

# Computer Networks

Er. Rajan Karmacharya

Lecturer (Dept. Of CSIT)

St. Xavier's College



# Introduction



# Introduction

- Computer Network is the interconnection of two or more than two computers by means of transmission medium and protocols (logical rules) to exchange information.
- Transmission medium like twisted pair, coaxial cable, etc provide physical path for transmission between computers in a network
- Protocols are the set of rules which the computers must follow to communicate with each other.
- Telecommunication is the sending of information in any form from one place to another using electronic or light emitting media.
- Data communication is a more specific term that describes the transmitting and receiving of data over communication links between one or more computer systems and a variety of input/output terminals.
- All forms of telecommunications now heavily rely on computers and computerized devices.

## Benefits of network:

Benefits of network can be studied under following three headings:

- Network for companies
- Network for people
- Network for social issues

## Benefits of network:

### 1. Network for Companies

#### a. Resource Sharing:

- Resource sharing means the availability of the required information irrespective of the physical location of the resources and the user.
- The resources can be anything like peripheral devices (e.g. printers) and other information stored in the computer.

#### b. High Reliability:

- High availability means confirmation with which we can obtain required information.
- There may be obstructing factors like hardware failure that affects the data transfer from a computer. If one of the computers is being obstructed, there should be another computer or any other source providing the same data.
- Having a network means having alternate source of providing data.

## Benefits of network:

### 1. Network for Companies

- c. **Simultaneous Access:** Different users can access the same information or the data files at the same time.
- d. **Saving Money:** downsizing (shifting of use of expensive computer like mainframe to the cheaper computers like microcomputers) process has made the company to save money.
- e. **Communication Medium:** Computer Network provides a powerful communication medium among widely separated employees of a company

## Benefits of network:

### 2. Network for people:

#### a. Access to remote information:

- People have access to information systems like the current World Wide Web, which contains information about art, business, technology and too many other topics.
- All these applications involve interactions between a person and a remote database.  
e.g. people pay their bills, manage bank accounts, etc.

#### b. Person to person communication: communication takes place through data communication applications like email, chat, etc.

#### c. Interactive entertainment: It includes the features like video on demand and game playing.

## Benefits of network:

### 3. Network for social issues:

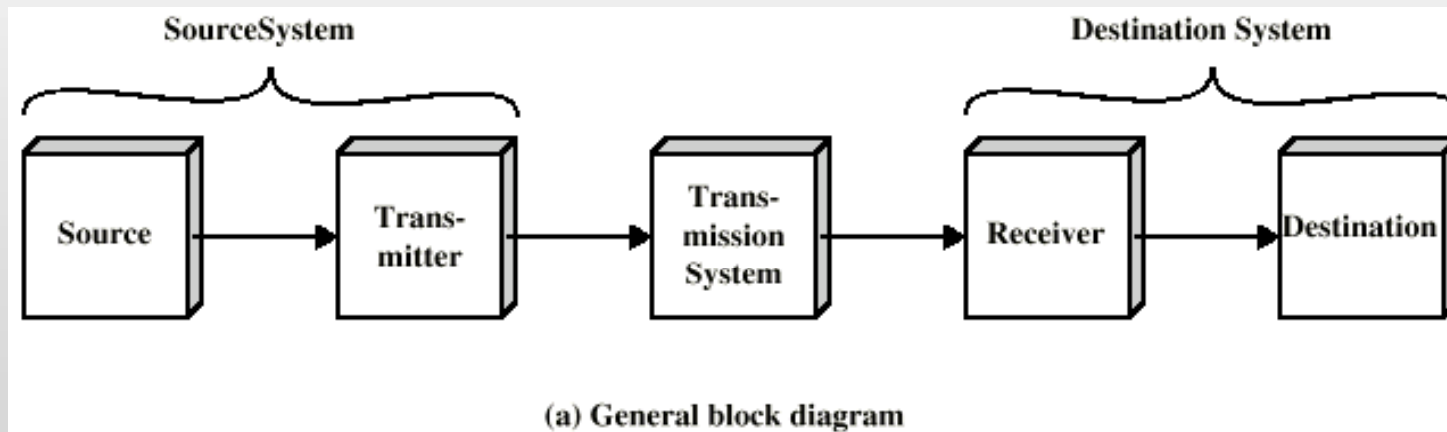
- Popular features of many networks are newsgroups or bulletin boards where people can exchange messages with like-minded individuals.
- The basic use of the computer has been the freedom for each user to distribute their views in different ways to different audiences.
- But this freedom of expressing views brings many unsolved socials, political and moral issues.



# Overview of Network

Data Communication model consists of:

- Source: generates data to be transmitted
- Transmitter: Converts data into transmittable signals
- Transmission System :Carries data
- Receiver: Converts received signal into data
- Destination: Takes incoming data



## Overview of Network

Data communication requires following **components**  
(simply **components required for networking**):

- Terminals
- Telecommunication Processors
- Telecommunication Channels and Media
- Computer
- Telecommunication Software

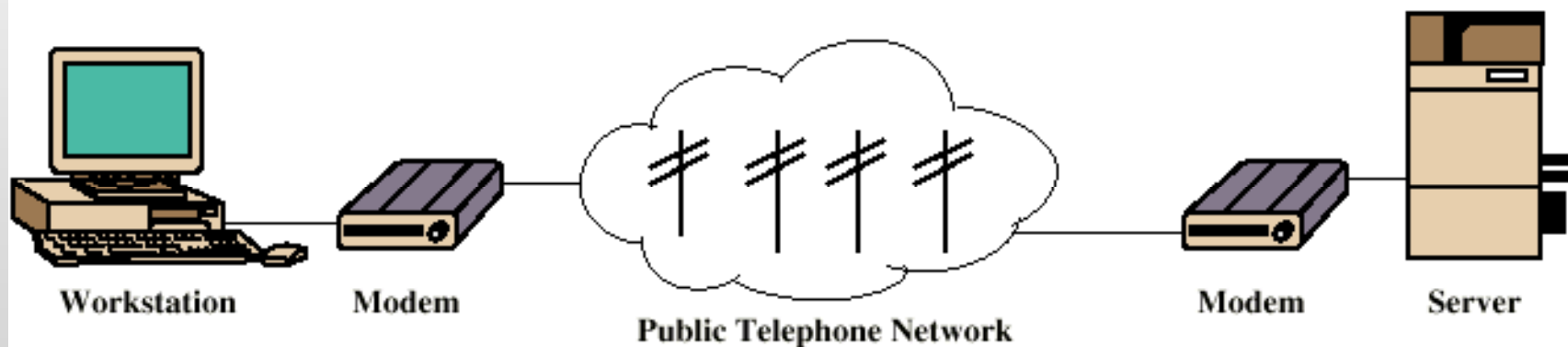
# Overview of Network

## Terminals:

- Any input/output device that uses a network to transmit or receive data is a terminal.
- It includes video display terminals and end user workstations like microcomputers, telephones, fax machines, etc.

## Telecommunication Processors:

- These are devices which support data transmission and reception between terminals and computers like modems, multiplexers, etc.
- E.g.: Modem is telecommunication processor which helps in converting analog data to digital and digital data to analog for the accurate and reliable data



(b) Example

# Overview of Network

## **Telecommunication Channels and Media:**

- The media over which data are transmitted and received are called telecommunication channels.
- E.g. twisted pair wire, coaxial cable, fiber optic cable, radio waves, etc.

## **Computer:**

- Network interconnects computer of all sizes so that they can carry out their information processing tasks.
- E.g.: A mainframe computer may serve as a host computer for a large organization's network and minicomputers acting as network servers for smallest networks for microcomputer workstations.

# Overview of Network

## **Telecommunication Software:**

- Telecommunication software consists of programs that reside in host computer systems, communication control computers and end user computers.
- This controls the telecommunication activities of the computer systems and manage the functions of networks.

# Overview of Network

## Functions of Telecommunication Software:

### a. Access Control:

- This function establishes the connection between the terminal and computers with the use of communication processors
- The communication processor aids in determining the transmission speed, mode of transfer and direction.

### b. Transmission Control:

- This function allows computers and the terminals to communicate with higher reliability.
- Error detection and correction is provided.

### c. Network Control:

- This function manages the communication in a network.
- Software determines transmission priorities, route messages, polls terminals in the network, etc.
- It also logs statistics of network activity and resource usage and performs error detection and correction.

# Overview of Network

## d. Error Control

- This function is added for special errors like line noise and power surges.
- Line noise and power surges are the fluctuation in the voltage transmitted.
- Communication software and processors control errors in the transmission by several methods like parity check, cyclic redundancy check (CRC), etc.
- A signal is sent back to the source terminal or computer as an indicator to retransmit the previous message.
- Error correction is attained through retransmission.

## e. Security Control

- It protects a communication network from unauthorized access.
- Access control software restricts access to data and the computing resources in the network from unauthorized users.
- Security is maintained by the use of encryption and decryption.
- Encryption means converting the original signal to non-understandable language.
- Decryption means to attain the original data from the encrypted data.

## Communication Processors

- Communication processors resemble computer CPUs in that they have similar circuitry, have memories and can be programmed.
- But the purpose of communication processors is limited to enhance data communication between two points.
- Examples of communication processors are: Modem, message switchers, multiplexers, concentrators, controllers and front end processors, NIC, bridge, routers, etc.



# Communication Processors

## Modem

- The most common type of communication processors
- The modem connected at the source computer converts the digital signal generated by the computer into an analog signal to be carried by a public access phone line. This process is called modulation.
- The modem connected at the destination computer converts the analog signals received over a phone line into digital signals usable by the computer. This process is called demodulation.
- The term modem is a composite word that refers to the two functional entities that make up the device: a signal modulator and a signal demodulator
- A modulator converts a digital signal to an analog signal.
- A demodulator converts an analog signal to a digital signal.

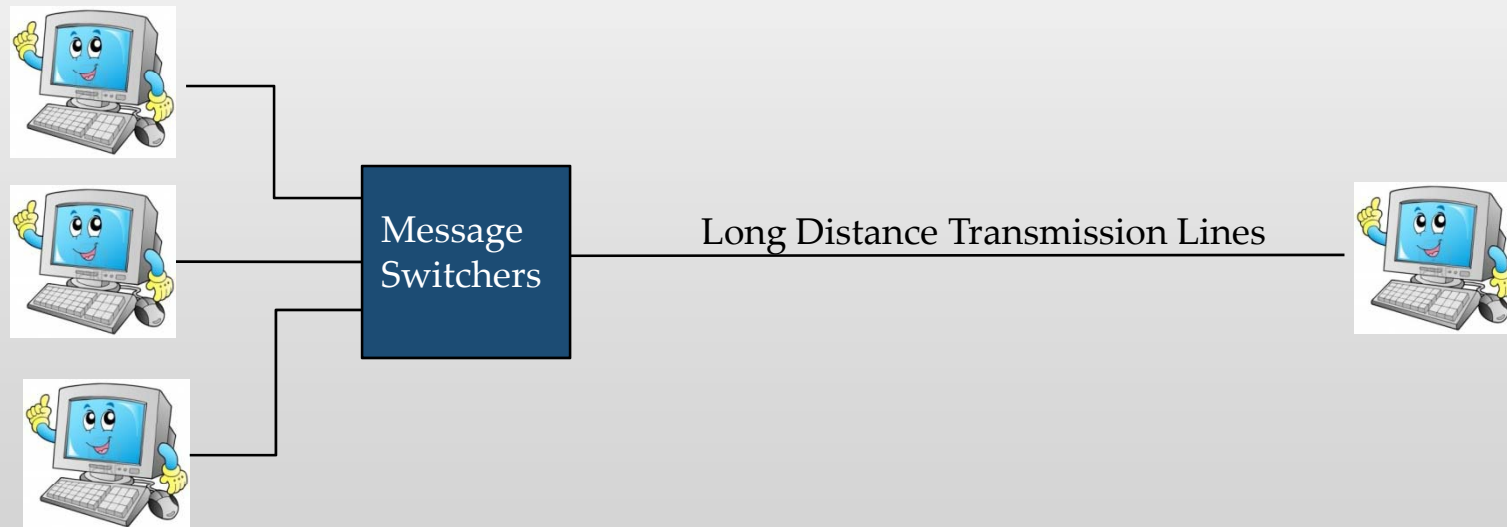
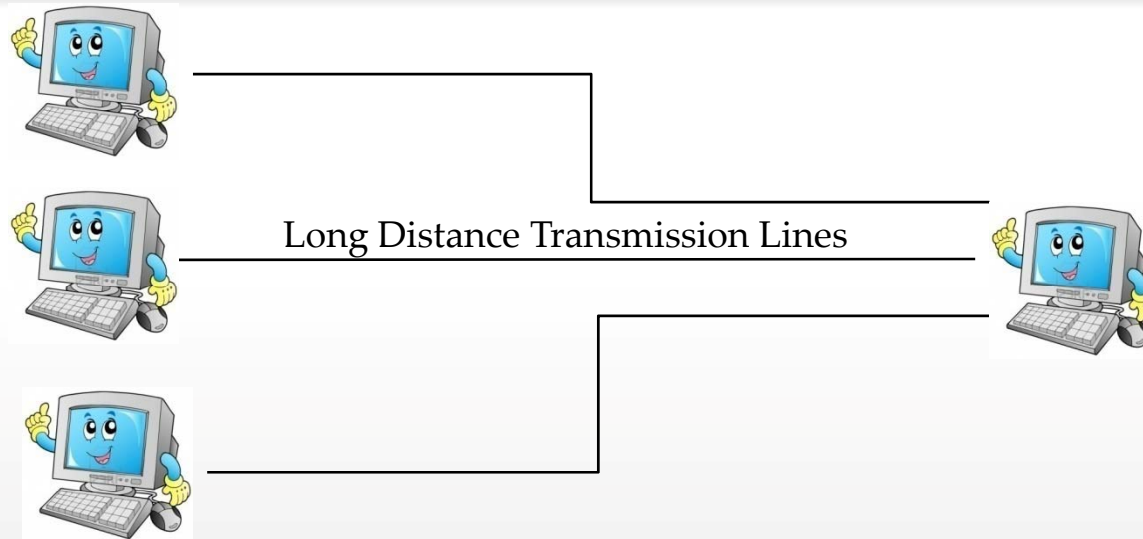
# Communication Processors

## Message Switchers:

- A message switcher is a processor that receives data from the terminals, appends the destination address and routes them one at a time from source to destination.
- Advantage: Reduces long distance transmission costs, since only a single line is needed.

## Multiplexers

- It is similar to message switches except that it allows several terminals to send data through a single line (medium) simultaneously.
- Multiplexers are used only when the data transmission capacity of the medium is greater than the transmission capacity of the source terminal.
- The process used by multiplexers is called multiplexing.



# Communication Processors

## Concentrators

- A concentrator is essentially a smarter multiplexer- it can be programmed, has more processing capability and is more flexible than a multiplexer.

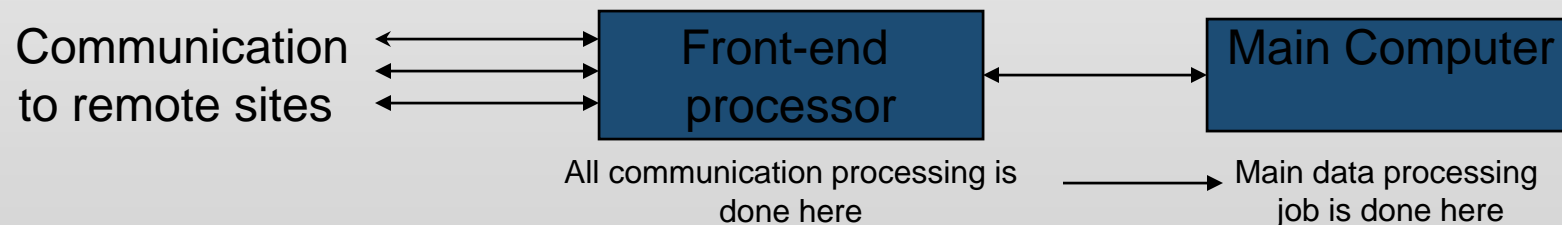
## Controllers

- **Controllers link groups of terminals or other devices to a communication channel.** The controller polls the status of each terminal and transfer data from a terminal to the host computer when necessary.
- Polling is a process in which the server checks all its adjoint terminals for their needs regarding the network and determines the status of network.

# Communication Processors

## Front end processors

- The purpose of front-end processor is to relieve the central computer of some of the communications tasks, leaving the larger computer free for processing applications programs.
- A front-end processor is usually installed in the same location as the main computer.
- It virtually acts like an intelligent terminal, or like a secretary/receptionist of the main computer.



# Communication Processors

## Network Interface Card

- The network interface card (NIC) provides the physical connection between the network and the computer workstation.
- Most NICs are internal, with the card fitting into an expansion slot inside the computer
- Network interface cards are a major factor in determining the speed and performance of a network. It is a good idea to use the fastest network card available for the type of workstation you are using.
- The three most common network interface connections are Ethernet cards, LocalTalk connectors, and Token Ring cards
- Ethernet is the most popular.

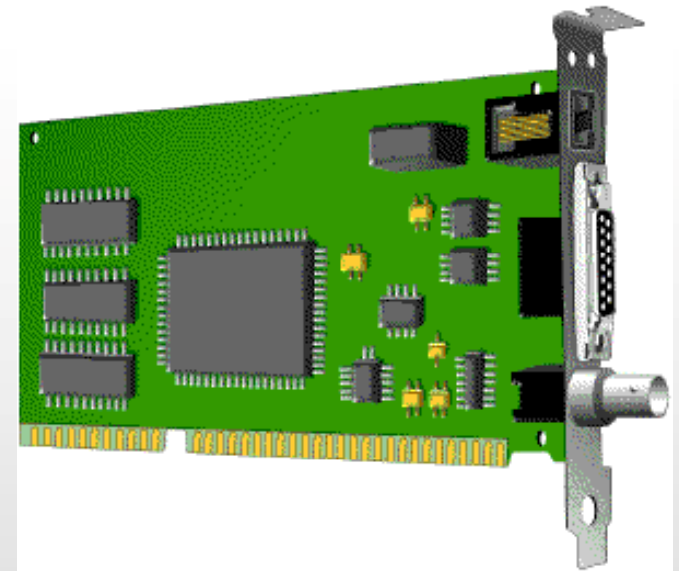


Fig. 1. Ethernet card.  
From top to bottom:  
RJ-45, AUI, and BNC  
connectors

# Communication Processors

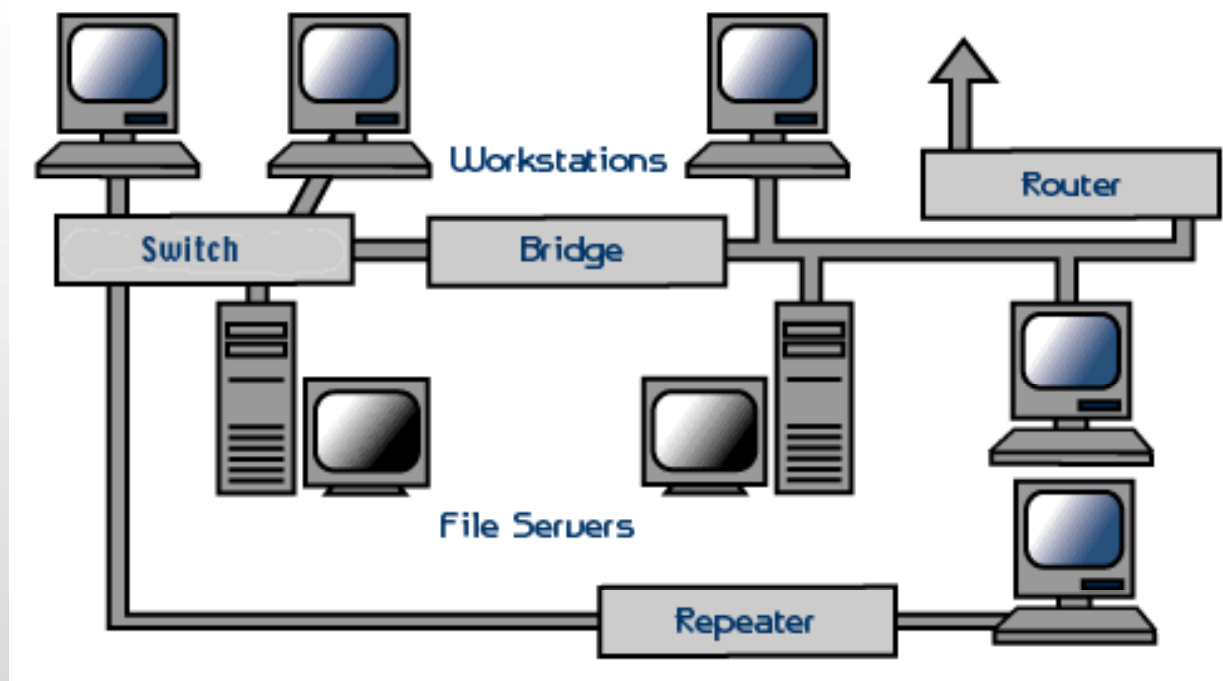
## Concentrators/Hubs

- A concentrator is a device that provides a central connection point for cables from workstations, servers, and peripherals.

## Bridges

- A bridge is a device that allows you to segment a large network into two smaller, more efficient networks.
- If you are adding to an older wiring scheme and want the new network to be up-to-date, a bridge can connect the two.
- Bridges can be used to connect different types of cabling, or physical topologies.

# Communication Processors





# Communication Processors

## **Routers:**

- Routers relay packets among multiple interconnected networks.
- Routers select the best path to route a message, based on the destination address and origin.
- Routers acts like stations on a network.

## **Repeaters:**

- Since a signal loses strength as it passes along a cable, it is often necessary to boost the signal with a device called a repeater.
- The repeater electrically amplifies the signal it receives and rebroadcasts it.
- They are used when the total length of your network cable exceeds the standards set for the type of cable being used.
- A good example of the use of repeaters would be in a local area network using a star topology with unshielded twisted-pair cabling. The length limit for unshielded twisted-pair cable is 100 meters.
- The repeator amplifies all the signals that pass through it allowing for the total length of cable on the network to exceed the 100 meter limit.

# Communication Media

- Computers and other telecommunication devices use signals to represent data.
- These signals are transmitted from one device to another in the form of electromagnetic energy.
- Electromagnetic signals can travel through a vacuum, air, other transmission media.
- Transmission media can be classified in two categories:
  - a. Guided media
  - b. Unguided media (Wireless media)

# Communication Media

- Wired
  - UTP
  - STP
  - Coaxial
  - Fiber Optic
- Wireless
  - Microwave
  - Satellite Communication

# Communication Media

## a. Guided media

- A signal traveling along the guided media is directed and contained by the physical limits of the media
  
- These include
  - A. Twisted pair cable
  - B. Coaxial cable
  - C. Fiber optic cable

# Communication Media

## A. Twisted Pair:

- Twisted pair cable consists of two insulated strands of copper wire twisted around each other.
- The twisting is done in order to avoid interference of noise.
- It is of two type:
  - UTP (Unshielded Twisted Pair)
  - STP (Shielded Twisted Pair)

### UTP (Unshielded Twisted Pair)

- Consists of a number of twisted pairs of wires with a simple plastic casing.
- Has low cost, so it is commonly used for local area network (LAN) and telephone connection.
- Suitable for transmitting voice and data.
- Twisting does not eliminate the noise completely, it reduces the effect of noise on the cable.

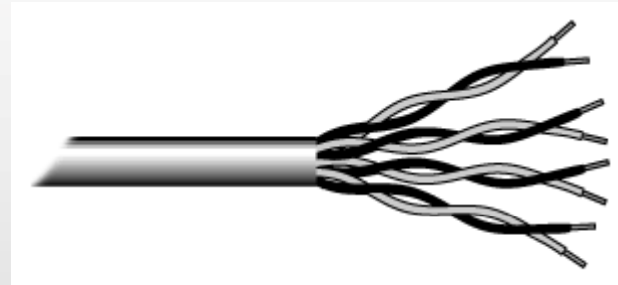


Fig Unshielded twisted pair

# Communication Media

## UTP (Unshielded Twisted Pair)

- Supports data transfer rates from 1 to 100 Mbps at a distances up to 100 meters.
- According to EIA/TIA (Electronic Industry Association/Telecommunication Industry Association) standard, UTP has been graded into five categories:

Type	Use
Category 1	For voice transmission Only (Telephone Wire)
Category 2	For data transmission at 4 Mbps
Category 3	For data transmission at 10 Mbps
Category 4	For data transmission at 16 Mbps
Category 5	For data transmission at 100 Mbps

# Communication Media

## UTP Connector:

- The standard connector for UTP cabling is a RJ-45 connector
- RJ stands for Registered Jack.

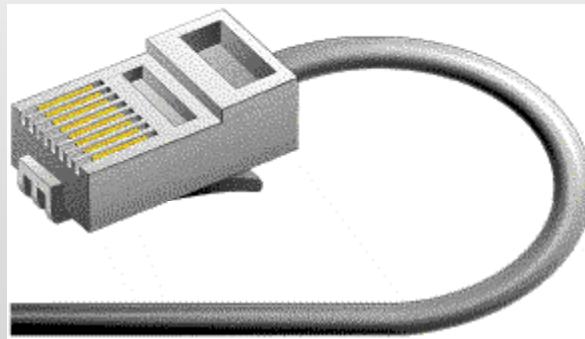
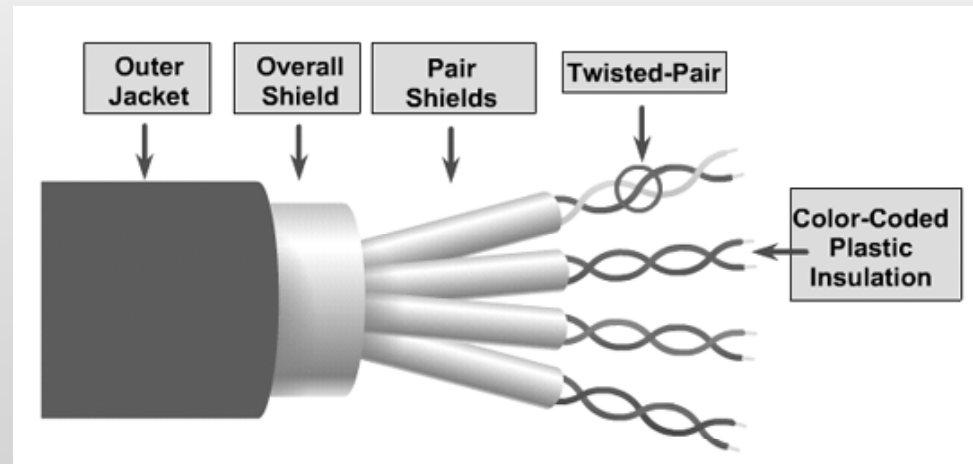


Fig. RJ-45 connector

# Communication Media

## STP (Shielded Twisted Pair)

- STP cable is similar in construction to UTP except that each twisted pairs are enclosed by the metal foil.
- It provides extra protection from external interference.
- It can also eliminates a phenomenon called crosstalk.
- Crosstalk occurs when one line (acting as a kind of receiving antenna) picks up some of the signals traveling down another line (acting as a kind of sending antenna). This experience can be experienced during telephone conversation when one can hear other conversation in the background.
- STP is quite more expensive than UTP

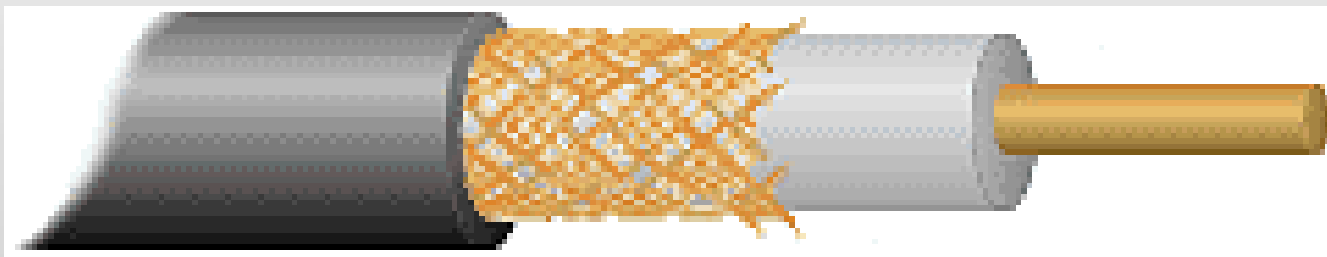




# Communication Media

## B. Coaxial Cable

- Coaxial cabling has a single copper conductor at its center.
- A plastic layer provides insulation between the center conductor and a braided metal shield
- The metal shield helps to block any outside interference from fluorescent lights, motors, and other computers.
- It is highly resistant to signal interference. So, it can support greater cable lengths between network devices than twisted pair cable.



Coaxial cable

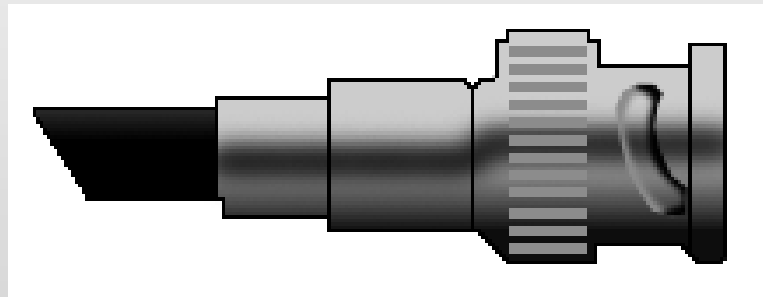
# Communication Media

- Two types of coaxial cable
  - a. **Thin coaxial cable**
    - Also called thinnet or 10Base2 cable.
    - 10Base2 refers to the specifications for thin coaxial cable
    - The 2 refers to the approximate maximum segment length being 200 meters
    - 10 refers to the speed (data rate) of the signal which is 10 Mbps.
    - Base defines the signal to be original i.e. no change is made to the signal before transmission.
  - b. **Thick coaxial.**
    - Also called thicknet or 10Base5 cable.
    - 10Base5 refers to the specifications for thick coaxial cable
    - The 5 refers to the approximate maximum segment length being 500 meters
    - 10 refers to the speed (data rate) of the signal which is 10 Mbps.
    - Base defines the signal to be original i.e. no change is made to the signal before transmission.

# Communication Media

## Coaxial Cable Connector:

The most common type of connector used with coaxial cables is the Bayonet-Neill-Concelman (BNC) connector .

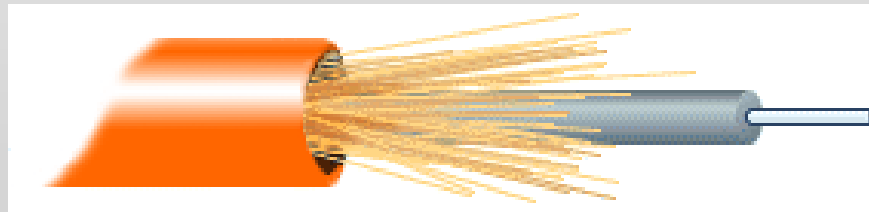


BNC connector

# Communication Media

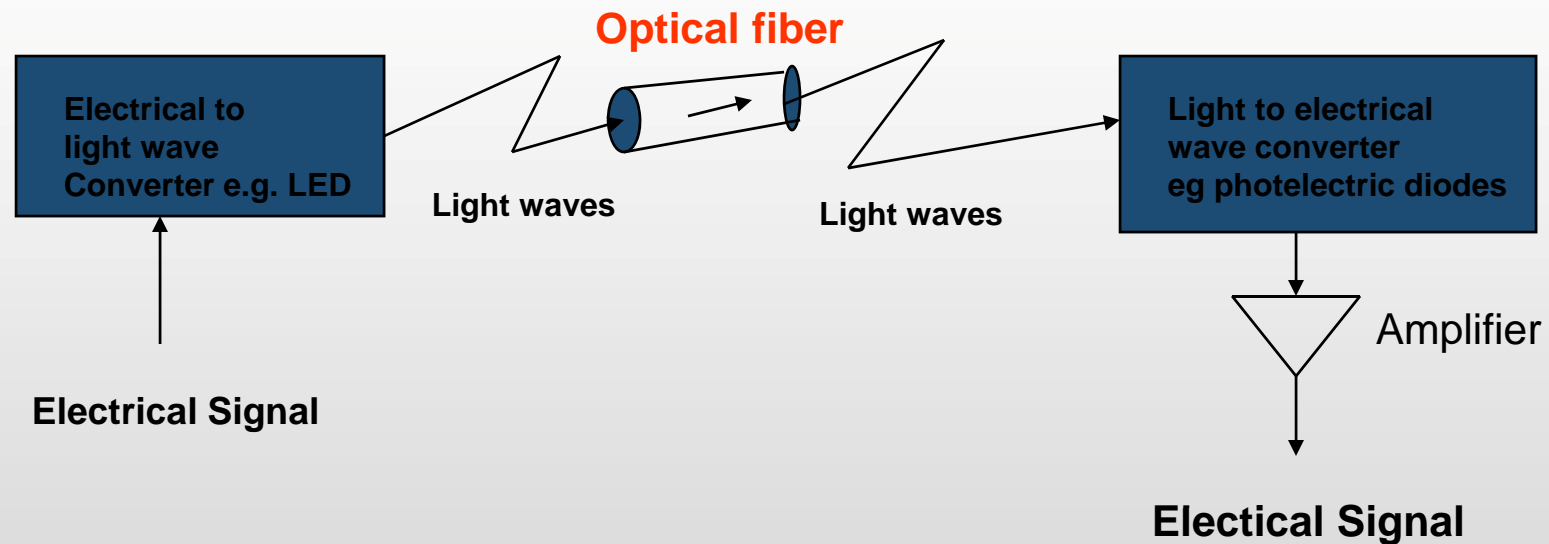
## C. Fiber Optic Cable

- Optical fibers are hair-thin threads of a glass or plastic surrounded by several layers of protective materials
- It transmits light rather than electronic signals
- Because light travels much faster than electricity, optical fibers can transmit data at much higher speed than twisted pair cables and coaxial cables.
- Optical fibers are made of plastic, glass or silica.
- Plastic fibers are less efficient and are cheaper than glass fibers.
- Glass or silica fibers are much smaller and have lower attenuation (property in which strength of a signal decreases with the increase in distance traveled by the signal). So they are high capacity channels.



# Communication Media

## C. Fiber Optic Cable



**Fig. An optical fiber communication system**

# Communication Media

## Advantages of optical fibers:

- a. **Large Bandwidth:** Fiber optical cables have 10 to 100 times greater bandwidth than twisted pair and coaxial cables. That means they can carry more data at very high speeds and to long distances.
- b. **Low loss:** There is no significant loss of intensity of light signal over distances as it can travel at very high speed. Optical fibers have lower attenuation. So light signals is not required to amplify much. Ultimately, repeaters need not be placed so close together as in coaxial cable.
- c. Optical fiber transmissions are not affected by electrical and magnetic interferences.
- d. Optical fibers are smaller in size and lighter in weight than coaxial or twisted pair cables.
- e. **Security:** Provides security against unauthorized tampering of information, since it is difficult to tap optical signals.
- f. Both analog and digital signals can be transmitted by the use of optical fibers.

# Communication Media

## Disadvantages of Optical Fiber

- Optical fibers are fragile and cannot be bent.
- Joining two optical fiber cables is not simple and easy.

## Fiber optic connector:

- The most common connector used with fiber optic cable is a ST connector.



# Communication Media

## **B. Unguided Media/ Wireless LANs:**

- Wireless LANs use high frequency radio signals or infrared light beams to communicate between the workstations and the file server.
- Each workstation and file server on a wireless network has some sort of transceiver/antenna to send and receive the data.
- Information is relayed between transceivers as if they were physically connected
- 2 most common type of wireless communication are:
  - a) Microwave System
  - b) Satellite Communication

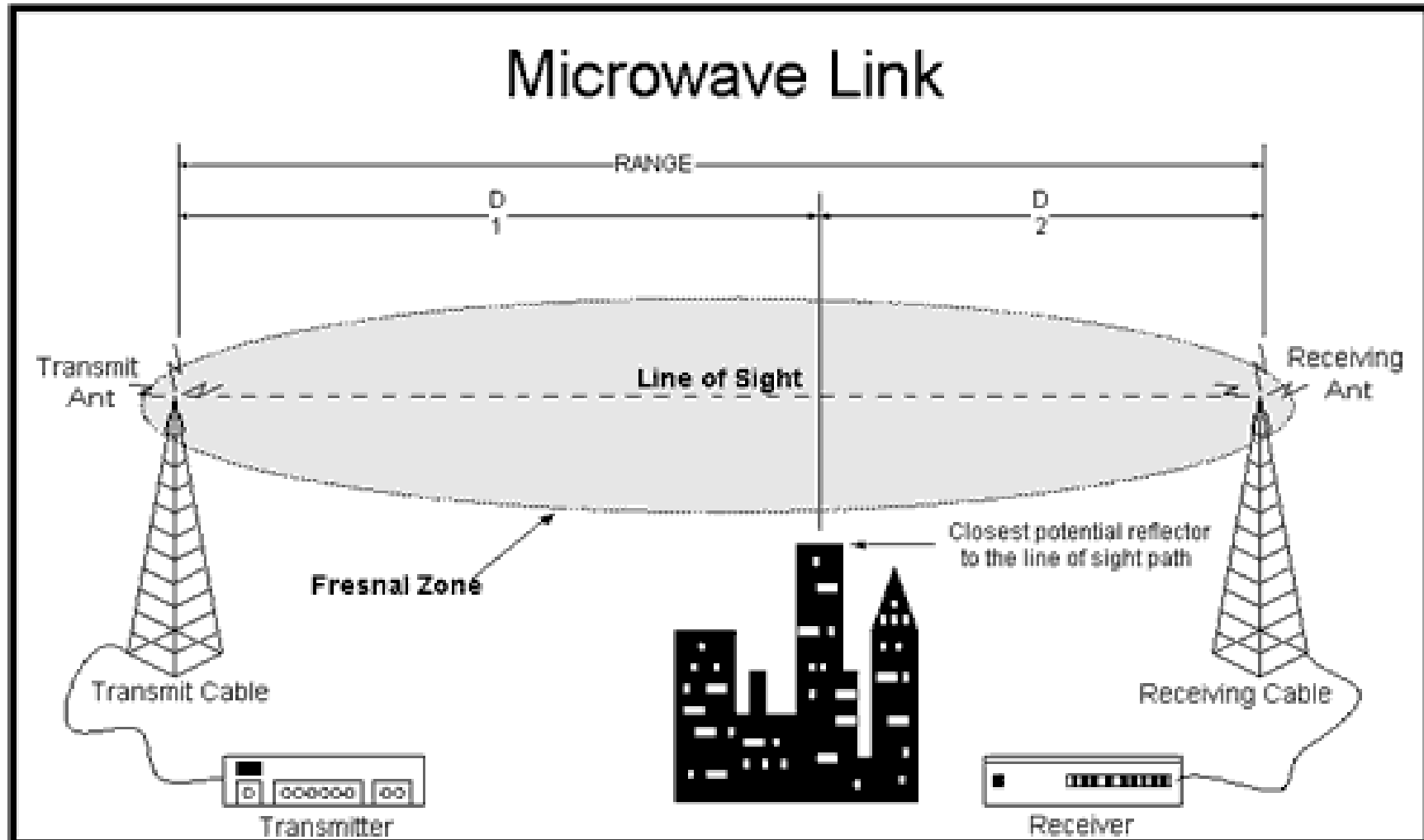


# Communication Media

## a) Microwave System

- Uses high frequency radio signals to transmit data through space.
- Line of sight communication is required.
- Line of sight communication means that there must be an unblocked direct line between the workstation and the transceiver.
- It is mainly used for short distance transmission.
- Repeaters are used at regular intervals of about 25 to 30 kms in between the transmitting and receiving station.
- Data transmission rate is about 16 Gigabits per second.

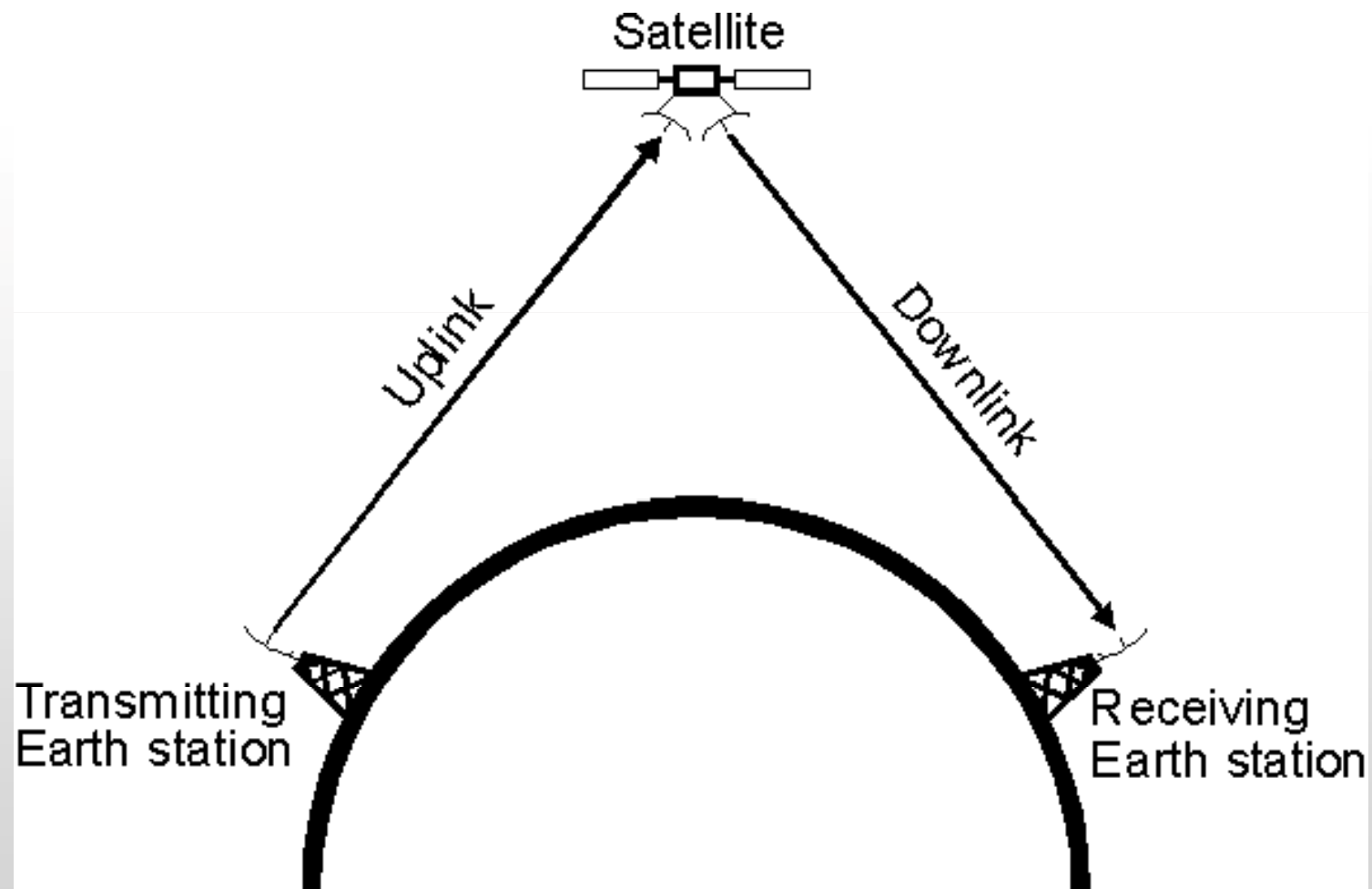
# Microwave Link



# Communication Media

## b) Satellite Communication

- It is much like the line of sight microwave transmission in which one of the stations is a satellite orbiting the earth.
- The principle is the same as the microwave system, with a satellite acting as a supertall antenna and repeater.
- Satellite communication can provide transmission capability to and from any location on earth, no matter how remote. There is no limitation imposed on distance.
- The satellites are basically positioned 36,000 km above equator with an orbit speed that exactly matches the earth's rotation speed.
- The process of transferring data to the satellite is called uplink and the process of obtaining data from the satellite is called downlink.
- The data transfer rate of uplink is usually lower than that of the downlink.



# Types of Network

- LAN
- MAN
- WAN

# Types of Network

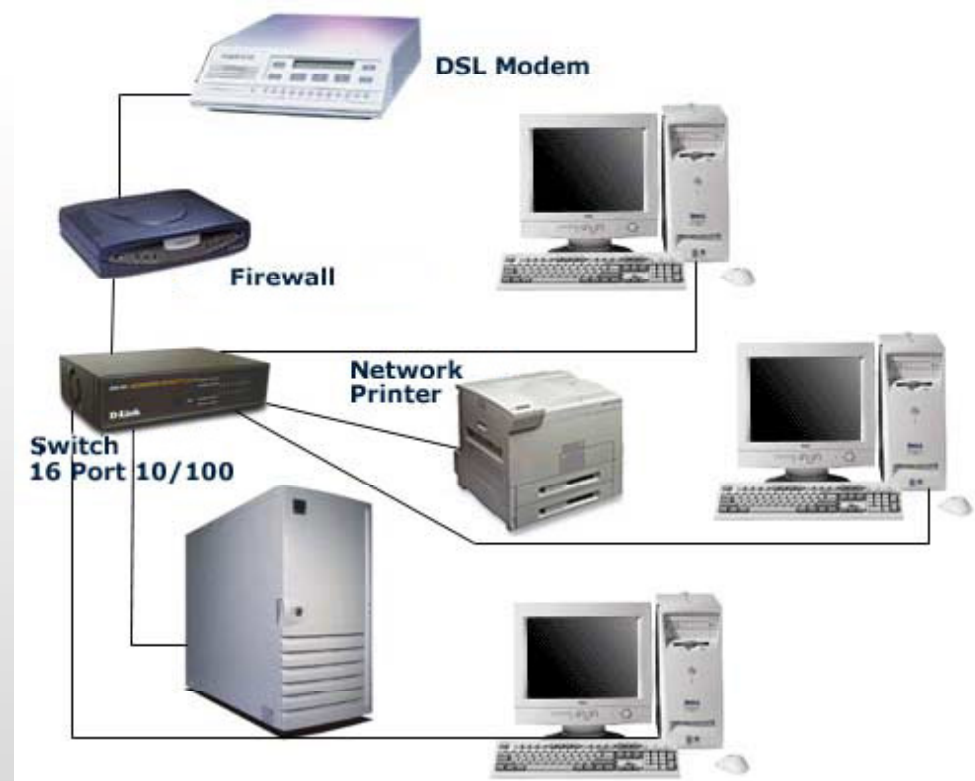
Basically 3 different types of networks

- a. Local Area Network (LAN)
- b. Metropolitan Area Network (MAN)
- c. Wide Area Network (WAN)

# Types of Network

## a. Local Area Network (LAN)

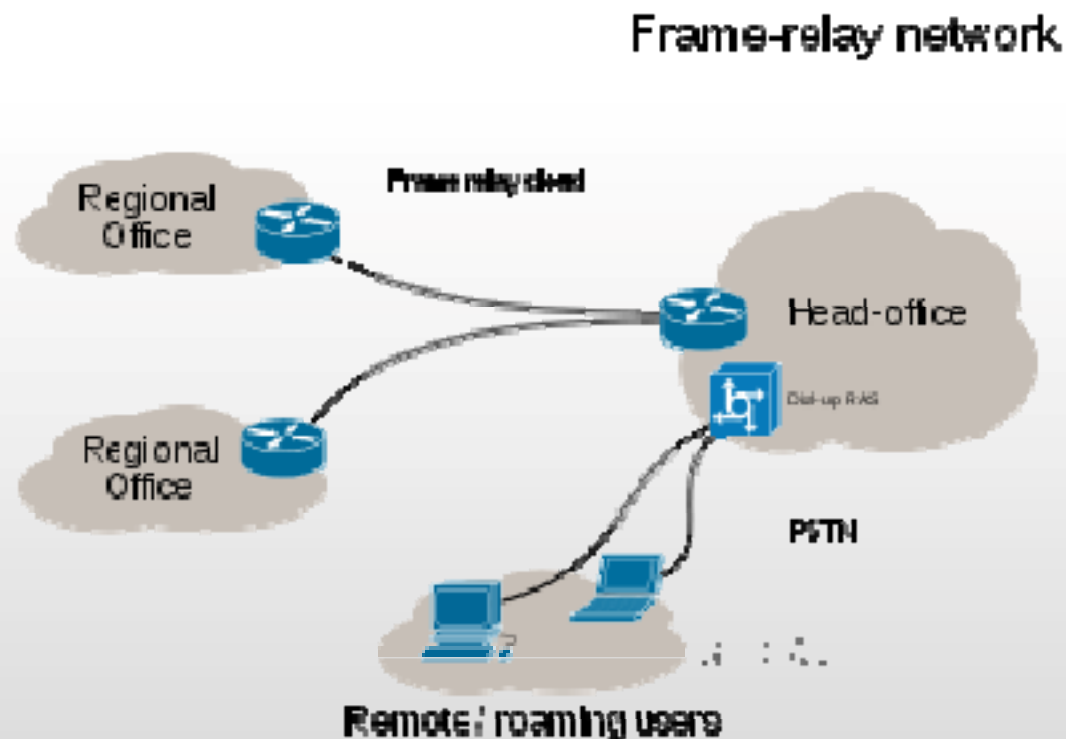
- A Local Area Network (LAN) is a network that is confined to a relatively small area.
- It is the network of computers located near to each other, in other words computers are interconnected together within the building, department or campus.
- The two computers connected together in an office or two buildings connected together by a high speed wire can also be considered LAN.
- The size is restricted from 10m to about 10 km
- A single cable either twisted pair cable or coaxial cable but not both is used to connect the computers in a LAN.
- LANs are characterized by comparatively high-speed communications.



## Types of Network

### b. Metropolitan Area Network (MAN)

- A MAN is a network that is larger than LAN
- It is called metropolitan since it normally covers the area of city (a few tens to about 100kms).
- This network may involve the transmission media like telephone wires or wireless links.

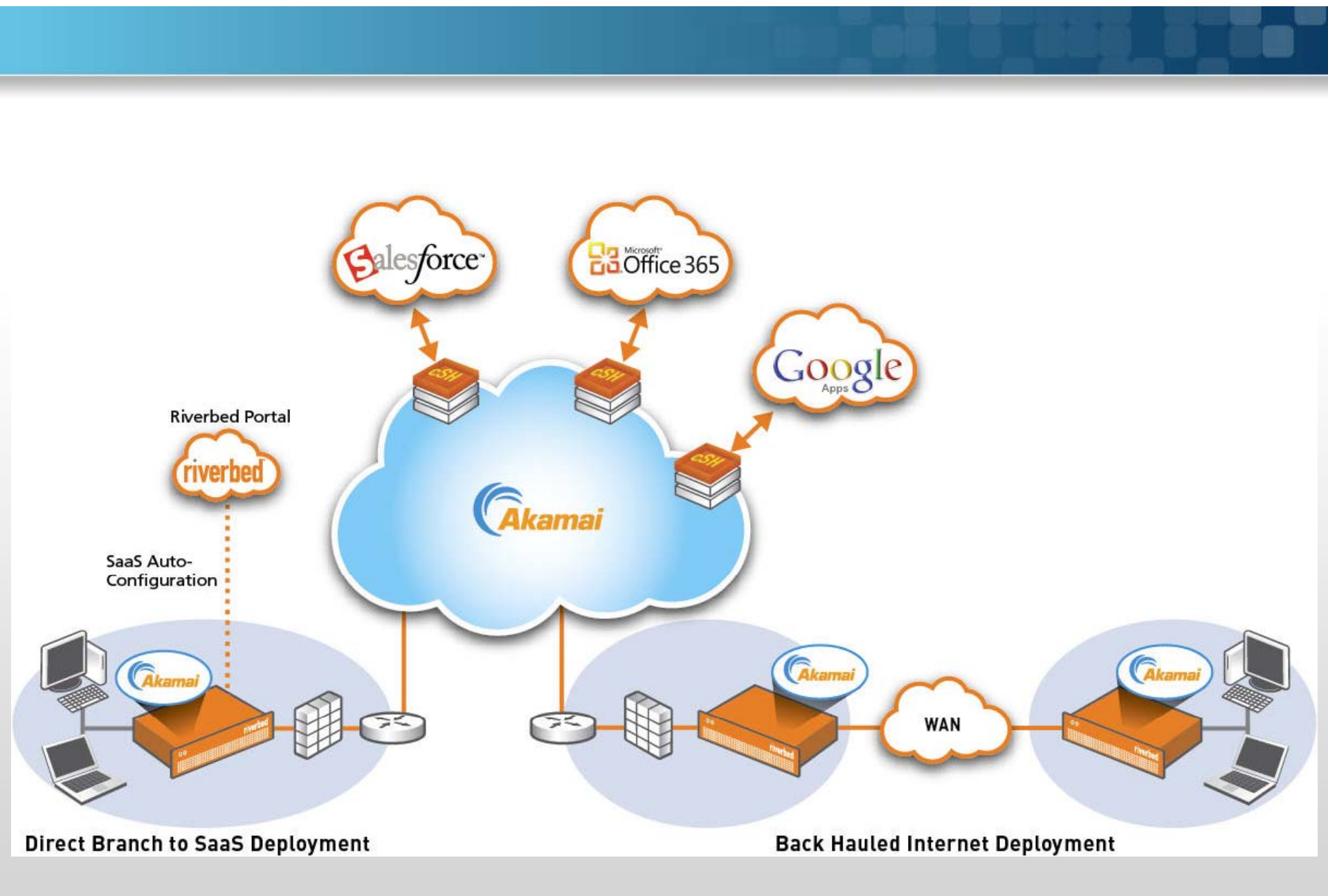




## Types of Network

### c. Wide Area Network (WAN)

- A Wide Area Network (WAN) includes all networks larger than MAN.
- WAN is a computer network that spans a large geographical area like Inter-city, inter-country, and inter-continent.
- We can say WAN is simply a LAN of LAN.
- WANs are characterized by the slowest data communication rates and the largest distance.
- It is used for the ranges of 100km and above.
- The communication can be through general cables, radio links or satellite.
- Internet is an example of WAN.
- It connects diverse locations, organizations and institutions throughout the world.



# Network Topology

- Bus Topology
- Star Topology
- Ring Topology

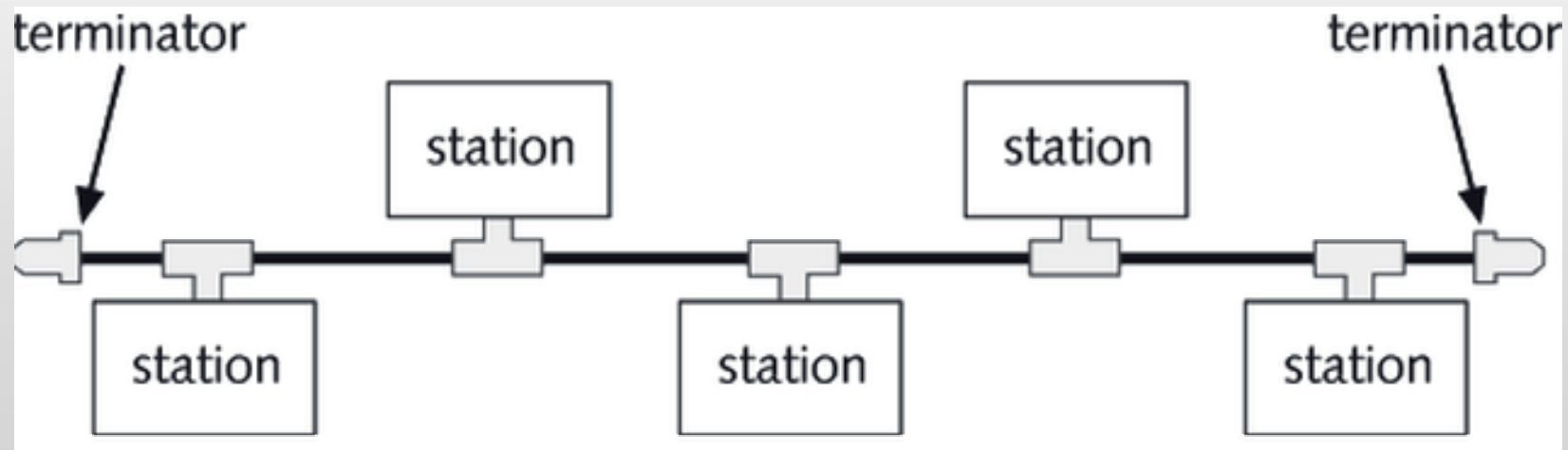
# Network Topologies

- Network topologies means the physical arrangement of the computers in a network.
- The most common topologies are as follows:
  - a. Bus Topology
  - b. Star Topology
  - c. Ring Topology

# Network Topologies

## a. Bus Topology

- In this topology, a single conductor is used to connect all the network nodes and peripheral devices.
- In it, computers are arranged in a linear fashion.
- It uses a linear cable to which the NIC of computers are attached using T-connectors.
- Commonly used transmission medium is coaxial cable.
- Terminators are used at the two ends to avoid the bouncing of the signal.



# Network Topologies

## Advantages

- The bus topology is simple, easy to use and understand.
- Least amount of cables required to connect the computers
- Easy to extend bus. Two cables can be joined into one long cable with a BNC connector. A repeater can also be used to extend the bus.

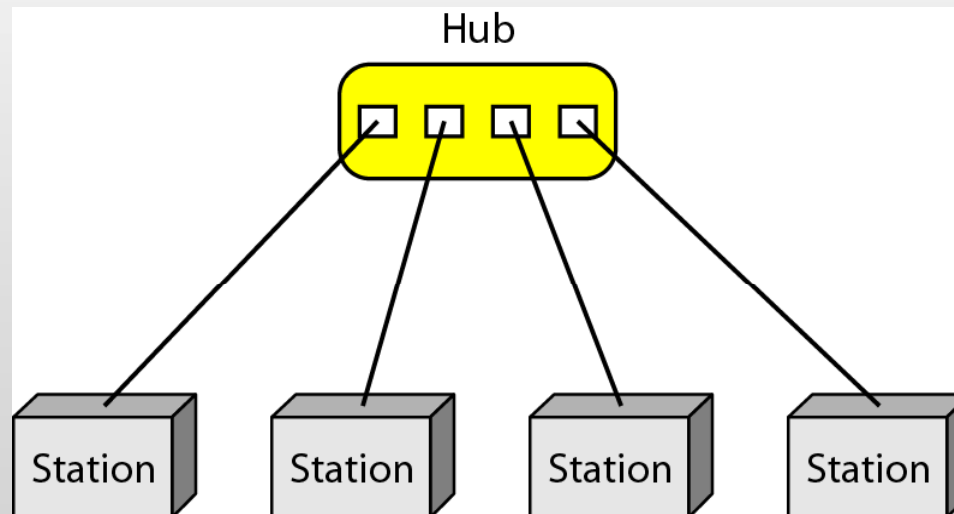
## Disadvantages

- When the fault arises at any point on the cable, entire network stops functioning.
- There is risk of data collision.

# Network Topologies

## b. Star Topology

- In star topology, all computers are connected to centrally located device known as **hub**.
- Holds specific master slave relationship



# Network Topologies

## Advantages:

- Easy to add new computers to a star network without disturbing the rest of the network.
- Single computer failure doesn't necessarily bring down the whole star network
- Transmission delay between two nodes does not increase by adding new nodes to the network.
- Easy to troubleshoot ie easy to diagnose network problems.

## Disadvantages

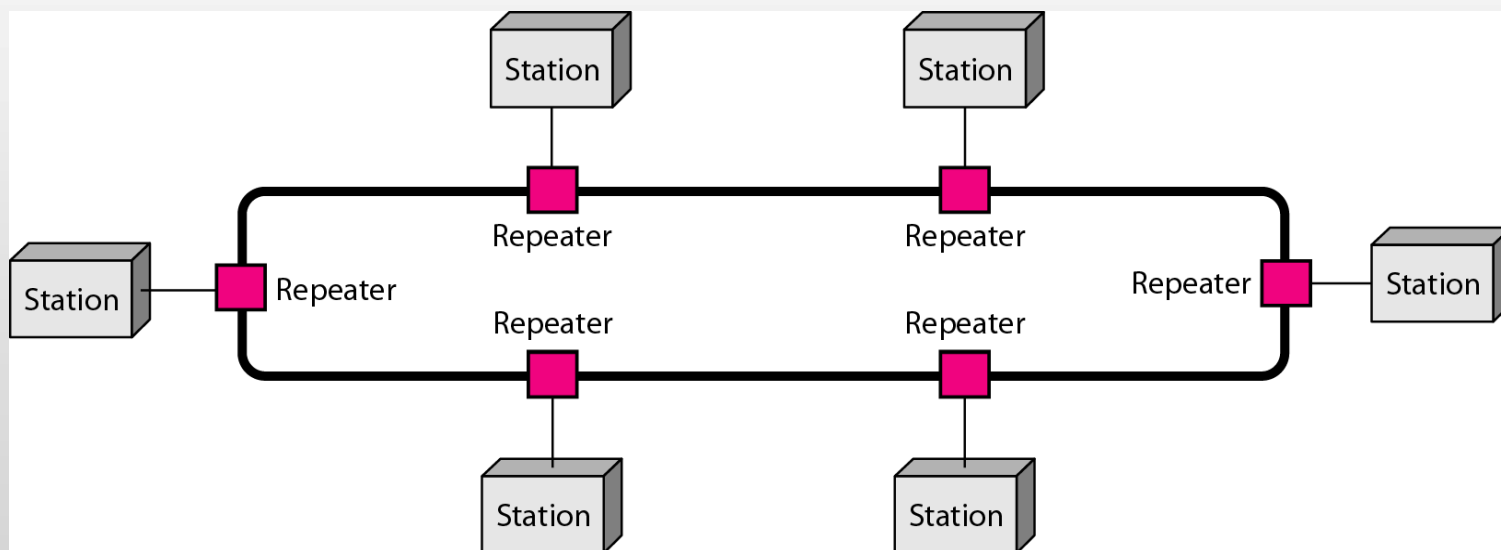
- It requires extra device i.e. hub
- If the central hub fails, the whole network stops.
- It requires more cables.



# Network Topologies

## c. Ring Topology

- In a ring topology, each computer is connected to the next computer with the last one connected to the first.
- In this topology, each node examines data that is sent through the ring. If the data is not addressed to the node examining it, that node passes it along to the next node in the ring.



# Network Topologies

## Advantages

- There is no problem of collision of two or more than two different data packets moving around the transmission media.
- It works well when there is no central server computer system.

## Disadvantages

- If at any point the cable breaks then entire networking stops functioning.
- There is delay in communication between the nodes if there are large number of nodes in the network.
- It is more complicated to control than any other topology used.

# Network Protocols

- A protocol is a complete set of rules and standards that allow different devices to communicate or understand each other.
- In other words, to ensure that computers in a network are able to communicate, they must share a common language called **protocol**.
- Therefore protocol is a set of rules or standards that enable communication between computers in a network.
- It represents an agreement between the communicating devices
- Protocols are actually software and must be installed on network components that need them.
- Computers can only communicate with each other only if they use same protocol.

# Network Protocols

- The protocols defines:
  - ✓ Types of error choking to be used
  - ✓ Data compression method, if any.
  - ✓ How a sending device will indicate that it has finished sending a message.
  - ✓ How a receiving device will indicate that it has received a message.
- Some of the popular protocols are **TCP/IP, HTTP, FTP, SMTP, POP, Token-Ring, Ethernet**, etc.

# Network Architecture

- Based on how the computers in a network are configured and how they access information, networks are classified into two types:
  1. Peer-to-peer architecture
  2. Client-server architecture

# Network Architecture

## 1. Peer-to-peer architecture

- In a peer-to-peer network there is no dedicated servers, and there is no hierarchy among the computers.
- All the computers are equal and therefore are known as peers.
- Each computer functions as both client and server and usually no administrator is responsible for maintaining the network.
- Networking using Windows 95/98 are the most common examples of peer-to-peer network.

# Network Architecture

## Advantages

- No need for dedicated server
- Only reconfiguration in operating system is enough for peer-to-peer operations.

## Disadvantages

- No central repository of files and applications.
- Doesn't provide the security as available in client/sever network

# Network Architecture

## 2. Client-server architecture

- This is a network architecture in which each computer or process on the network is either a client or a server.
- Servers are powerful computers or processors which responds to the request sent by the client machine
- Clients are less powerful PCs or workstations on which user run applications.
- Clients rely on server and send request to it for resources, such as files, devices, and even processing power.
- Also with servers performing the network tasks, the workload on individual computers is reduced.
- Networking using Windows NT is the most common example of client-server network.
- Client/server computing is also a commonly used model on Internet.



# Network Architecture

## Advantages

- Centralized: resources and data security are controlled through the server
- Scalability: Any or all elements can be replaced individually as need increase.
- Flexibility: New technology can be easily integrated into system.
- Interoperability: All components (client/network/server) work together.
- Accessibility: Server can be accessed remotely and across multiple platforms.

## Disadvantages

- Expense: requires high initial investment to install dedicated server.
- Maintenance: Large networks will require a staff to ensure efficient operation.
- Dependence: When server goes down, operations will cease across the network.

# Communication Systems

- Radio
- TV
- Microwave Systems
- Communication Satellite
- Radar
- Fiber Optics
- ISDN

# Radio

- A radio in its simplest form comprises of
  - Input circuit + Turner
  - Demodulation circuit
  - Amplifier
  - Speaker
- Input circuit receives signal from antenna and turner tunes into the right frequency
- Demodulation circuit demodulates original signal and separates audio frequencies from high frequency carrier waves.
- Amplifier amplifies original or low frequency signal
- Speaker gives the final output
- Long wave and medium wave is transmitted as direct waves along the earth's surface and including an indirect wave.
- Generally direct wave is received (upto some hundred miles) and the indirect wave is reflected back.

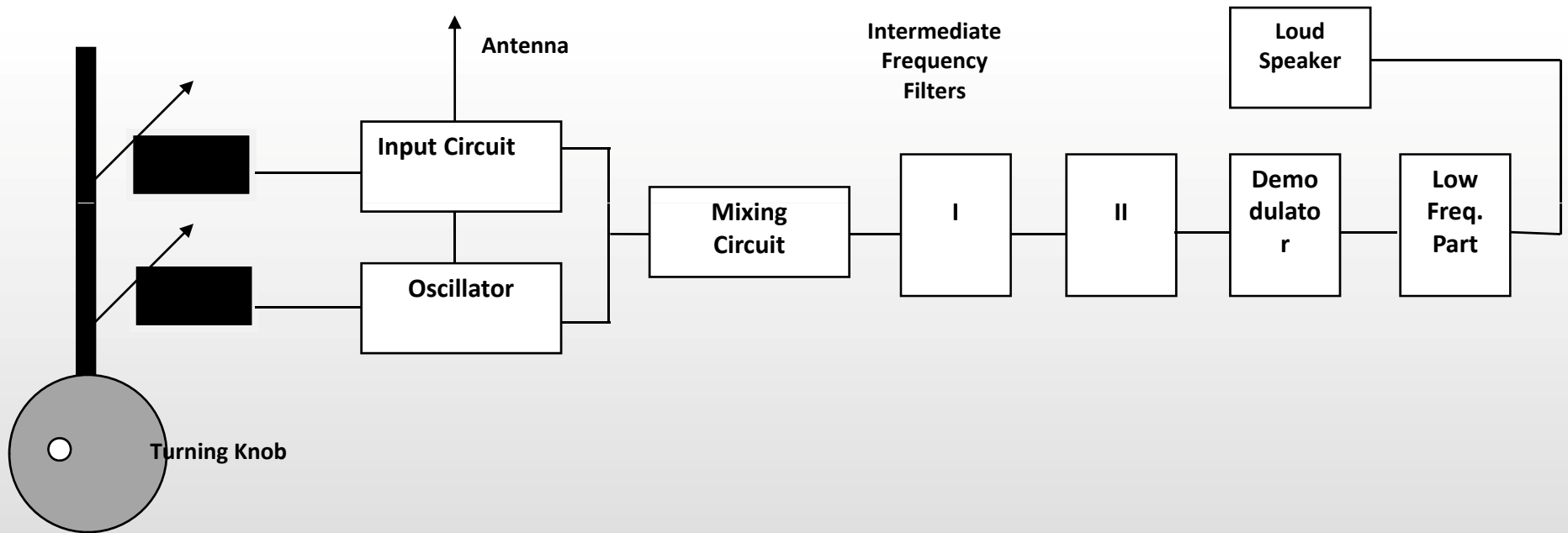
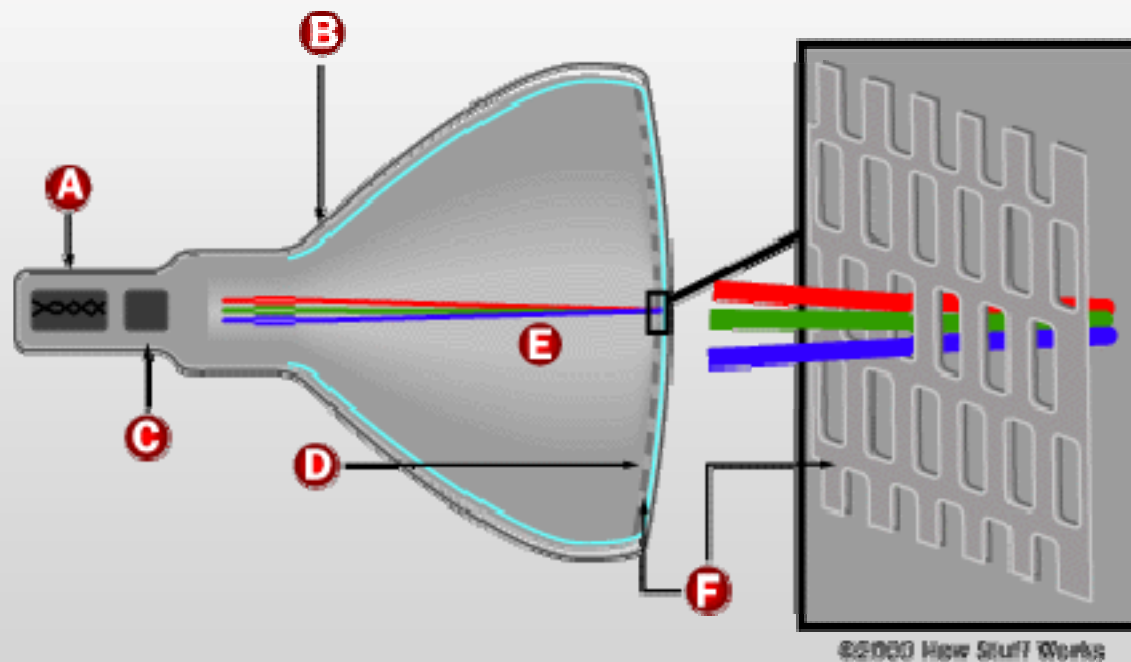


Fig: Major Components of a Radio Receiver

# Television

- Is a system of sending and receiving pictures and sound by means of electronic signals transmitted through wires and optical fibers or by electromagnetic radiations.
- These signals are usually broadcast from a central television station to reception devices in television sets at home

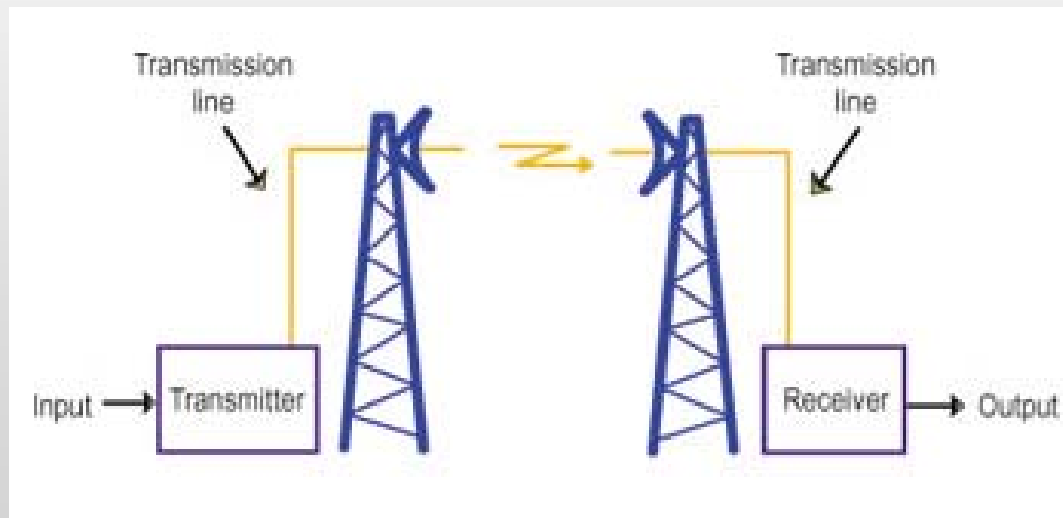


## Television (Contd..)

- The pictures on a TV are drawn by a beam of electrons fired out of a gun at the back of the set.
- When the beam hits the chemicals called phosphors that are painted on the inside of the picture tube, the phosphor glows. But because they glow only for a fraction of second, the beam has to immediately draw another picture.
- The beam draws a picture 30 times every second which is so fast that , together, the picture looks like they are moving.

## Microwave systems

- Consists of high frequency waves (1000 – 3000 Mhz) that travel in straight lines through air rather than wires
- BTS are located at an interval of 25 to 30 miles on which disc like antennas are mounted.
- Because the waves can't bend with the curvature of the earth, the BTS must be within the LOS with one another.



# Communication Satellite

- Is a radio – relay station with a potential advantage of direct-line of sight path upto 98% (excluding the polar caps, which are inaccessible to the satellites) of earth's surface.
- **Satellite Orbit**
  - Communication satellites are placed in orbits called equatorial geosynchronous orbit.
  - Satellites placed in this orbit will appear stationary over a selected location.
  - Satellites are placed in an orbit that is directly over the equator, moving in a west to east direction at an altitude of 22,282 miles above sea level and with a forward velocity of 6874 mph to complete one orbit in 24 hours.
- **Uplink and Downlink**
  - Uplink – how much data can a satellite take measured in bytes, KB, MB, GB etc.
  - Downlink – how much data can a satellite transmit

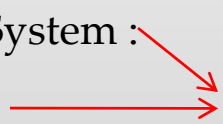


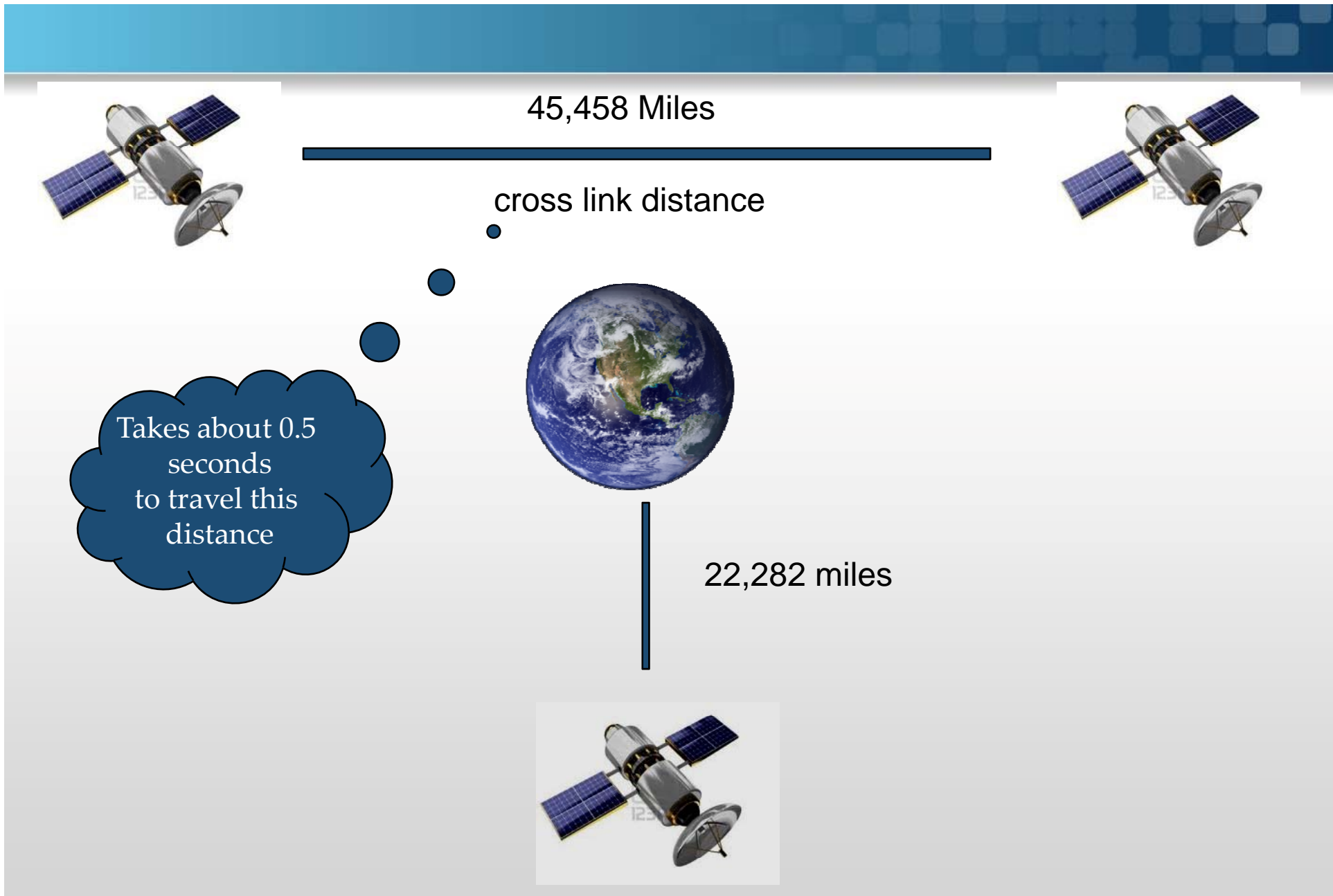
## Communication Satellite Contd...

### ■ Cross link

- at an altitude of Clarke Orbit, one satellite can cover 42.2% of the Earth's surface, Since such a satellite is not enough for global coverage, we need three satellites. These satellites are placed 120 degrees apart in the Clarke Orbit .

### ■ Components of a Satellite

1. The transponder : High Frequency Radio Receiver, Frequency Down converter and power amplifier used to transmit downlink signal.
  2. The Antenna System : comprises antenna and mechanism to position them correctly
  3. The Power Package : power supply to the satellite
  4. The Control and Information System :
  5. The Rocket Thruster System: 
- Together called station keeping system.
  - Function is to keep satellite in the correct orbit with the antennas pointed in the exact direction desired



# RADAR

- Acronym for Radio Detection and Ranging
- Denotes the method of scanning the surrounding space by means of high frequency radio waves which are sent out from a powerful transmitter and are reflected by any objects which they encounter
- The reflected beam is picked up by a receiver and its strength and direction gives information on the size, distance and altitude of the object

# Fiber Optics

- Is a transmission system employing a light emitting source turned on and off rapidly by electrical impulse whose emissions are sent through a glass pipe to a light sensitive receiver to convert the changing light intensities back into electrical impulse.
- Is based on the theory of total internal reflection.
- They can conduct light pulses generated by lasers at transmission rate as high as 2 billion bits per second

# ISDN (Integrated Service Digital Networks)

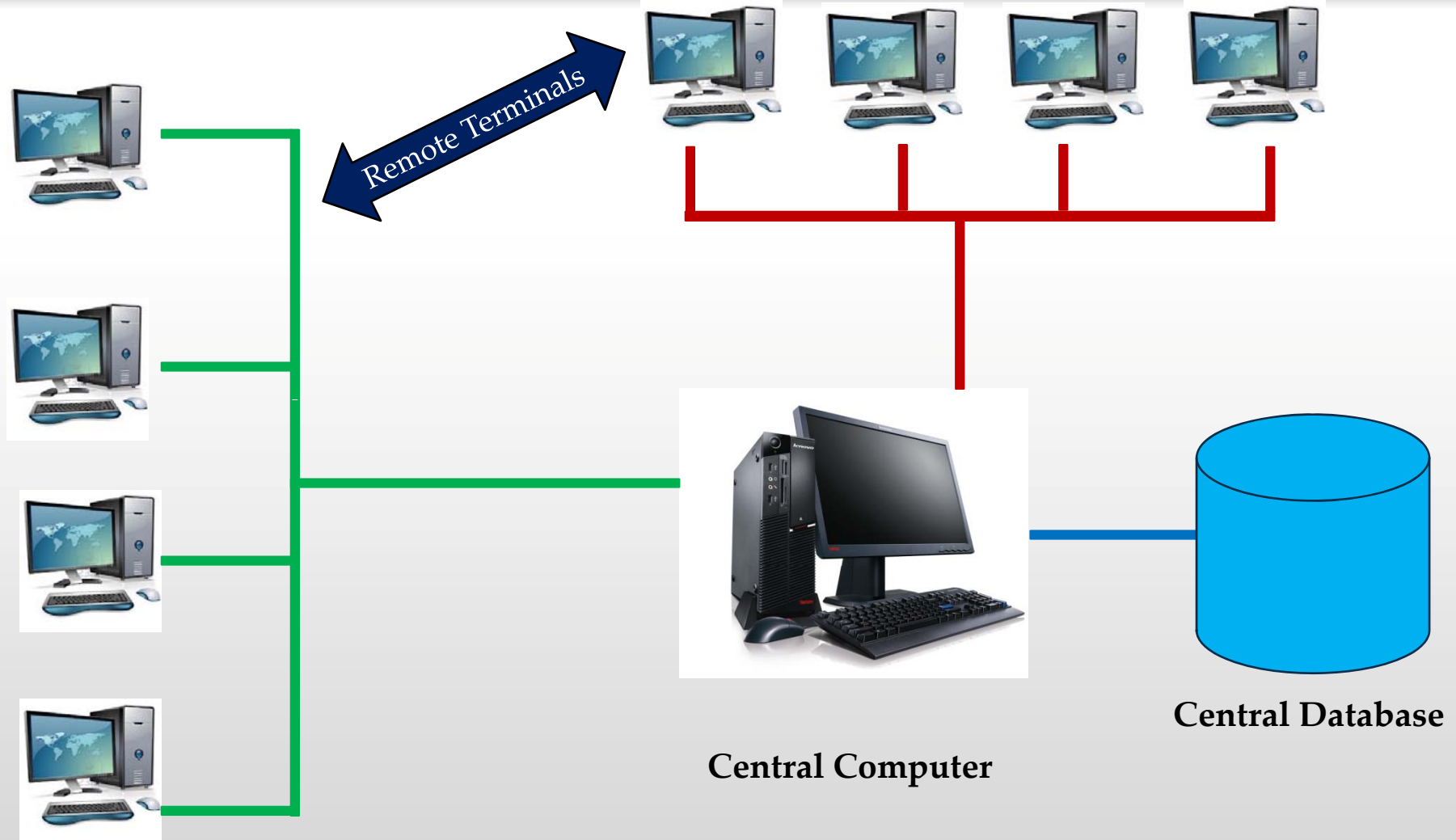
- High speed, fully digital telephone service
- Can operate at the speed of 128 kilobits/second which is five times faster than analog modems.
- ISDN brings the digital network to the individual user
- It enables the twisted pair copper telephone line that could traditionally carry only one voice signal to carry as many as three separate conversations at the same time, through the same line.

# Distributed Systems

- Centralized Data Processing
- Distributed Data Processing
- Features of Distributed Systems
- Pros and Cons of Distributed Systems

# Centralized System and Data Processing

- In centralized data processing system, the CPU, storage devices, software and the professional data processing staff are located in one central facility.
- All the devices converge on one central computer even though the users many work at distant terminals.
- All the processing and storage take place at the central location.

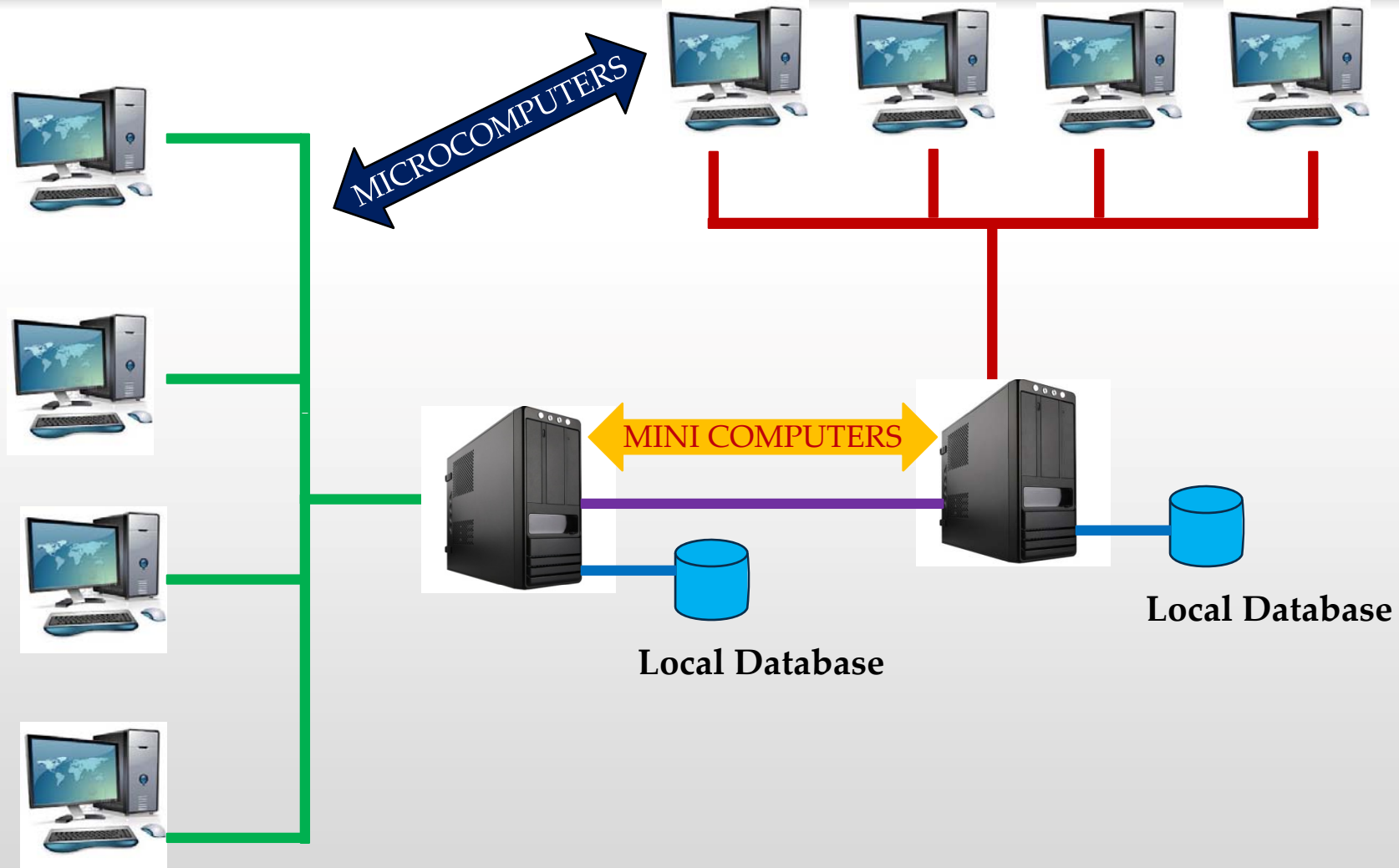


**Fig. Centralized Data Processing System**

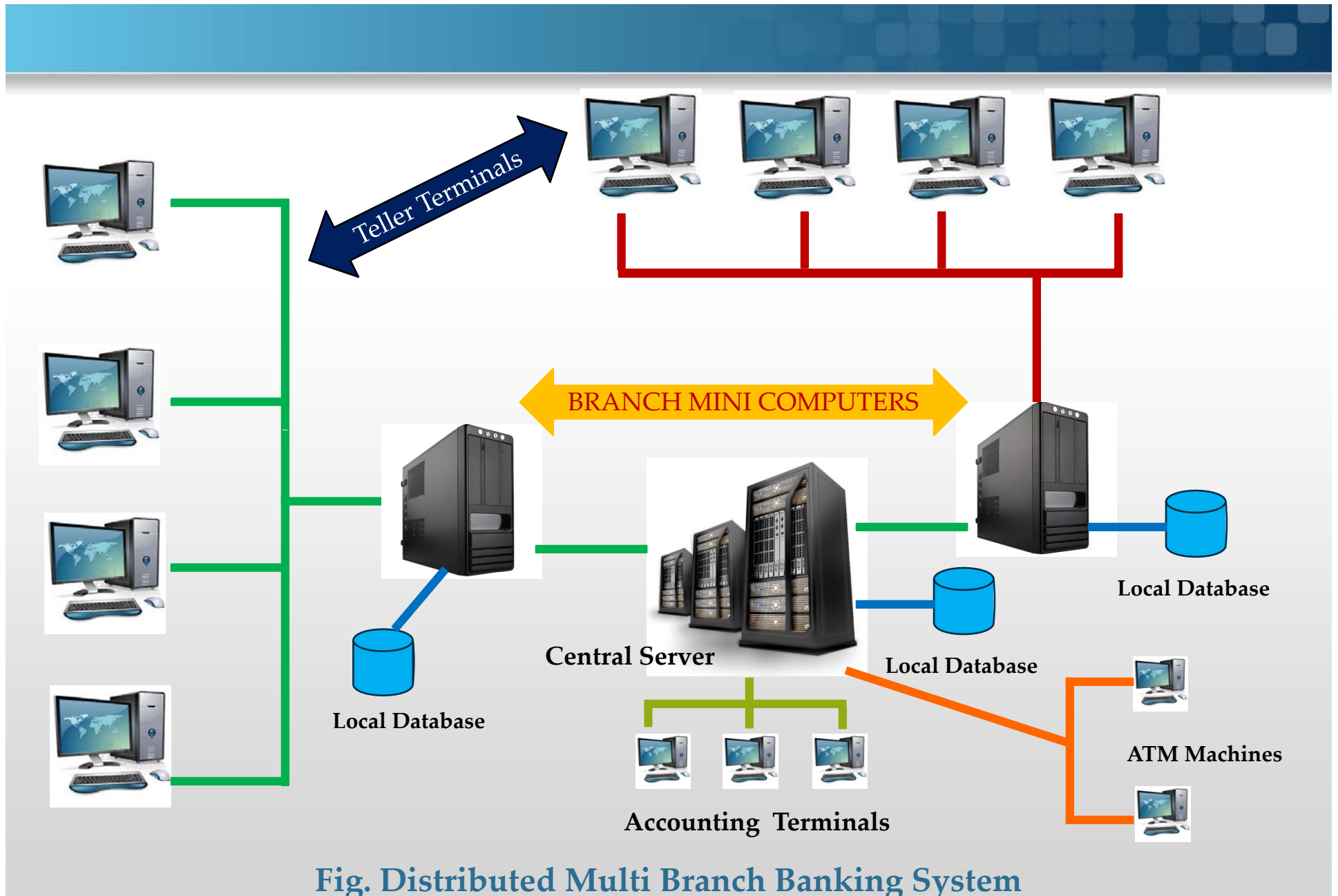


# Distributed Data Processing

- The computers, storage devices and even some computer professionals are distributed to separate locations through our the organization.
- Processing and storage may occur at several locations in the computer network.
- Such systems are more responsive to users and less costly to develop and maintain.
- Computing load is distributed along with distributed storage.
- The data stored at different locations can be shared among the users.



**Fig. Distributed Data Processing System**



**Fig. Distributed Multi Branch Banking System**

# Distributed Data Processing System

- A distributed data processing system comprises of computers installed at different sites, each of them performing independent data processing, ie. Accomplishing information services of its own. Usually each computer of the distributed system is specialized to perform a range of activities or support a certain workplace.
- Distributed Computers
- Distributed Control
- Resource Sharing
- End User Productivity
- Data Independence

# Advantages of Distributed Systems

## ■ Local Control of Local Data

- The local organization can take more responsibility for developing, scheduling, introducing and managing applications
- The local perspective can keep the information system more focused on the local organization's objective

## ■ Lower Cost

- The hardware of Distributed System is less expensive than centralized as several mini and micro-computers cost less than one mainframe.
- The maintenance cost is also less compared to centralized system.

## ■ Modularity

- Distributed system tends to be modular as the systems and supportive equipments can be added according to the necessity
- Additional compute, printer or storage devices are functional as soon as they are plugged into the system.

# Advantages of Distributed Systems

## ■ Better Response Time

- In distributed system, local processing is done in local machine and in many systems, local machines only occasionally need to call upon the resource of the other machine in the system. As a result, there won't be much increase in the response time.
- In centralized system, the response time increases drastically with the increase in request from multiple users.

## ■ Ability to Share Data

- The distributed systems in a network can share data across the nodes through the electronic interface of the networks.
- This is more efficient, time saving and cost effective compared to manual transfer through USB or floppy disks.

## ■ Greater Reliability

- On account of crash of a centralized system, the whole operations of an organization come into halt but distributed systems are not subject to such catastrophe in general.
- If one system breaks down, the rest of the machines may not be affected depending upon the topology used.

# Advantages of Distributed Systems

## ■ Direct User Interaction

- Users can directly interact with the information system in Distributed System.
- The users will not consider the computer an unapproachable, mysterious blackbox located behind the closed doors.

# Disadvantages of Distributed Systems

## ■ Technical Problem of Connecting Dissimilar Machines

- Systems working on different platform may require protocol conversion to maintain a standard.
- They may also require additional layers of operating system to control and coordinate the flow of data between machines.
- Additional hardware may be required for such dissimilar network

## ■ Need of sophisticated communication system

- Distributed Data processing requires the development of a data communication system which are costly to develop and use
- On the top, their maintenance is a clumsy process.

## ■ Data Integrity and Security Problems

- As data in distributed processing can be accessed from different locations in a network, controlling the integrity of a database is difficult and it always tend to be insecure
- On the top, their maintenance is a clumsy process.

## ■ Lack of Professional Support

- Distributed computers may be placed in a location where minimal or no data processing support is available. Consequently, they are maintained by non-professionals.
- The communication systems also require trained personnel for maintenance.



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**St. Xavier's College**

Department Of Computer Science  
and Information Technology



**Any Queries?**