

# CN1O47 INTRODUCTION TO COMPUTER NETWORKING

## CHAPTER 1 BASIC CONCEPTS OF NETWORK

# DEFINTION & APPLICATIONS

## DEFINITION:

A computer network is defined as the interconnection of two or more computers. It is done to enable the computers to communicate and share available resources.

## APPLICATIONS:

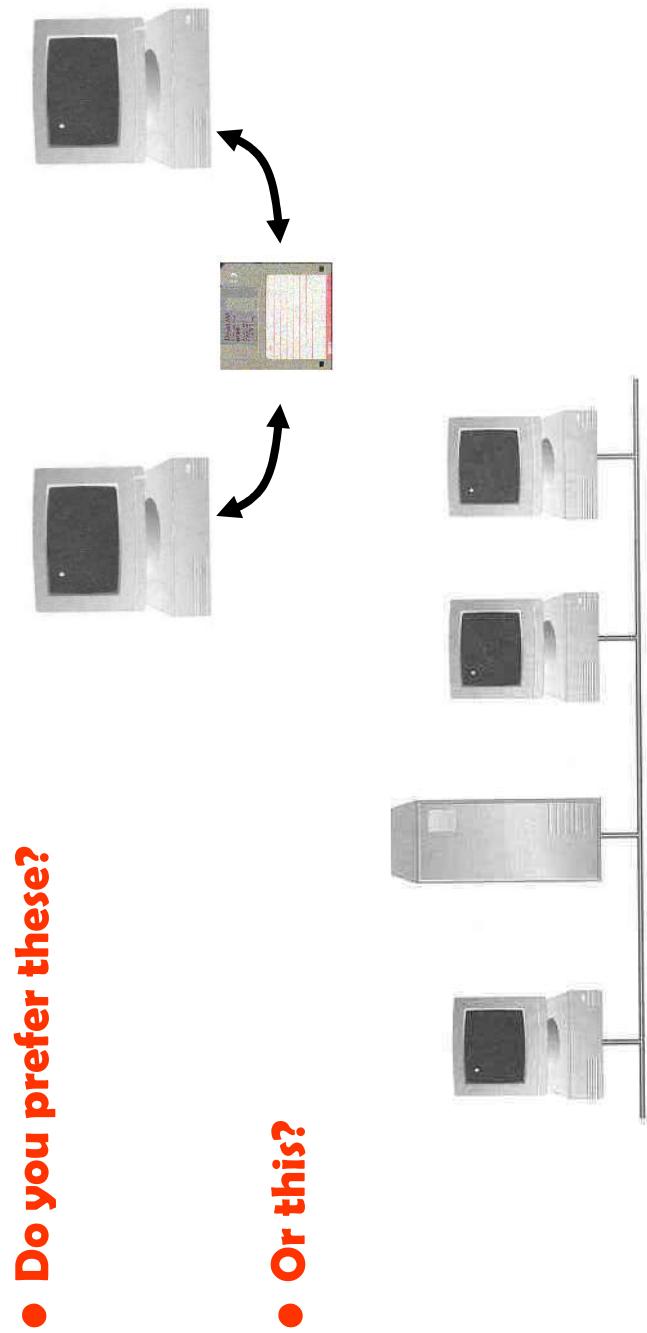
- i. Sharing of resources such as printers
- ii. Sharing of expensive software's and database
- iii. Communication from one computer to another computer
- iv. Exchange of data and information among users via network
- v. Sharing of information over geographically wide areas.

# THE USE OF COMPUTER NETWORK

- **Business Applications**
  - online buying
- **Home Applications**
  - mail, chat
- **Mobile Users**
  - wireless: laptops, PDA, mobile, in plane
- **Social Issues**

# THE USE OF COMPUTER NETWORK

- Sharing information – i.e. **data communication**



# THE USE OF COMPUTER NETWORK

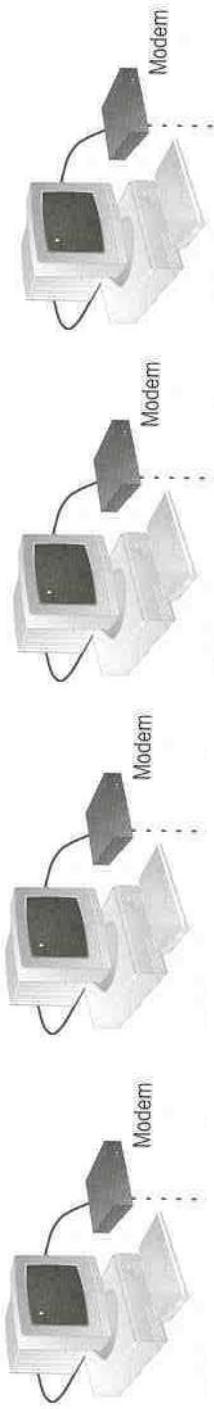
- **Sharing hardware or software**

- E.g. print document



- **Centralize administration and support**

- E.g. Internet-based, so everyone can access the same administrative or support application from their PCs



# COMPONENTS OF COMPUTER NETWORK

- **Two or more computers**
- **Cables as links between the computers**
- **A network interfacing card(NIC) on each computer**
- **Switches**
- **Software called operating system(OS)**

# NETWORK BENEFITS

- The network provided to the users can be divided into two categories:
  - i. Sharing
  - ii. Connectivity

# SHARING RESOURCES

## Types of resources are:

1. **Hardware:** A network allows users to share many hardware devices such as printers , modems, fax machines, CD ROM, players, etc.
2. **Software:** sharing software reduces the cost of software installation, saves space on hard disk.

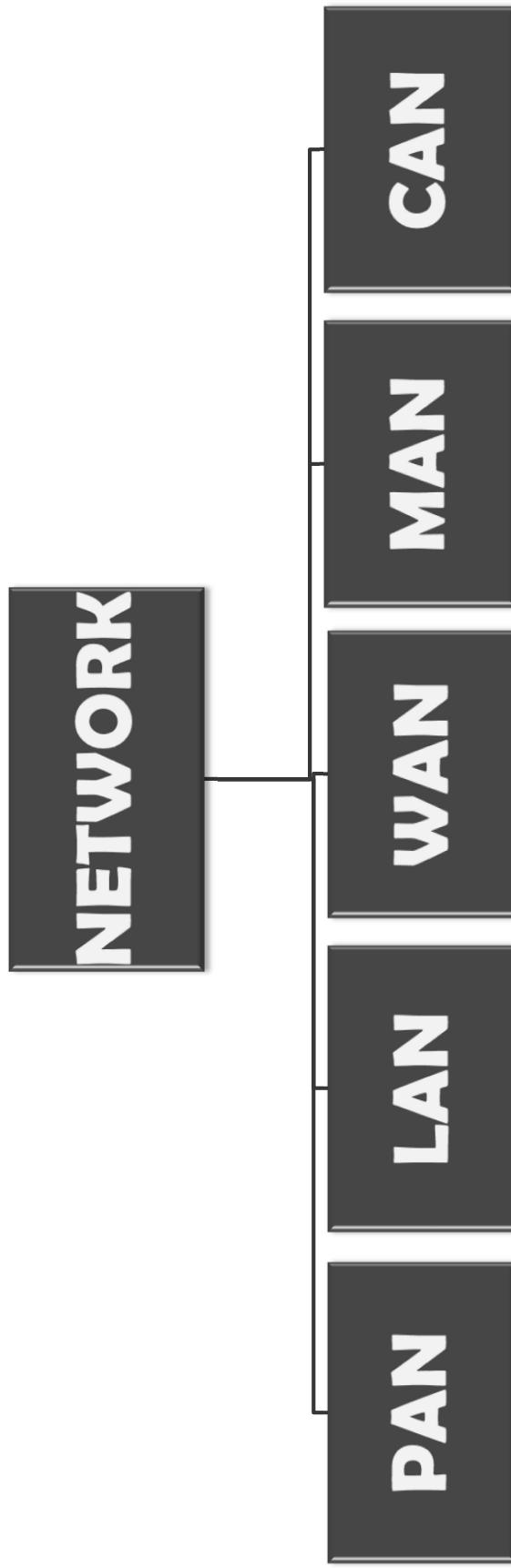
# OTHER BENEFITS OF COMPUTER NETWORK

- **Increased speed**
- **Reduced cost**
- **Improved security**
- **Centralized software management**
- **Electronic mail**
- **Flexible access**

# DISADVANTAGES OF NETWORKS

- **High cost of installation**
- **Requires time for administration**
- **Failure of server**
- **Cable faults**

# CLASSIFICATION OF AREA BY THEIR GEOGRAPHY



# LOCAL AREA NETWORK(LAN)

- LAN is a network which is designed to operate over a small physical area such as an office, factory or a group of buildings.
- LAN's are easy to design and troubleshoot
- Exchange of information and sharing of resources becomes easy because of LAN.
- In LAN all machines are connected to a single cable.
- Different types of topologies such as star, tree, bus, ring, etc Can be used
- It is usually a privately owned network.

# WIDE AREA NETWORK(WAN)

- When network spans over a large distance or when the computers to be connected to each other are at widely separated locations a local area network cannot be used. A wide area network(WAN) is installed.
- The communication between different users of WAN is established using leased telephone lines, satellite links and similar channels.
- It is cheaper and more efficient to use the phone network for the link.
- Most WAN networks are used to transfer large blocks of data between its users.

# PERSONAL AREA NETWORK(PAN)

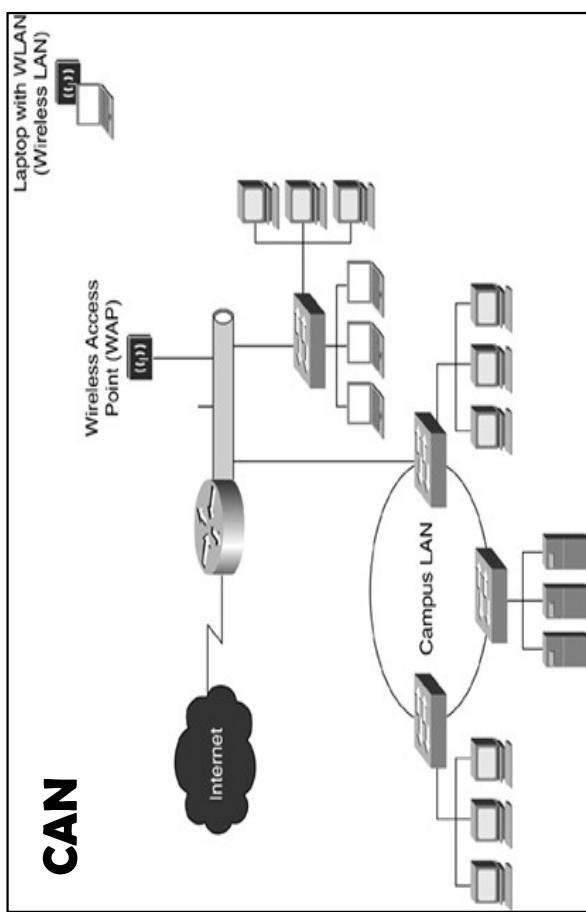
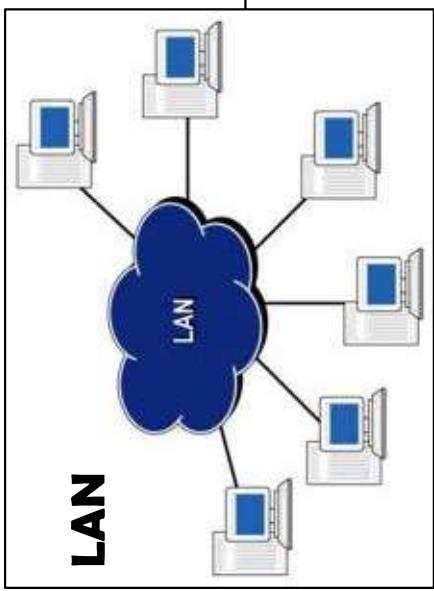
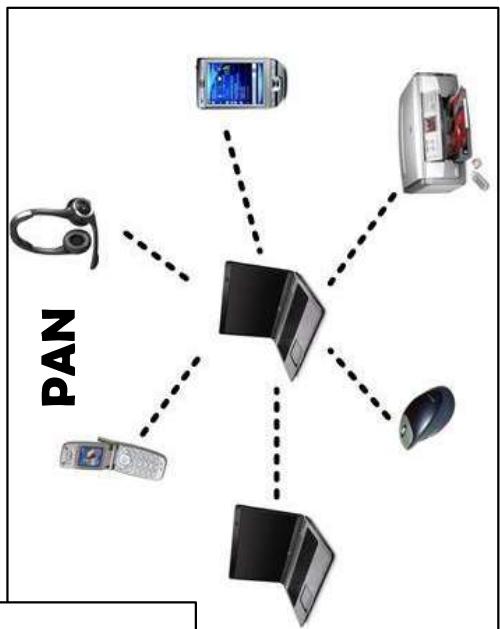
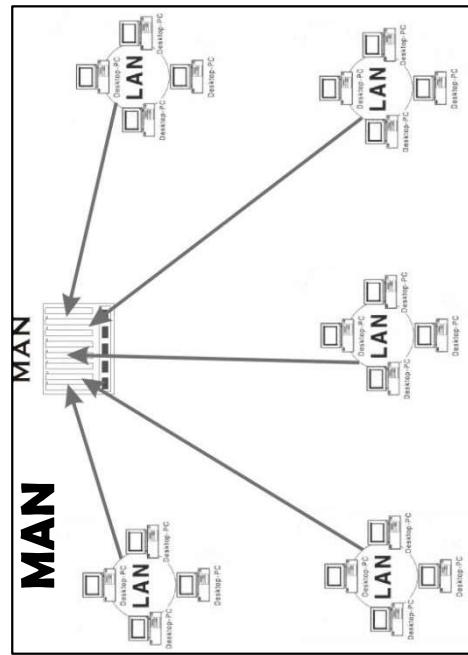
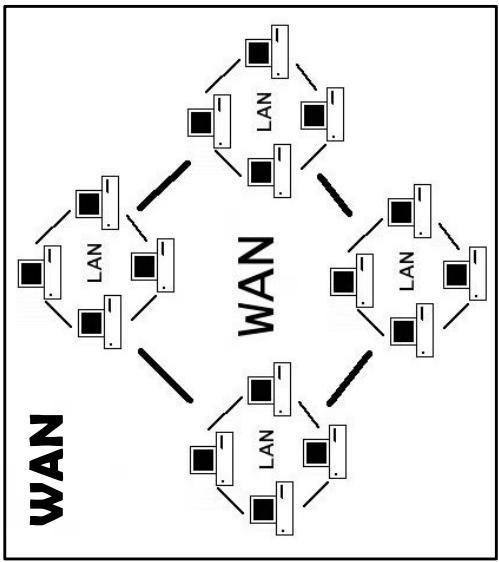
- A **personal area network** is a computer network organized around an individual person.
- It generally consists of a mobile computer, a cell phone or personal digital assistant. PAN enables the communication among these devices.
- It can also be used for communication among personal devices themselves for connecting to a digital level network and internet.
- The PANs can be constructed using wireless or cables.

# CAMPUS AREA NETWORK(CAN)

- **The campus area network is made up of an interconnection of LAN with limited geographical area.**
- **Network equipments such as switches, routers and the transmission media i.e. optical fibre etc are almost entirely owned by the campus owner.**

# METROPOLITAN AREA NETWORK(MAN)

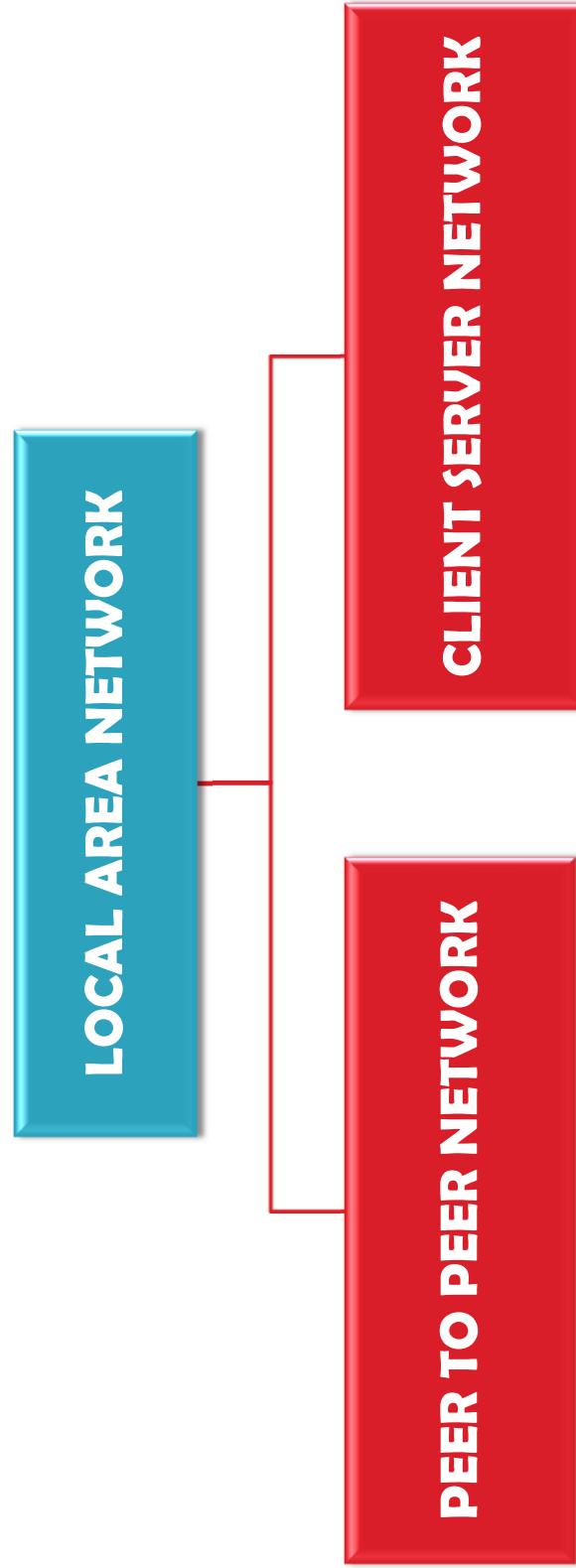
- It is in between LAN & WAN technology that covers the entire city.
- It uses similar technology as LAN.
- It can be a single network such as cable TV network, or a measure of connecting a number of LAN's or a large network so that resources can be shared LAN to LAN as well as device to device.



# DISTINGUISH BETWEEN LAN,WAN,MAN

PARAMETERS	LAN	WAN	MAN
<b>Ownership of network</b>	<b>Private</b>	<b>Private or public</b>	<b>Private or public</b>
<b>Geographical area covered</b>	<b>Small</b>	<b>Very large</b>	<b>Moderate</b>
<b>Design and maintenance</b>	<b>Easy</b>	<b>Not easy</b>	<b>Not easy</b>
<b>Communication medium</b>	<b>Coaxial cable</b>	<b>PSTN or satellite links</b>	<b>Coaxial cables, PSTN, optical fibre, cables, wireless</b>
<b>Bandwidth</b>	<b>Low</b>	<b>High</b>	<b>moderate</b>
<b>Data rates(speed)</b>	<b>High</b>	<b>Low</b>	<b>moderate</b>

# NETWORK CLASSIFICATION BY THEIR COMPONENT ROLE



# PEER TO PEER NETWORK

- In peer to peer network each computer is responsible for making its own resources available to other computers on the network.
- Each computer is responsible for setting up and maintaining its own security for these resources.
- Also each computer is responsible for accessing the required network resources from peer to peer relationships.
- Peer to peer network is useful for a small network containing less than 10 computers on a single LAN.
- In peer to peer network each computer can function as both client and server.
- Peer to peer networks do not have a central control system. There are no servers in peer networks.
- Peer networks are amplified into home group.

# ADVANTAGES & DISADVANTAGES OF PEER TO PEER NETWORK

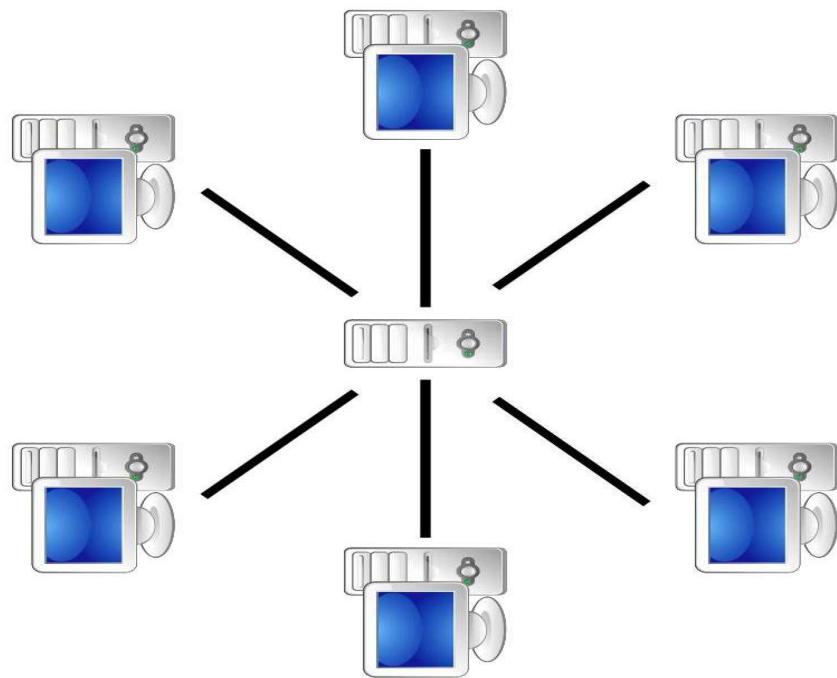
## Advantages:

- **Use less expensive computer hardware**
- **Easy to administer**
- **No NOS required**
- **More built in redundancy**
- **Easy setup & low cost**

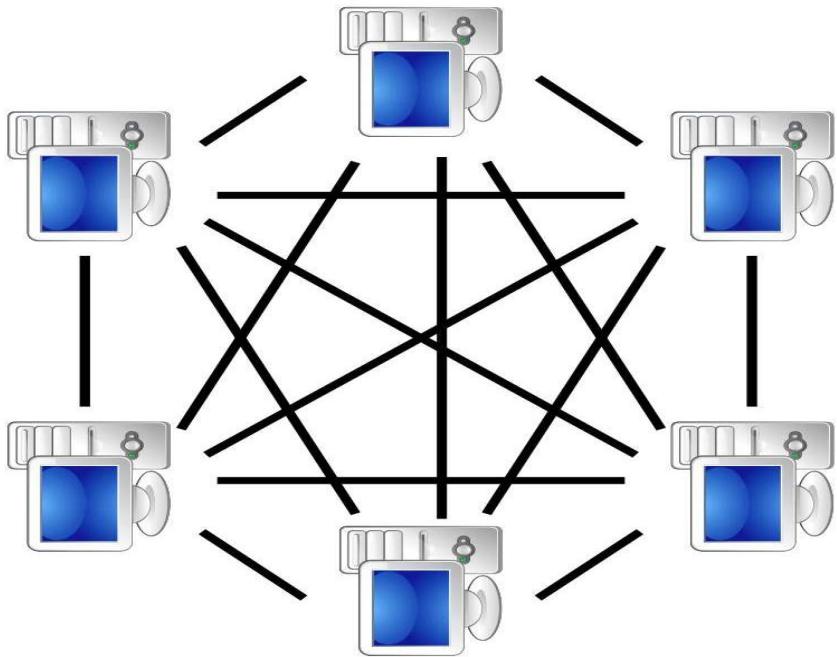
## Disadvantages:

- **Not very secure**
- **No central point of storage or file archiving**
- **Additional load on computer because of resource sharing**
- **Hard to maintain version control**

**Server-based**



**P2P-network**



# CLIENT/SERVER NETWORK

- In client-server network relationships, certain computers act as server and other act as clients. A server is simply a computer, that available the **network resources** and provides service to other computers when they request it. A client is the computer running a program that requests the service from a server.
- Local area network(LAN) is based on client server network relationship.
- A client-server network is one in which all **available network resources such as files, directories, applications and shared devices, are centrally managed and hosted and then are accessed by client**.
- Client serve network are defined by the presence of servers on a network that provide security and administration of the network.

# **ADVANTAGES AND DISADVANTAGES OF CLIENT-SERVER NETWORK**

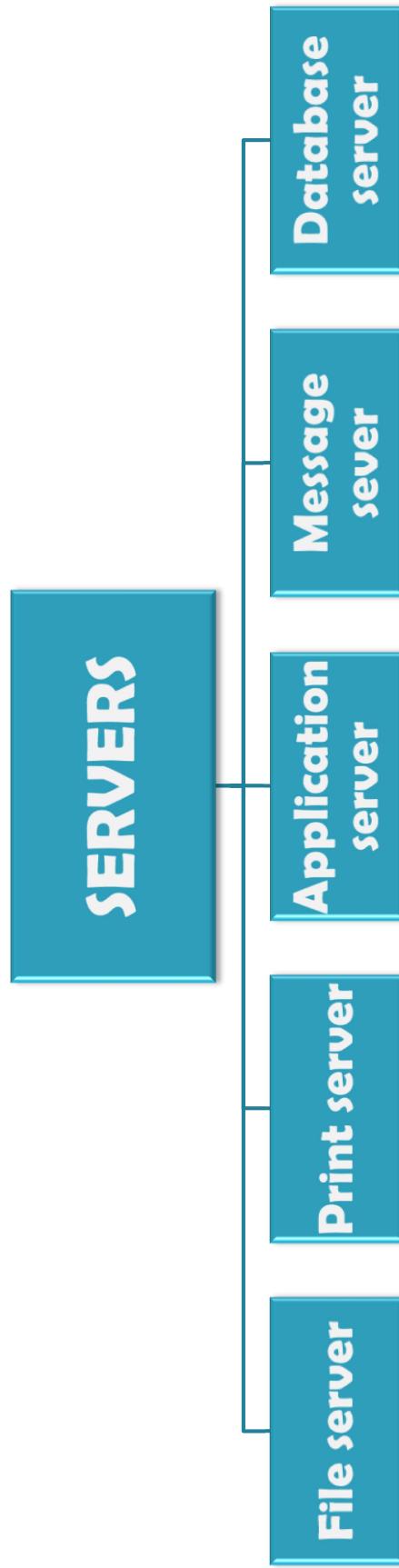
## **Advantages:**

- **Very secure**
- **Better performance**
- **Centralized backup**
- **very reliable**

## **Disadvantages:**

- **requires professional administration**
- **More hardware-intensive**
- **More software-intensive**
- **Expensive dedicated software**

# TYPES OF SERVERS



# TYPES OF SERVERS

- **File server:** These servers provide the services for storing, retrieving and moving the data. A user can read, write, exchange and manage the files with the help of file servers.
- **Printer server:** The printer server is used for controlling and managing printing on the network. It also offers the fax service to the network users.
- **Application server:** The expensive software and additional computing power can be shared by the computers in a network with the help of application servers.
- **Message server:** It is used to co-ordinate the interaction between users, documents and applications. The data can be used in the form of audio, video, binary, text or graphics.
- **Database server:** It is a type of application server. It allows the users to access the centralised strong database.

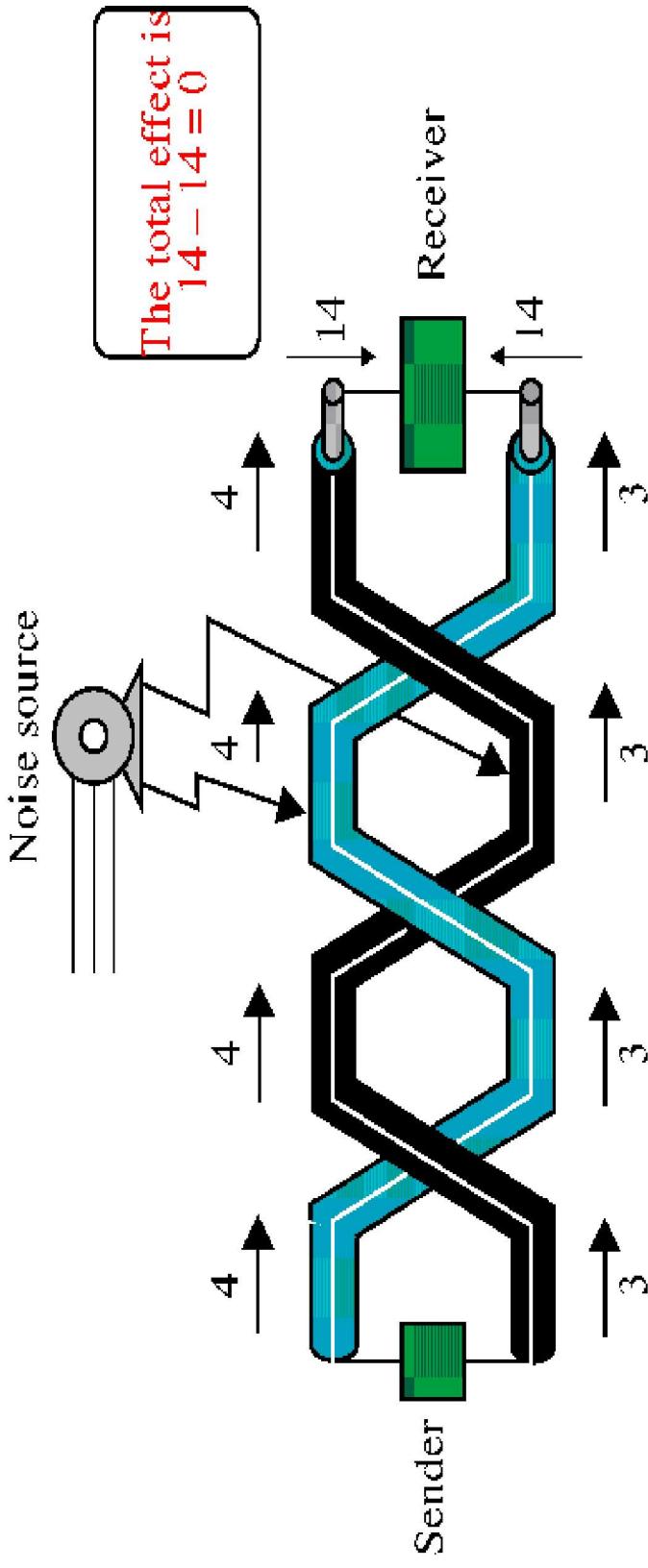
# TRANSMISSION MEDIA

- Two main categories:
  - Guided — wires, cables
  - Unguided — wireless transmission, e.g. radio, microwave, infrared, sound, sonar
- We will concentrate on guided media here:
  - Twisted-Pair cables:
    - Unshielded Twisted-Pair (UTP) cables
    - Shielded Twisted-Pair (STP) cables
  - Coaxial cables
  - Fiber-optic cables

# TRANSMISSION MEDIA

## Twisted-Pair Cables

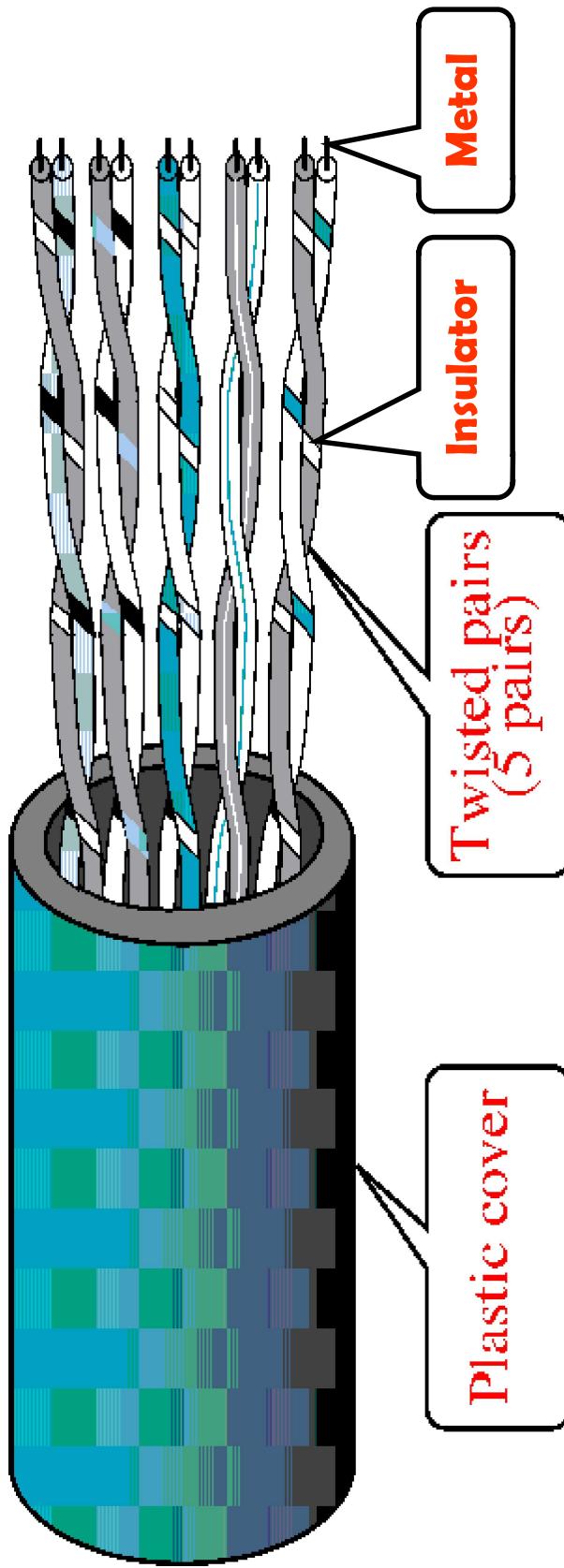
- If the pair of wires are not twisted, electromagnetic noises from, e.g., motors, will affect the closer wire more than the further one, thereby causing errors



# TRANSMISSION MEDIA

## Unshielded Twisted-Pair (UTP)

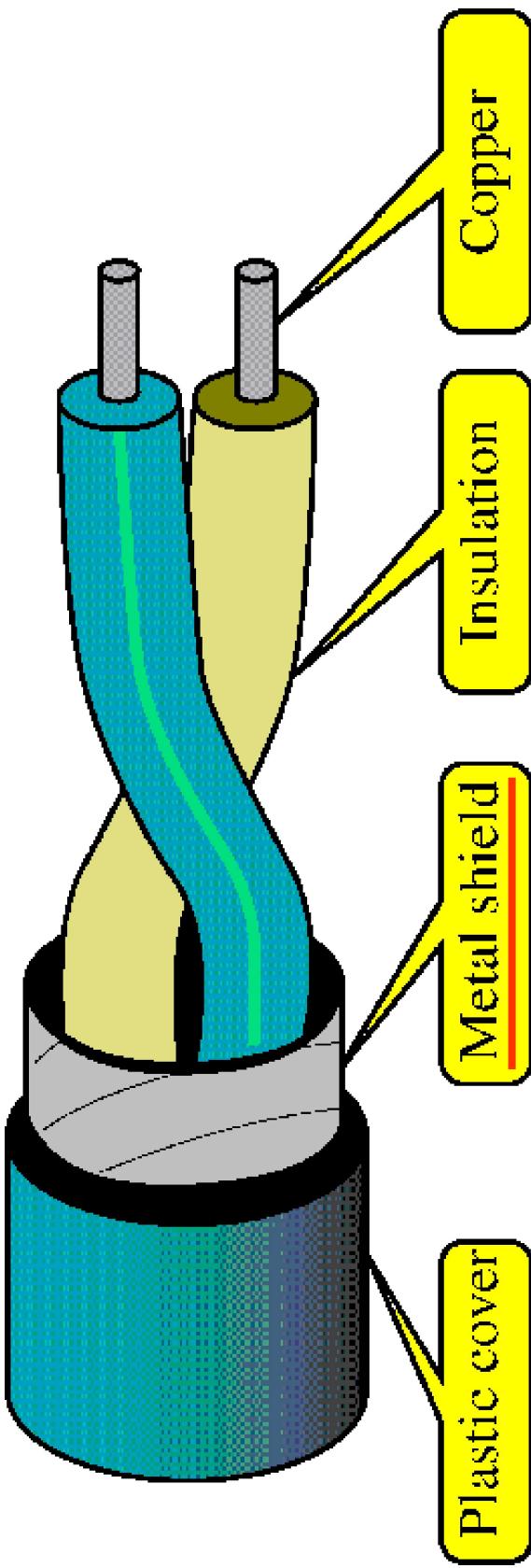
- Typically wrapped inside a plastic cover (for mechanical protection)
- A sample UTP cable with 5 unshielded twisted pairs of wires



# TRANSMISSION MEDIA

## Shielded Twisted-Pair (STP)

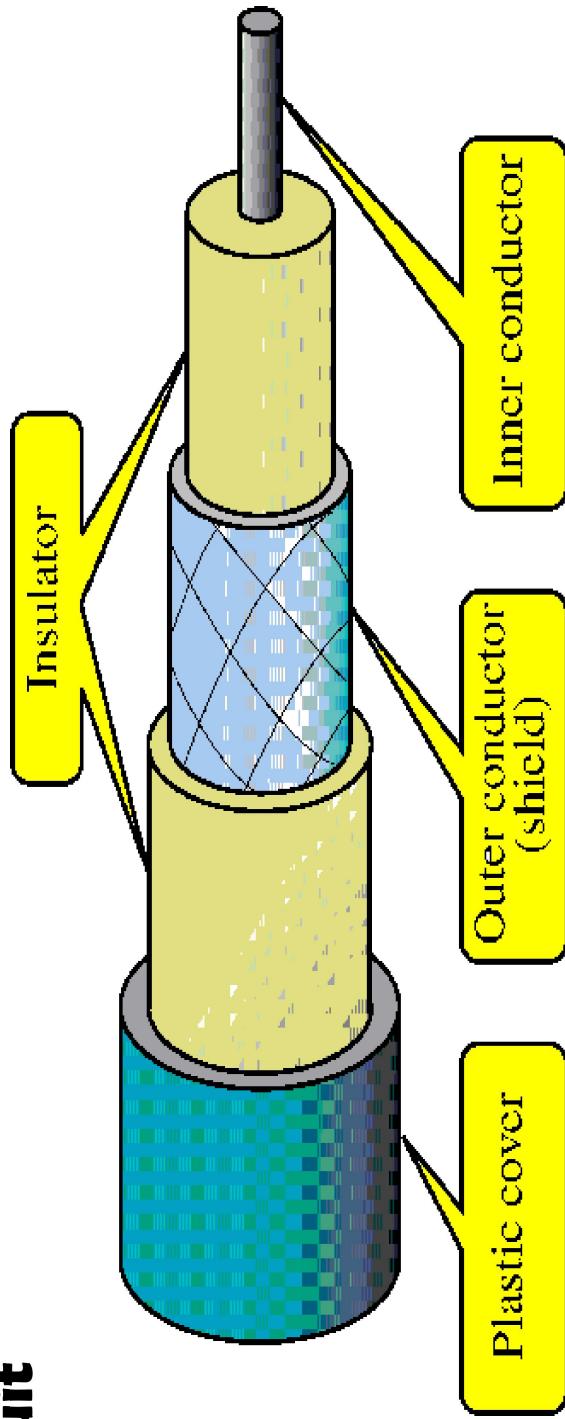
- STP cables are similar to UTP cables, except there is a metal foil or braided-metal-mesh cover that encases each pair of insulated wires



# TRANSMISSION MEDIA

## Coaxial Cables

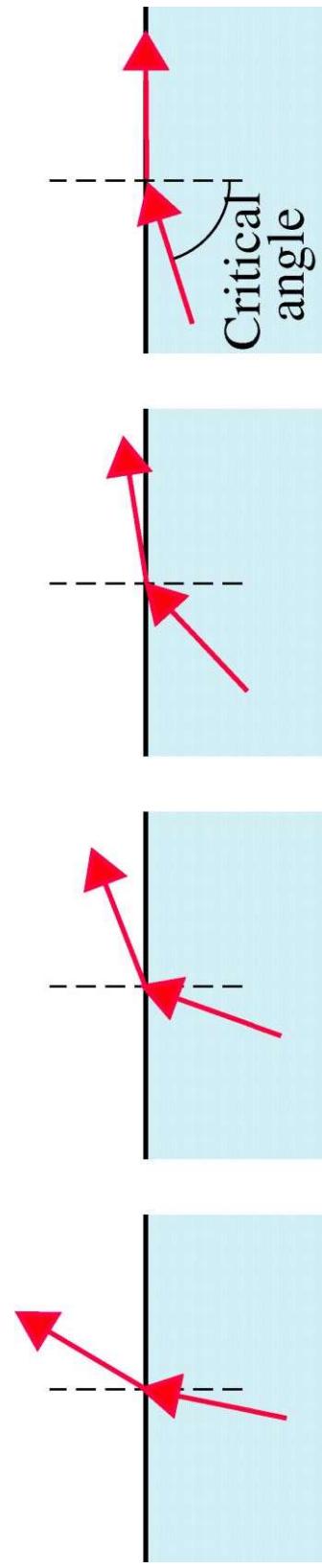
- In general, **coaxial cables**, or **coax**, carry signals of higher freq (100KHz–500MHz) than UTP cables
- Outer metallic wrapping serves both as a shield against noise and as the second conductor that completes the circuit



# TRANSMISSION MEDIA

## Fiber-Optic Cables

- Light travels at  $3 \times 10^8 \text{ ms}^{-1}$  in free space and is the fastest possible speed in the Universe
- Light slows down in denser media, e.g. glass
- **Refraction** occurs at interface, with light bending away from the normal when it enters a less dense medium



- Beyond the **critical angle** → total internal reflection

# TRANSMISSION MEDIA

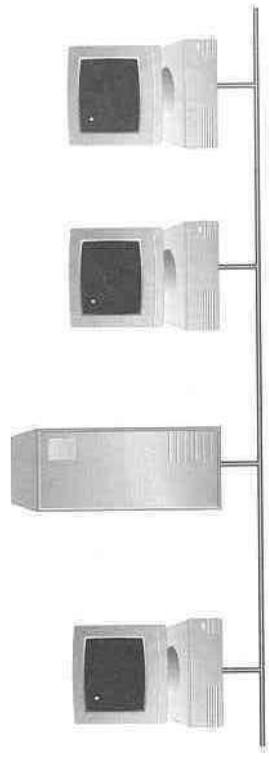
## Fiber-Optic Cables

- An optical fiber consists of a core (denser material) and a cladding (less dense material)
- Simplest one is a multimode step-index optical fiber
- Multimode = multiple paths, whereas step-index = refractive index follows a step-function profile (i.e. an abrupt change of refractive index between the core and the cladding)
- Light bounces back and forth along the core
- Common light sources: LEDs and lasers

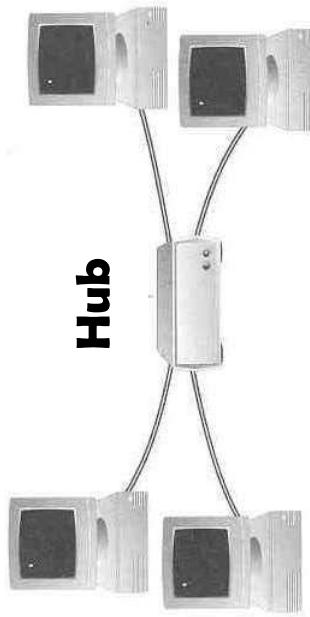
# TOPOLOGY

• How so many computers are connected together?

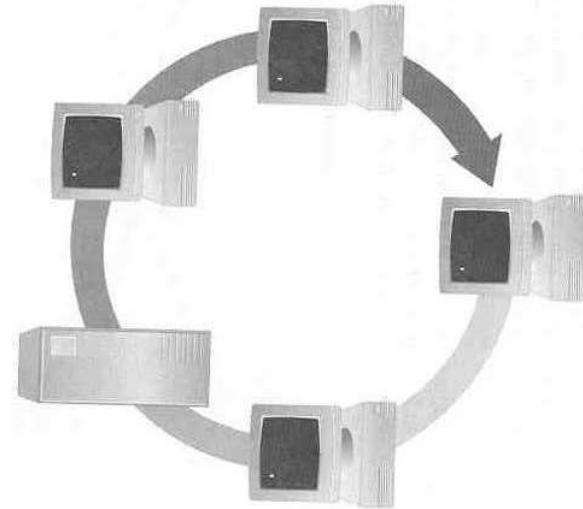
**Bus Topology**



**Star Topology**



**Ring Topology**



# TOPOLOGY

- **Bus Topology**
  - Simple and low-cost
  - A single cable called a **trunk** (**backbone, segment**)
  - Only one computer can send messages at a time
  - Passive topology - computer only listen for, not regenerate data
- **Star Topology**
  - Each computer has a cable connected to a single point
  - More cabling, hence **higher cost**
  - All signals transmission through the hub; **if down, entire network down**
  - Depending on the intelligence of hub, two or more computers may send message at the same time

# TOPOLOGY

- **Ring Topology**
  - Every computer serves as a repeater to boost signals
  - Typical way to send data:
    - **Token passing**
    - only the computer who gets the token can send data
- Disadvantages
  - Difficult to add computers
  - More expensive
  - If one computer fails, whole network fails