of breaking a message into individual packets, sending the packets along the best route available, and then reassembling the data.

Social networking

This is an online platform or site that focusses on facilitating social relations among people who share common interests.

Common examples of social networking sites:

- Facebook
- WhatsApp
- Twitter
- Telegram
- Instagram

Advantages of social networking

- Improves social skills
- Facilitates group discussions
- Facilitates advertisements
- Helps in communication

Disadvantages of social networking

- Minimizes privacy
- Leads to cyber bullying
- Wastages of valuable time

E- learning

This is the use of electronic media and information and communication technology in education

E-commerce

This is the process of buying and selling of goods over the internet and computer networks

E- banking

This is the method used by people to make transactions and manage their own finances using networks without having to go to their banks

Web portal:

This is a specially designed website that brings information from diverse sources together in a uniform way.

Bandwidth:

Bandwidth is the amount of data that can be transferred from one point to another in a specified period of time within a network.

