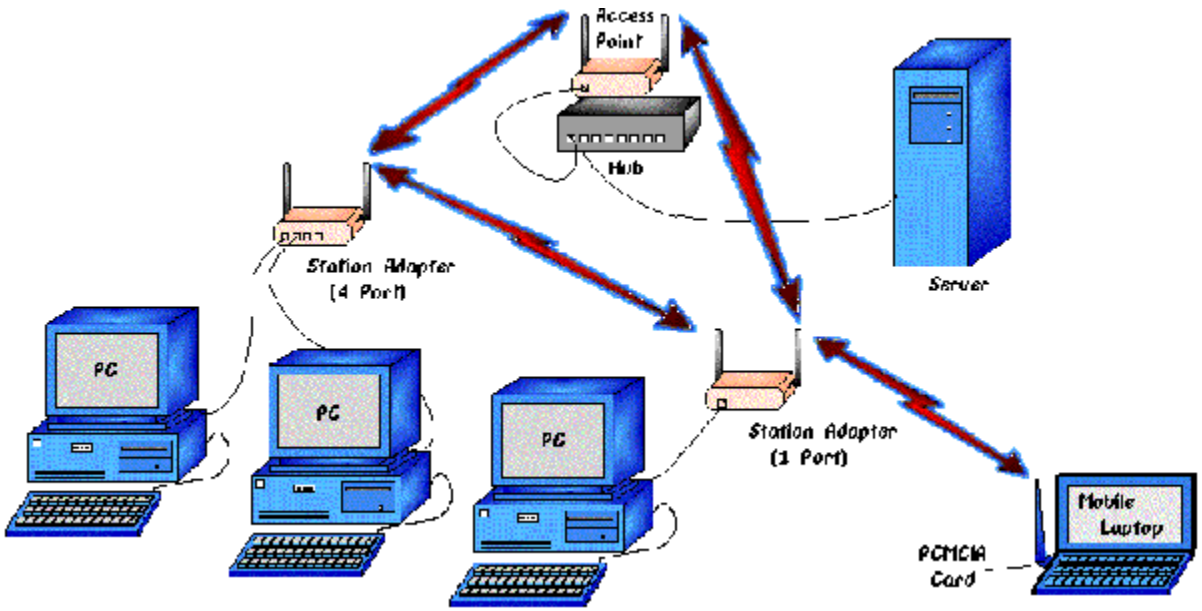
NETWORKING

- Data communication involves the transfer of information from one computer to another.
- This transfer is controlled by communication devices and communications software.
- A communication device is any component or piece of hardware that assists in the transfer of data.
  - For example, modems, and cables are all communications devices.

WHAT IS A COMPUTER NETWORK?



WHAT IS COMPUTER NETWORK

- A Computer Network is a group of two or more independent computers connected in an organized manner such that they can communicate with each other.
- Computers and peripherals on a network are sometimes called nodes.
- Intranet: computer network, based on Internet technology, that is designed to meet the internal needs for sharing information within a single organization or company.

- Extranet: An extranet is a private network that uses the Internet protocols and the public telecommunication system to securely share part of a business's information or operations with suppliers, vendors, partners, customers, or other businesses. An extranet can be viewed as part of a company's intranet that is extended to users outside the company. An extranet requires security and privacy

WHY A COMPUTER NETWORK?

- The main reasons are:
- Distribute pieces of computation among computers (nodes). Applications installed on certain nodes are accessible
- Coordination between processes running on different nodes

  – share Remote I/O Devices. Users can share printers and telecom services

  –Share Remote Data/File Access. Centrally stored company databases are available to all users of the LAN

  –Personal communications (like e-mail, chat, audio/video conferencing). Users can communicate throughout the LAN using e-mail.

Disadvantages of Computer Networks

- Network Architecture management
  - –The organisation has to pay technical staff to maintain the network.
- Disk space management.
  - –users' data is stored on the servers hard drives need to be backed up regularly or there would be a public outcry if it were lost. Each user is allocated a specific amount of space on the hard drive, they exceed it and moan for more
- Resource management.
  - –Networks fail occasionally and then no one in the organisation can use the computers. As more users log onto the network, the servers have to share their time among them and the system may slow down

Characteristics used to categorize different types of networks:

1.Area of location: Based on geographical areas covered as Networks can be divided into : LAN, MAN,& WAN

2.Topology : geometric arrangement of nodes and cable links in a local area network;, BUS,STAR, RING ,tree etc

Characteristics used to categorize different types of networks:

3.Architecture / **configurations** :

- Client/server network where we have one server and many clients.
- Peer-to-peer network – all computers have the same capability and can communicate with each other

Area of location

- LANs : Local Area Networks
  - Typically connects computer in a single building or campus OR is a network that is confined within a building. Rarely are LAN computers more than a mile apart.
- On most LANs, cables are used to connect the network interface cards in each computer.
  - Medium : optical fibers, coaxial cables, twisted pair, wireless.

Area of location

- MANs: Metropolitan Area Networks
  - Generally covers towns and cities (50 kms)
  - Medium : optical fibers, cables.
  - Data rates adequate for distributed computing applications.
- WANs : Wide Area Networks.
  - Generally covers large distances (states, countries, continents).
  - Medium : communication circuits connected by routers.

NETWORK TOPOLOGIES

Topology

- **Topology: The physical layout of a local area network. How computers get connected, bus, star, hub, hybrid, mesh, tree topologies.**
- **In Computer Networking "topology" refers to the layout or design of the connected devices. Network Topologies can be physical or logical.**

What is a Topology?

- refers to the configuration of cables, computers, and other peripherals.
- They include the following.
  - **1. Star Topology 2. Bus Topology**
  - **3. Ring Topology**
  - **Tree**

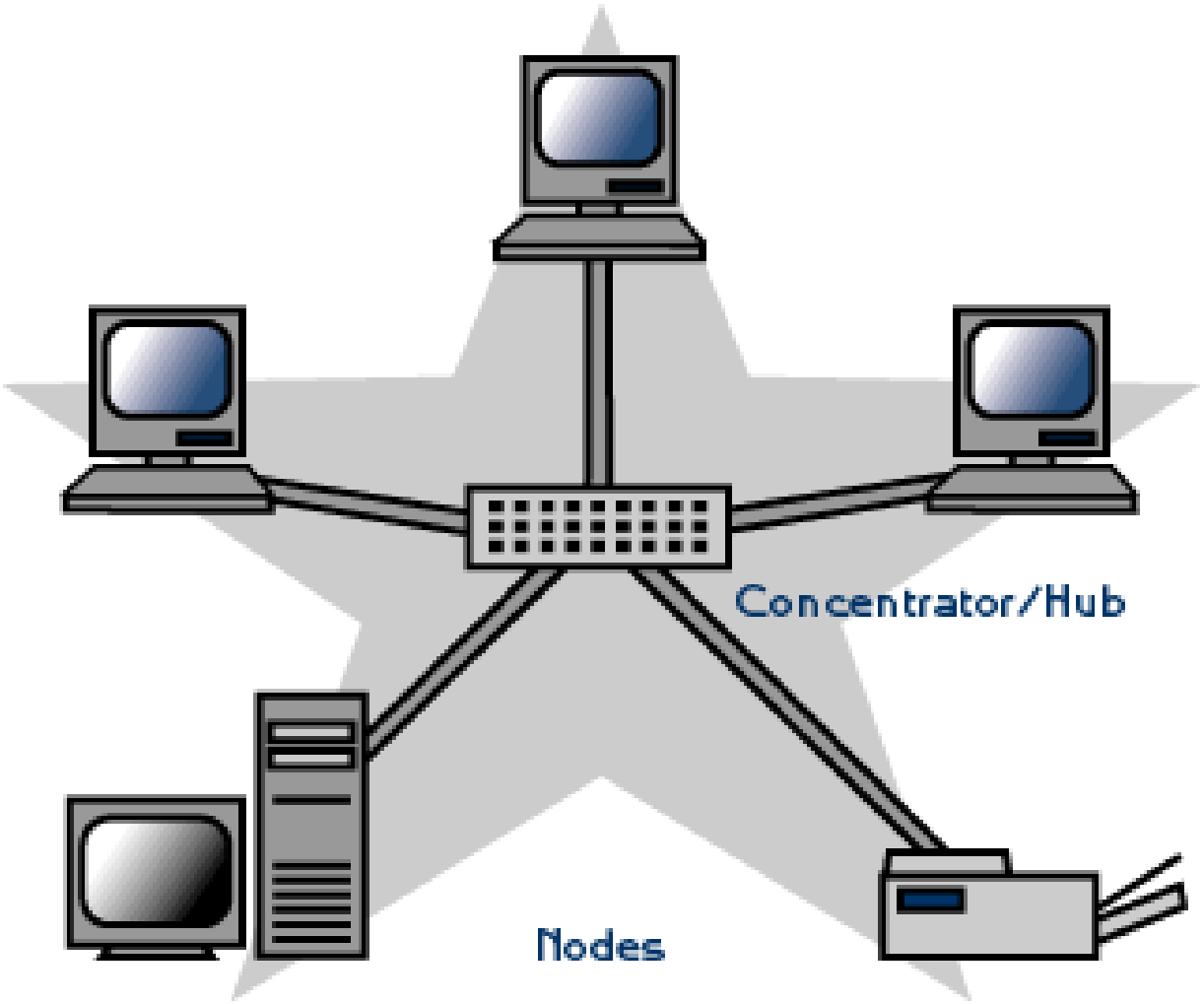
Star Topology

- A star topology is designed with each node (file server, workstations, and peripherals) connected directly to a central network hub or concentrator
- Data on a star network passes through the hub or concentrator before continuing to its destination

Star Topology

- The hub or concentrator manages and controls all functions of the network.
- It also acts as a repeater for the data flow.
- This configuration is common with twisted pair cable; however, it can also be used with coaxial cable or fiber optic cable.
- Data is transmitted using Ethernet method

Star Topology



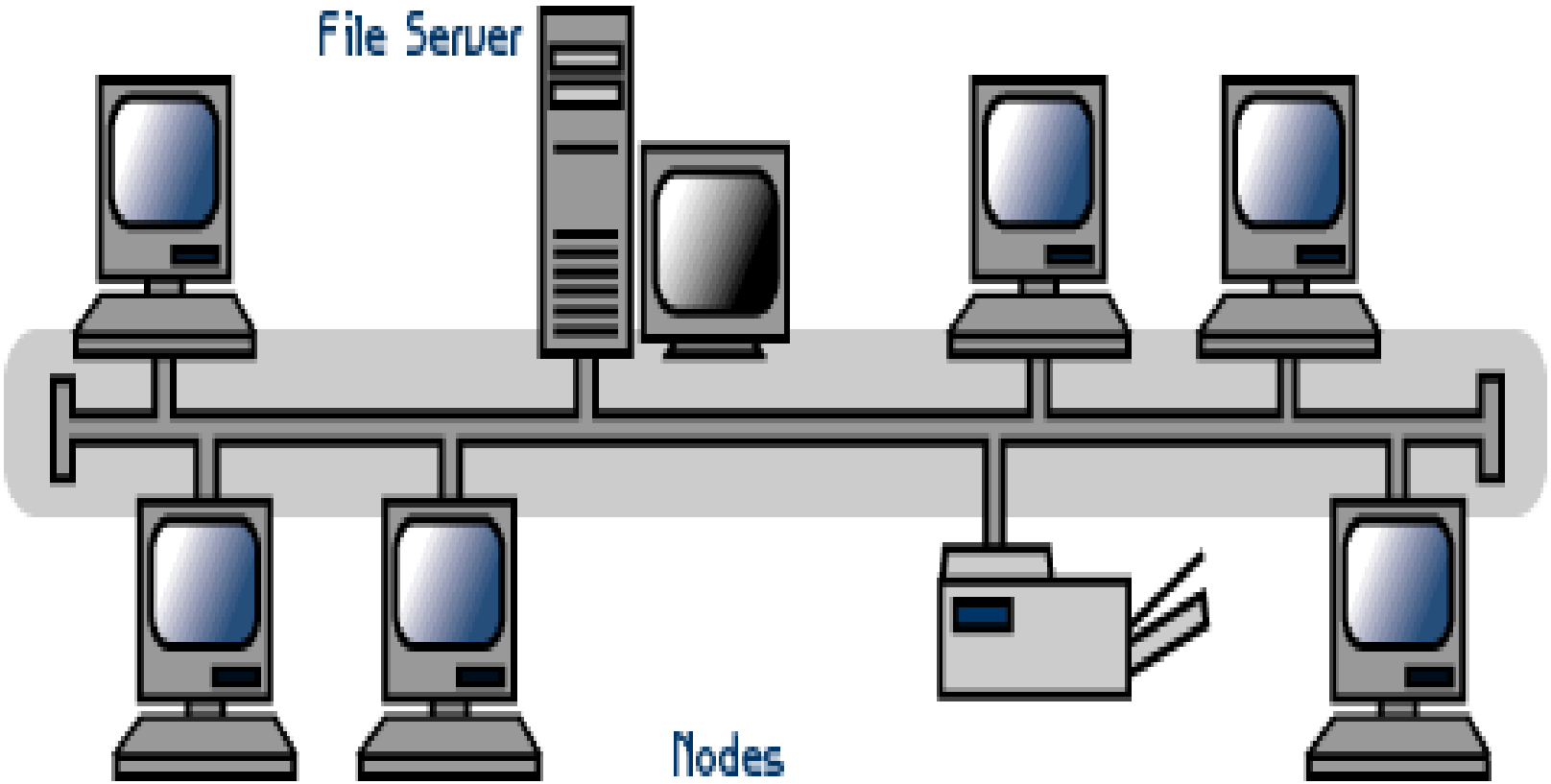
Star Topology

- **Advantages of a Star Topology**
- Easy to install and wire.
- No disruptions to the network when connecting or removing devices.
- Easy to detect faults and to remove parts.
- **Disadvantages of a Star Topology**
- Requires more cable length than a linear topology.
- If the hub or concentrator fails, nodes attached are disabled.
- More expensive than linear bus topologies because of the cost of the concentrators.

BUS Topology

- consists of a main run of cable with a terminator at each end.
- All nodes are connected to the linear cable.
- Data is transmitted using Ethernet and local talk methods.

BUS Topology



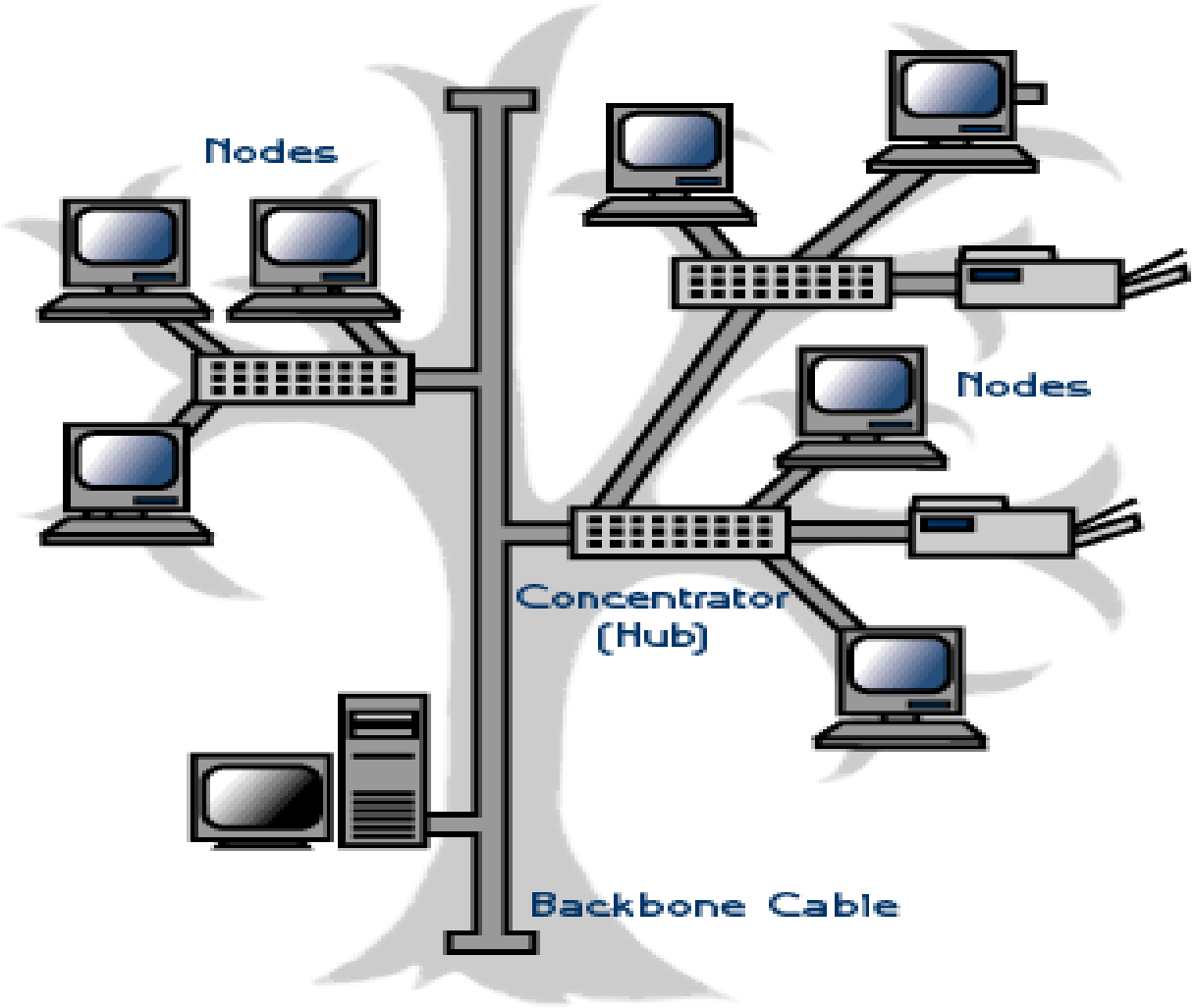
BUS Topology

- **Advantages of a Linear Bus Topology**
- Easy to connect a computer or peripheral to a linear bus.
- Requires less cable length than a star topology.
- **Disadvantages of a Linear Bus Topology**
- Entire network shuts down if there is a break in the main cable.
- Terminators are required at both ends of the backbone cable.
- Difficult to identify the problem if the entire network shuts down.
- Not meant to be used as a stand-alone solution in a large building.

Tree Topology

- This combines characteristics of linear bus and star topologies. Also called hybrid topology
- consists of groups of star-configured workstations connected to a linear bus backbone cable
- The topology allow for the expansion of an existing network, and enable schools to configure a network to meet their needs.
- if a single computer fails, it will not affect the rest of the network

Tree Topology



Tree Topology

Advantages of a Tree Topology

- Point-to-point wiring for individual segments.
- Supported by several hardware and software venders.

Disadvantages of a Tree Topology

- Overall length of each segment is limited by the type of cabling used.
- If the backbone line breaks, the entire segment goes down.
- More difficult to configure and wire than other topologies.

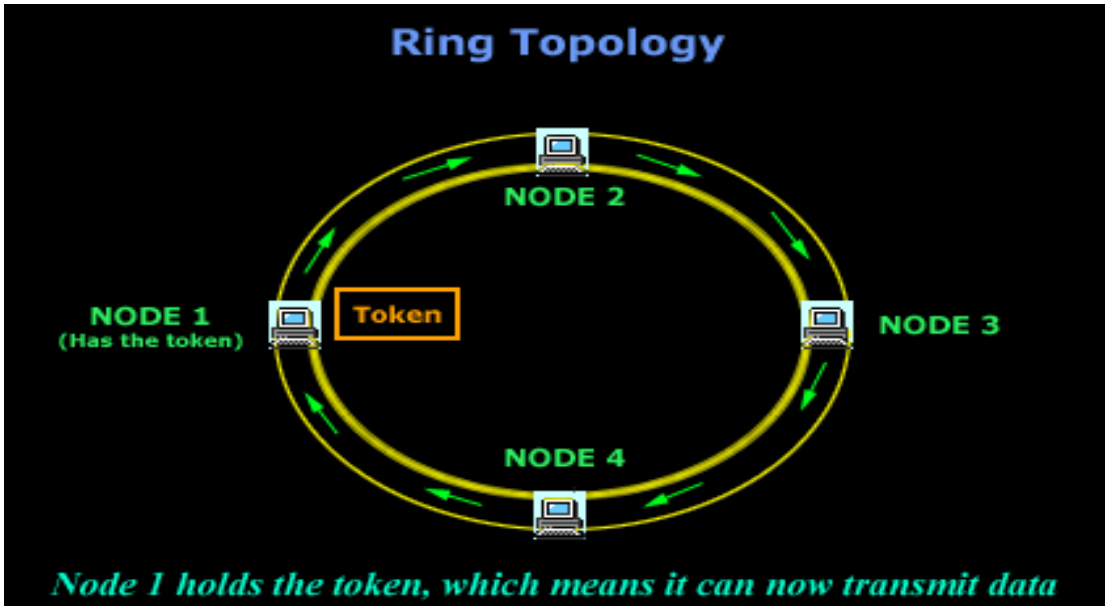
Ring Topology

- Computers are connected on a single circle of cable.
- The signals travel around the loop in one direction and pass through each computer, which acts as a repeater to boost the signal and send it to the next computer
- The method by which the data is transmitted around the ring is called token passing

Ring Topology

- A *token* is a special series of bits that contains control information. Possession of the token allows a network device to transmit data to the network. Each network has only one token.

Ring Topology



Star-Ring Topology

- The computers are connected to a central component as in a star network. These components, however, are wired to form a ring network
- If a single computer fails, it will not affect the rest of the network. By using token passing, each computer in a star-ring topology has an equal chance of communicating. This allows for greater network traffic between segments than in a star-bus topology.

Network Protocols:

- A communication protocols is a set of rules that ensures the orderly and accurate transmission and reception of data. The most widely used network communications protocol are: TCP/IP (Transmission control protocol/Internet protocol) which is used on minicomputer, micro computer and mainframe networks. It is frequently used in UNIX and Win. NT systems and is the basis for a communication on the network. IPx (Internet-work packet exchange) is the protocol used by Novell NetWare, the most popular microcomputer network software.

Network Hardware for LAN

- 1. Network interface card (NIC) This is the key hardware component for connecting a computer to a LAN. It is a small circuit board designed to plug into an expansion slot on a computer main-board. The NIC sends data from your 23 workstation out over the network and collects incoming data for your workstation. Most recent computers have them integrated onto the motherboard

Network Hardware for LAN

- 2. Connecting cables:- The cables commonly used for interconnecting PCs are the twisted pair copper wires, either Category 5 (CAT 5) or Category 6 (CAT 6) cables. Or fiber optic connections. Instead of using cables, some wireless networks use radio or infrared signals to transmit data from one network device to another. The NIC on a wireless network contain the transmitting device necessary to send data to other devices on the LAN.

Network Hardware for LAN

3. Network Servers

These are different kinds of network servers. A dedicated file server is devoted only to the task of delivering programs and data files to workstations. It does not process data or run programs for the Workstations. Instead programs run using the memory and processor of the workstation. Non-dedicated server (peer-to-peer capability) here a network computer performs a dual role as both file server and

Other servers in networks

- Print server – stores files in a print queue and sends each queued file to the network printer. A print job is a file that has been sent to the printer
- Mail server
- Modem- ref to communication devices