Computer Networks

Presented by

Syed Shakil Mahmud
Lecturer
Department of Computer Science and Engineering
Bangladesh Army International University of Science and Technology

Network

- A network is a set of devices (often referred to as nodes) connected by communication links.
- A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.
- A group of computers and other devices joint together through some transmission medium is called Computer Network.

Why Computer Network?

To share information or receive a service via a network, or group of members able to communicate with each other.

The concept of connected computers sharing resources is called Networking.

Computer network that is part of network can share the following, Data, Messages, Graphics, Printers, Modem, Fax machine & other Hardware resources.

Applications of Networks

- **Resource Sharing**
  - Hardware (computing resources, disks, printers)
  - Software (application software)
- **Information Sharing**
  - Easy accessibility from anywhere (files, databases)
  - Search Capability (WWW)
- **Communication**
  - Email
  - Message broadcast

What do you find on a network?

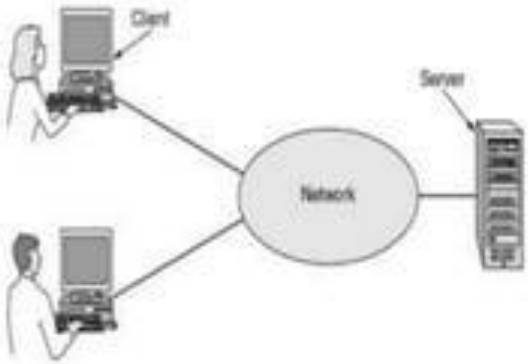
The following types of nodes may be found on a data communications system.

- **Host:** - A central computer which stores data and executes programs for terminals.
- It is usually associated with minicomputers or mainframes.
- It requires a multi-tasking, multi-user operating system such as Unix.

- **Terminal:** - A computing device which is composed of a video screen and a keyboard. It allows a user to communicate with a host by typing in information or commands.
- The host communicates with the terminal by updating the CRT (video).
- Terminals cannot execute programs.

What do you find on a Network? (Cont'd)

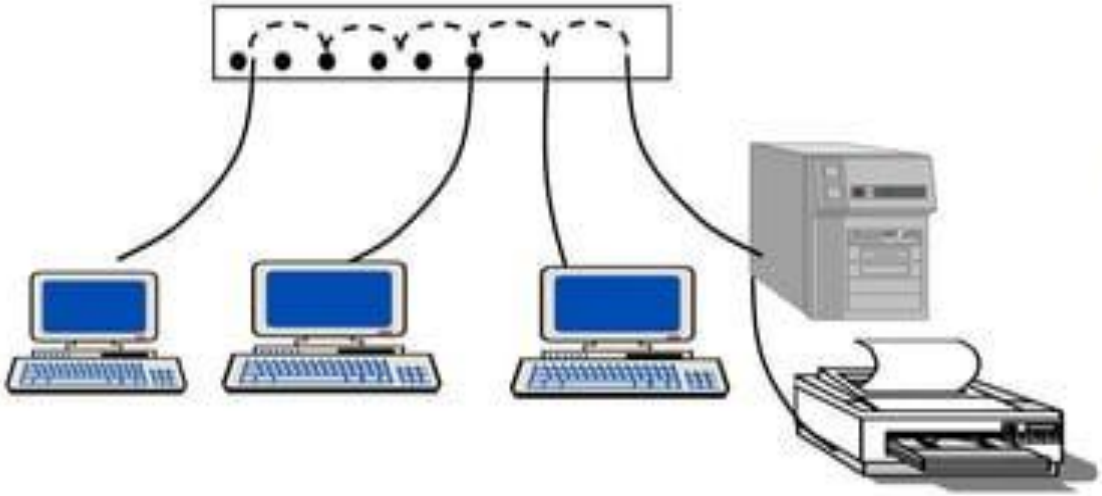
- **Client**
- A computer which takes advantage of the services provided by servers on the network.
- Client also called Front End computer.
- **Server**
- The computer which used and provide services & resources is called Server.
- Server is also called Back End computer.

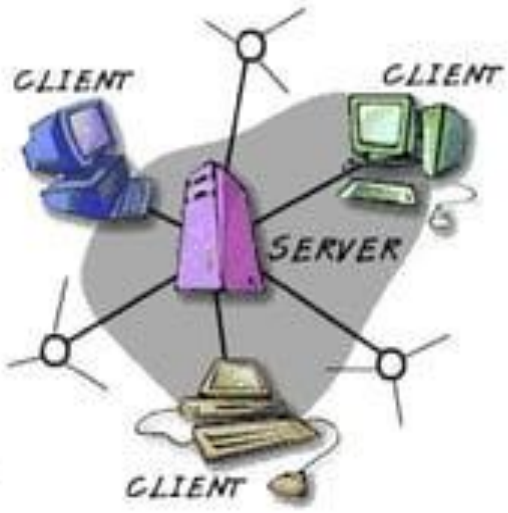


A Network with two Clients and one Server.

What do you find on a Network? (Cont'd)

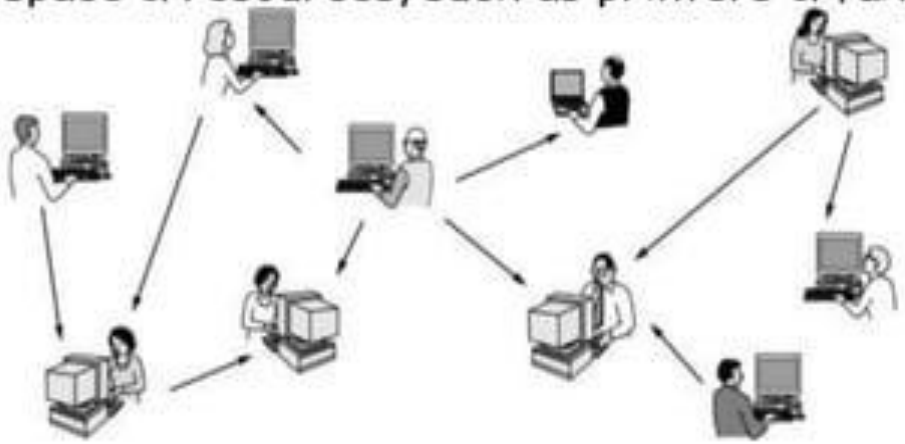
- **Client Server Network**
- Server based network also called client-server network, containing Client & the server that support them.
- The Web is known as a **client-server** system. Your computer is the client; the remote computers that store electronic files are the servers. Examples include file, print or communication servers.





What do you find on a Network? (Cont'd)

- **Peer-to-Peer Network:** - Peer-to-Peer or simply peer means the computer which has both qualities as server as well as client.
- It means which both use & provide network resources.
- Peer network which have no servers & use the network to share resources among independent peers.
- Users simply share disk space & resources, such as printers & faxes.



In a peer-to-peer system there are no fixed clients and servers.

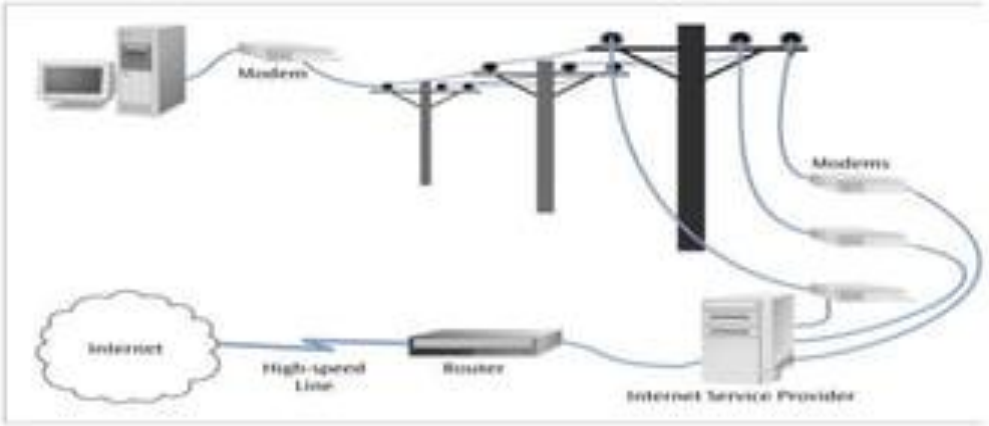
Network Interface Card

- A computer is connected to the network cabling with a network interface card, (also called a "NIC", "nick", or network adapter.
- Faster computers, like high-speed Pentiums, Dual Core, and Core 2 Duo or Core 2 Quad, often have 32-bit, 64-bit or PCI slots.
- These PCs require 32-bit NICs to achieve the fastest networking speeds possible for speed-critical applications like desktop video, multimedia, publishing, and databases.

MODEM

- MODEM short for modulator/demodulator.
- The modem is necessary because the phone network transmits audio, not data bits.
- The modem is for compatibility with existing equipment.
- Modulation is a prescribed method of encoding digital (or analog) signals onto a waveform (the carrier signal).
- Once encoded, the original signal may be recovered by an inverse process called demodulation.

A microcomputer/ workstation sending data over a telephone line to an Internet service provider and onto the Internet



HUB

- HUB is a common connection point for devices in a network.
- The benefits of HUB used in a network is that if a cable break on a network, the break cable node will only affected and not affect on the rest of network.
- HUB internally uses BUS topology.
- Network can be easily expanded using Hubs.

- **Active Hub**: - A HUB that regenerate and retransmit signals are called Active Hub.
- Active HUB is also called multi-port repeater.
- Active HUB requires electrical Power to run.
- **Passive HUB**: - A HUB that do not regenerate and do not retransmit signals are called Passive HUB.
- Passive HUB do not require electrical power to run.

Connector RJ-45

- The standard connector for twisted pair cabling is an RJ-45 connector. This is a plastic connector that looks like a large telephone-style connector.
- Cable used as a medium to carry the signal.
- Coaxial Cable
- Twisted-Pair Cable
- Fiber-optic Cable

Categories of Networks

Today when we speak, we are generally referring the primary categories LAN, MAN and WAN.

The category into which a network falls is determined by

Technology,

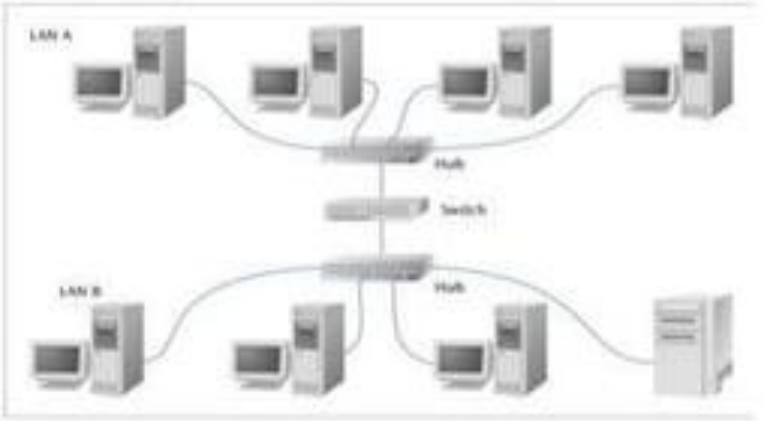
its Size,

Standard Port & Media.

Local Area Network

- A Local Area Network can connect many types of computing devices together such as microcomputers, minicomputers and switches.
- A LAN is usually privately owned links the devices in a single office, building, or campus.
- Depending on the need of organization and the type of technology used.
- A LAN can be as simple as two PCs and a printer in someone's home office, or it extend throughout a company and include voice, sound, and video peripherals. Currently LAN size is limited to a few kilometers.

Ethernet, token ring

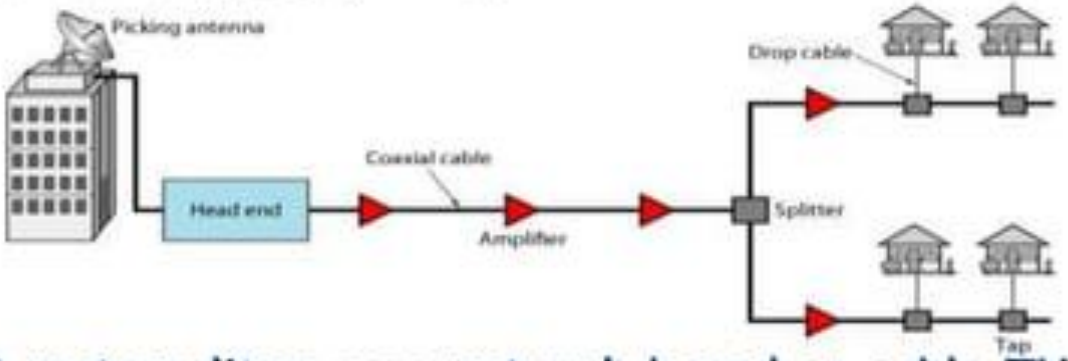


Local Area Network (Cont'd)

- It has two main components Hardware & Software.
- Network hardware includes NIC, Hub, Switch, Medium, Connectors (RJ-45).
- Network software includes, Protocols (TCP/IP), Network services.
- It usually uses cable (coaxial, twisted pair or fiber) but may use radio waves, infrared or micro waves.
- It is used by a single organization.

Metropolitan Area Network

- A high speed (100Mbps) network which spans city distances. or
- It may be a single network such as a cable television network, or
- It may be a means of connecting a number of LANs into a larger network, so that resources may be shared LAN-to-LAN as well as device-to-device. **FDDI, ATM**

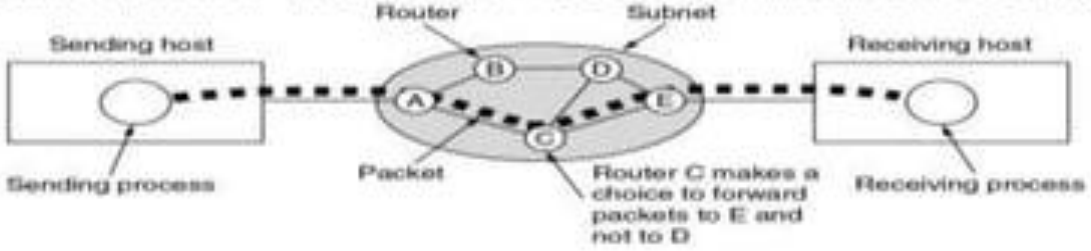


A metropolitan area network based on cable TV.

- Many telephone companies provided a popular MAN service called Switched Multi-megabit Data Service (SMDS). It is a service for handling high-speed communication for metropolitan area network.

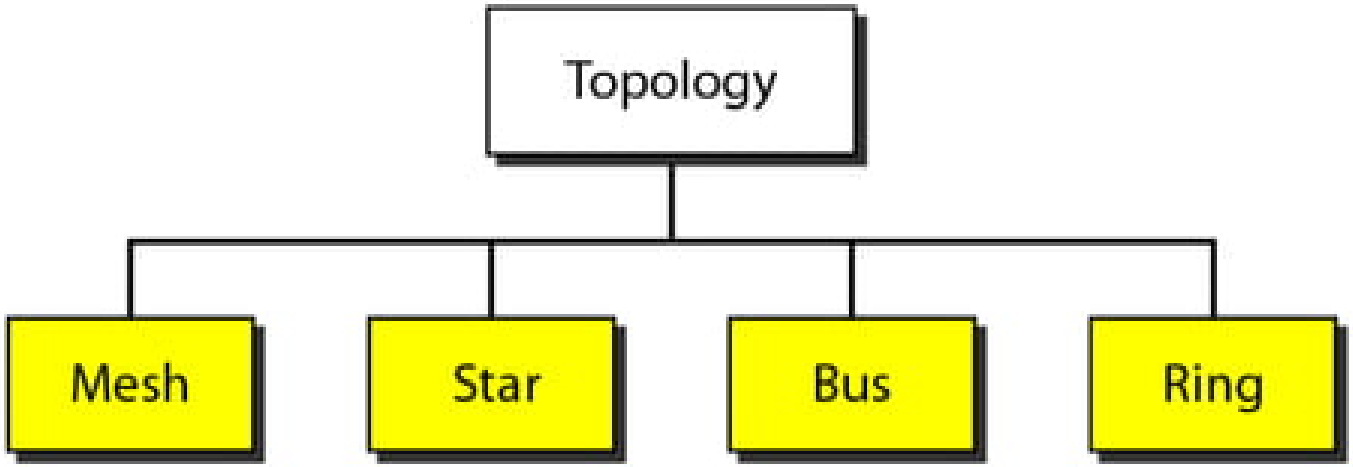
Wide Area Network

- **WAN**: - The network between different cities, countries or in the world using WAN standard port & routing technology is called WAN.
- A WAN is a network that covers a large geographical area using communication channel that combines many types of media such as telephone lines, cables & radio waves.
- The Internet is the worlds largest WAN.
- They use data lines which belong to a third party service provider such as the telephone company.
- They require special interfaces to the data lines such as synchronous modems & routers.
- Routing technology is a crucial component of a WAN. Routers decide how a packet should be sent in order that it arrives at its intended destination.



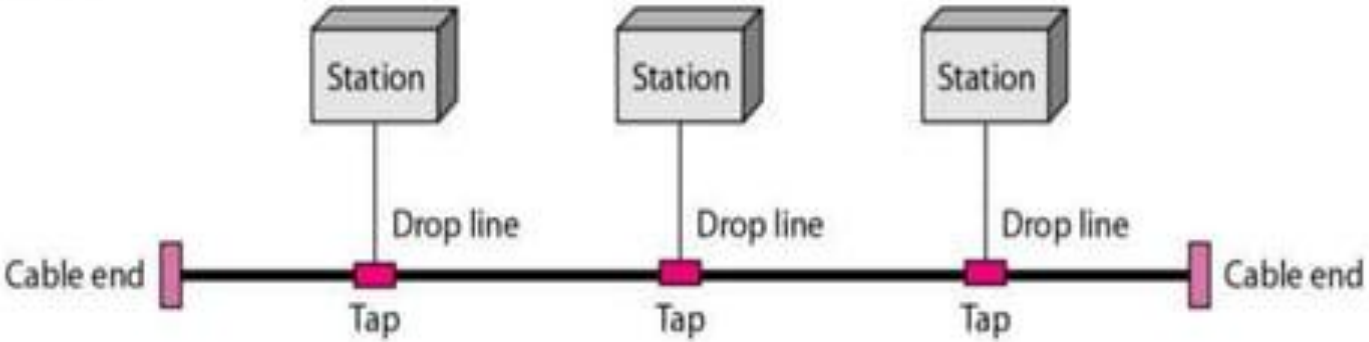
Network Topology

The network topology is the shape or the physical connectivity
Of the network.



Bus Topology

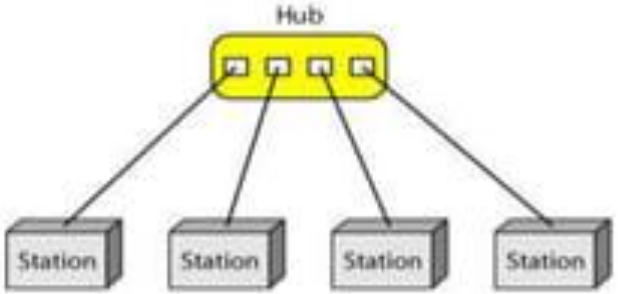
- A bus topology is a multipoint. One long cable acts as a backbone to link to the entire device in a network.
- In this topology all the computers are connected in a series to one cable.



- Nodes are connected to the bus cable by drop-line and tap.
- A drop-line is a connection running b/w the device and main cable.
- A tap is a connector that either splices into the main cable to create a contact with the metallic core.

Star Topology

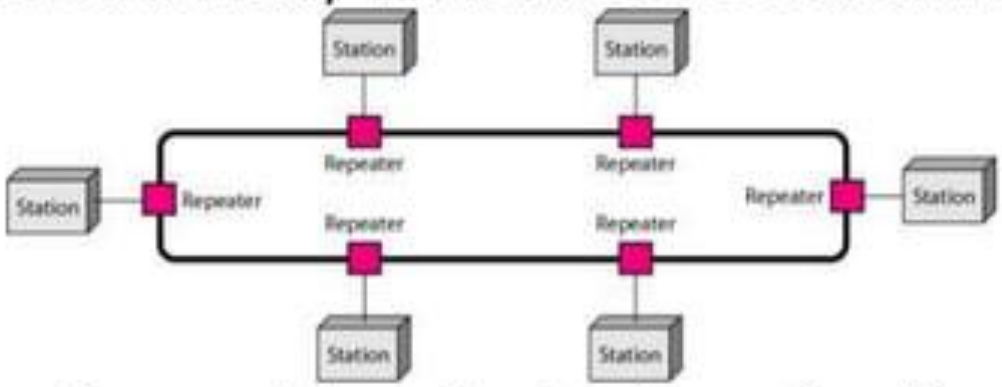
- In star topology, each device has a dedicated point-to-point link only to the central controller, usually called HUB.



- In star topology communication with a central HUB that resend the message either to all the computers (in a broadcast star network) or only to the destination computer (in a switch star network).
- The devices are not directly linked to one another. The controller acts as an exchange, if one device want to send data to another, it send the data to the controller, which than relays the data to the other connected device.

Ring Topology

- In ring topology, each device has a dedicated point-to-point connection with only to the two devices on either side of it.

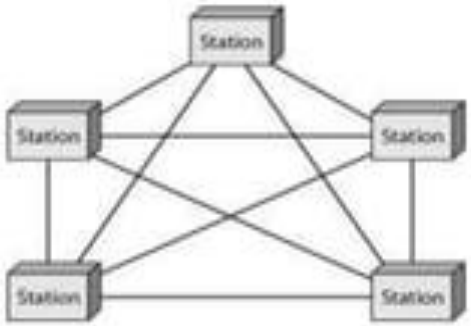


A signal is passed along the ring in one direction, from device to device, until it reaches its destination.

- Each device in the ring incorporates the repeater, when a device receives a signal intended for another device; its repeater generates the bit and passes them along.

Mesh Topology

- In mesh topology, every device has a dedicated point-to-point link to every other device.



- The term dedicated means that link carries traffic only b/w two devices it connects.
- So we need n (n-1) physical link, however, if physical link allow communication in both direction (duplex mode), we can divide the no; of links by 2.
  In other words we can say that in mesh topology we need n (n-1)/2 duplex mode links.

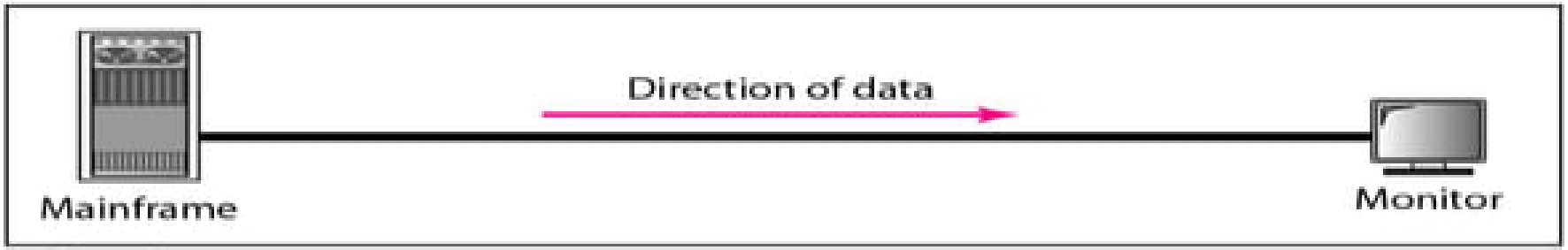
Data Transmission Modes

- There are three modes of communication.
  - **Simplex**
    - In simplex transmission mode, communication can take place in only one direction.
    - It means the sender will always send & the receiver will always receive.
    - An example is TV waves, we can watch different channels on TV but there is no need to send any type of signals from TV. Another example is line printer.
  - **Half-Duplex**
    - A half-duplex system can transmit data in both direction, but only in one direction at a time.
    - It means that at a time one computer can only send or receive, when one device completes a transmission, this device must "turn over" the medium to the other device so that this second device has turn to transmit. e.g. wireless

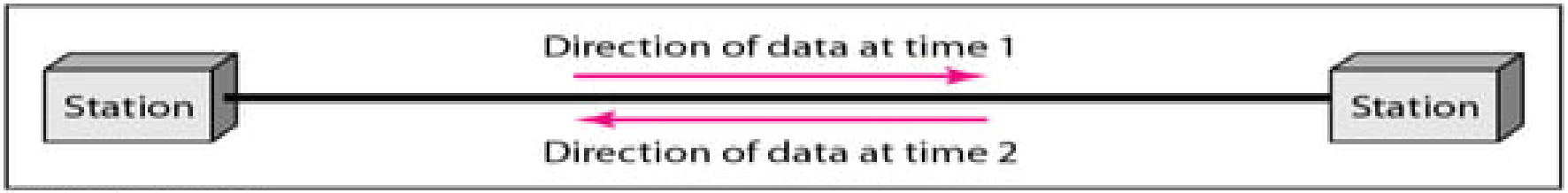
Data Transmission Modes (Cont'd)

- **Full-Duplex**
  - This mode allows a device to send & receive data simultaneously is called duplex or full-duplex mode.
  - This mode provides two ways to simultaneously data transfer by providing each device with a separate communication channel. Voice telephone is full-duplex devices and either party to a conversation can talk at any time.

Data Transmission Modes (Cont'd)



a. Simplex



b. Half-duplex

c. Full-duplex