

# Principles of Data Communications

Reference Book: Data Communications and Networking by Behrouz A. Forouzan

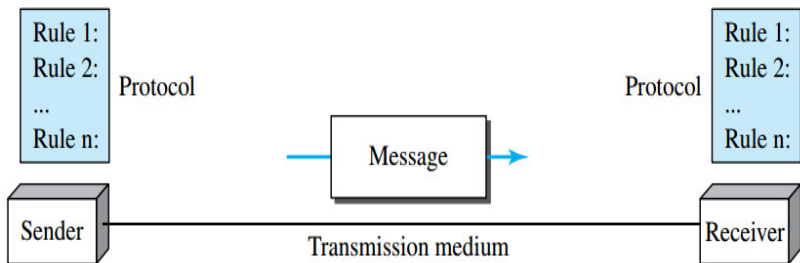
# Introduction to Communication

- Human Beings
  - Local: Face to Face
  - Remote: takes place over distance
- Telecommunication
  - includes telephony, telegraphy and television
  - communication at a distance
  - 'tele' in Greek means "far" / "distant"

- Data: refers to the information presented in whatever form is agreed upon by both the parties creating and using the data
- Data Communications: Exchange of data between two devices via some form of transmission medium such as a wire/cable
- Communication System: Made up of a combination of hardware and software

- Effectiveness of a data communication system depends on 4 fundamental characteristics
  - Delivery: S/y must deliver data to correct destination
  - Accuracy: Accurately- no alteration
  - Timeliness: No use if late
  - Jitter: Variation in packet arrival time

## *Five components of data communication*



# Components

## 5 components of a data commn system

- Message: Data to be communicated (text, numbers, pictures, audio, video)
- Sender: Device that sends the message (computer, telephone handset, video camera etc.)
- Receiver: Device that receives the message (computer, telephone handset, television etc.)
- Transmission Medium: Physical path by which message travels from sender to receiver (eg.) twisted pair wire, coaxial cable, fiber-optic cable, radio waves etc.
- Protocol: A protocol is a set of rules that govern data commns. It represents an agreement between the communicating devices. Without a protocol, 2 devices may be connected, but not communicating (just as a person speaking French cannot understand a person speaking Japanese).

# Data Transmission Basics

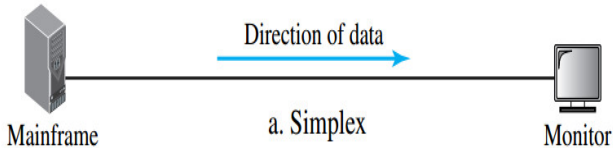
- Computers operate in binary, meaning they store data and perform calculations using only 0's and 1's.
- A single binary digit can only represent True (1) or False (0) in boolean logic.
- When we enter data into the computer via keyboard, each keyed element is encoded by the electronics within the keyboard into an equivalent binary coded pattern, using one of the standard coding schemes that are used for the interchange of information.
- The most widely used codes that have been adopted for this function are the Extended Binary Coded Decimal (EBCDIC) and the American Standard Code for Information Interchange codes (ASCII).

- Text: character, ASCII value
- Numbers: bit patterns
- Images: bit patterns- Image is composed of a matrix of pixels
- Audio: continuous
- Video: broadcasting; movie



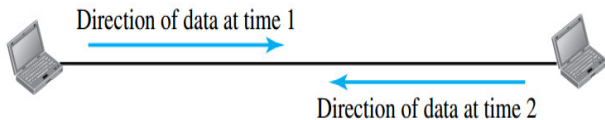
- Simplex
- Half-duplex
- Full-duplex

- eg) Keyboard-monitor; Server-Monitor: One way traffic



# Half Duplex

- Each station can transmit and receive; but not at the same time
- eg) One lane road with traffic allowed in both the directions, but only one at a time



b. Half-duplex

# Half Duplex

eg) Walkie-talkie



# Half Duplex

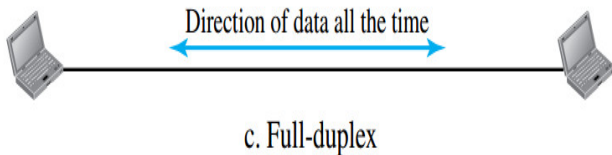
eg) Walkie-talkie

PTT button (Push-To-Talk/ Press-To-Transmit)



# Full Duplex

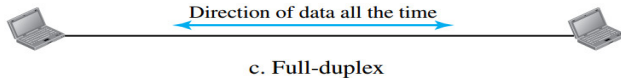
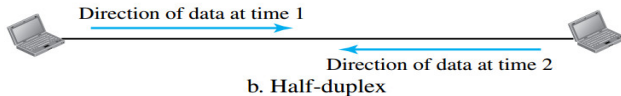
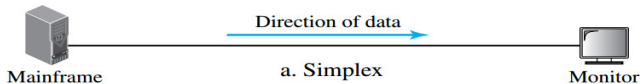
- Both stations can transmit and receive simultaneously
- (eg) Telephone Channel



# DataFlow

## *Data flow (simplex, half-duplex, and full-duplex)*

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- Networks: Interconnection of a set of devices (computer, phone etc.) capable of communication
- Internet: Network of Networks
- Network criteria- performance, reliability and security
  - Performance
    - Transit time is the amount of time required for a msg to travel from one device to another
    - Response time is the time elapsed between an enquiry and response
    - Throughput and Delay
    - Throughput: how much is actually traveling (bps).
    - eg) Road: designed for 100 cars to cross per second, (bandwidth=100bps); actual flow is 50 cars per second due to some block or so (throughput=50bps). Bandwidth: how much can (max.) actually travel through the channel.
    - More throughput + Less delay.



- Reliability
  - Measured by the frequency of failure
  - Time taken to recover from failure
- Security
  - Protecting the data from unauthorized access

- Components of a data communication system
- Data Representation
- Data Flow
- Network Criteria

THANK YOU