Communication Basics

Dr. Md. Fazlul Kader

Professor

Dept. of EEE, University of Chittagong

Course Outline

- Course Name (Theory): Data Communication
  - Course Code:
  - Credits: 3
  - Hours/week: 3
  - Total Weeks: 14
  - Software: MATLAB (All kinds of communication and signal processing tools must be installed)
- Book References:
  - Data Communication and Networking by Behrouz A Forouzan

Overall Assessment

- **Marks Distribution**

Type	Marks
Class Assessment	10%
Assignment/Class Performance*	10%
Class Test	20%
Midterm	20%
Final Exam	40%
Overall	100%

* MatLab Simulation

Books & Software

Texts and Materials

A. Recommended Readings:

1. Data Communications and Networking by Behrouz A. Forouzan
2. Advanced Electronic Communication Systems by Wayne Tomasi
3. Communication Systems by Simon Haykin

B. Supplementary Readings:

1. Digital Communication Systems by Simon Haykin
2. Data and Computer Communications by William Stallings

- MatLab R2015 or later

Data

- In the context of communication, data refers to information that is exchanged between two or more devices or systems.
- This information can be in various forms, including
  - text,
  - numbers,
  - images,
  - audio, and
  - video

Communication & communication System

Communication

- **Communication** is the transfer of information from one place to another.
- This should be done

*- as **efficiently** as possible*

*- with as much **fidelity/reliability** as possible*

- *as **securely** as possible*

Communication System

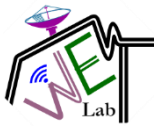
- Components/subsystems act together to accomplish information transfer/exchange.

NEED FOR COMMUNICATION

- Interaction purposes – enables people to interact in a timely fashion on a global level in social, political, economic and scientific areas, through telephones, electronic-mail and video conference.
- Transfer Information – Tx in the form of audio, video, texts, computer data and picture through facsimile, telegraph or telex and internet.
- Broadcasting – Broadcast information to masses, through radio, television or teletext.

Examples of Modern Communication Systems

- E-mail
- Voice Mail
- Fax
- Smart Phone
- Instant Messaging
- Telecommuting
- Video-conferencing
- Groupware
- Telephony
- E-Commerce
- The Internet
- Bulletin board system
- The Web
- Global positioning system

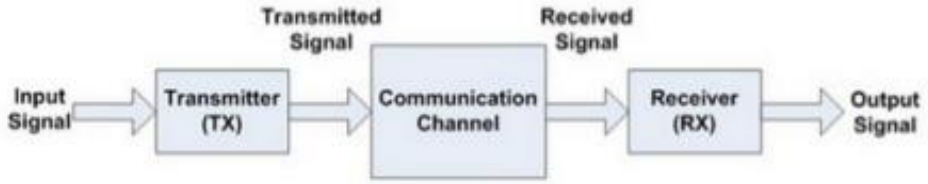


Basic Elements

- Basic Elements/parts of a communication systems

Parts of Communication System

- Communication systems consist of five parts:
  Source, Transmitter, Channel, Receiver, and Destination.

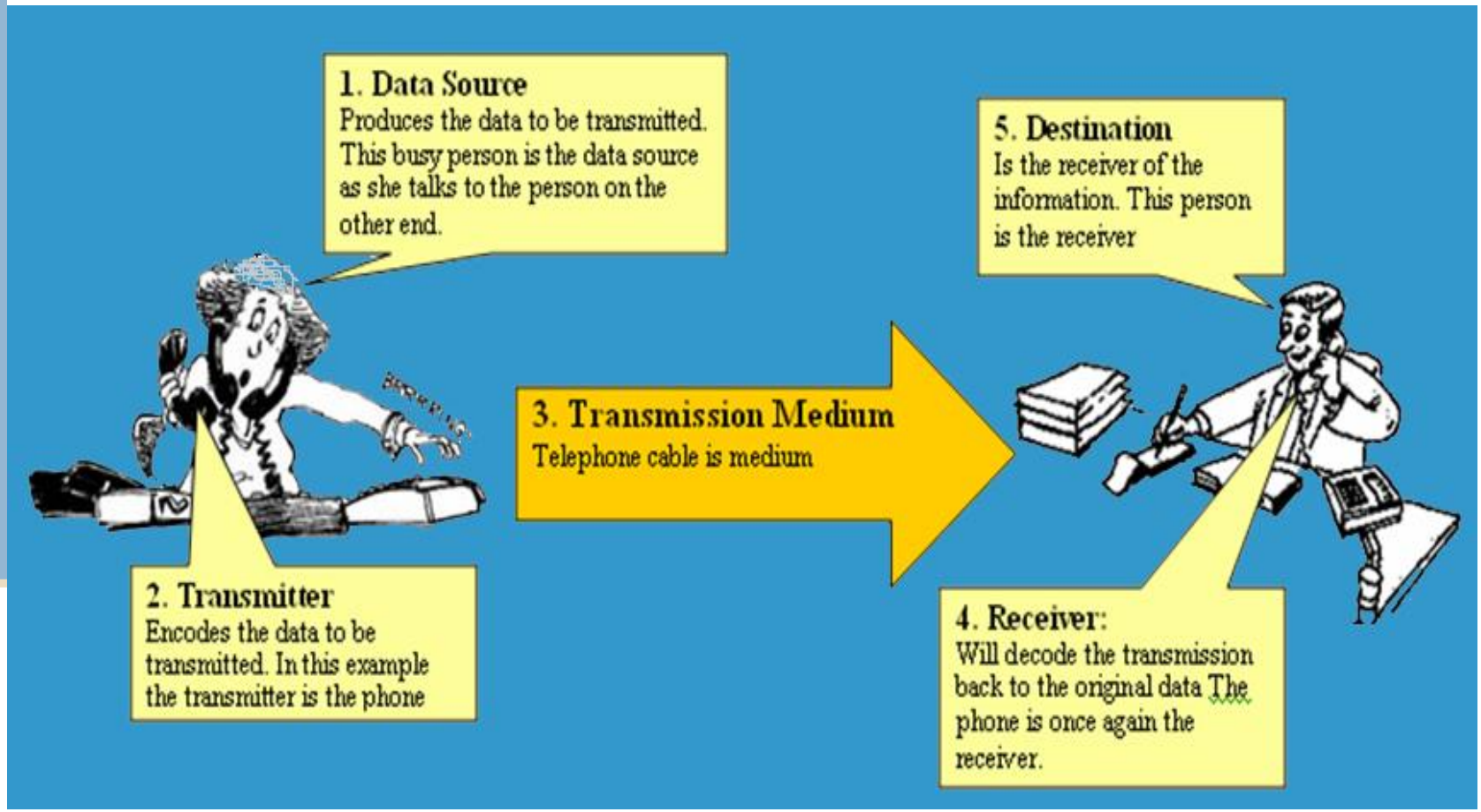


Shannons Model of Communication

5 Basic elements/Components

- Every communication system has 5 basic requirements
  - **Data Source** (where the data originates)
  - **Transmitter** (device used to transmit data)
  - **Transmission Medium** /channel (cables or non cable)
  - **Receiver** (device used to receive data)
  - **Destination** (where the data will be placed)

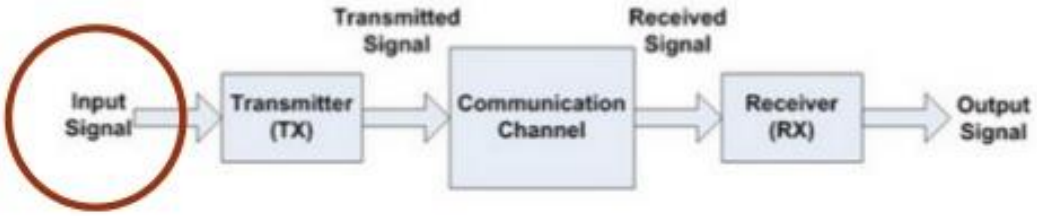
5 Basic elements/Components



Basic Elements

Parts of Communication System

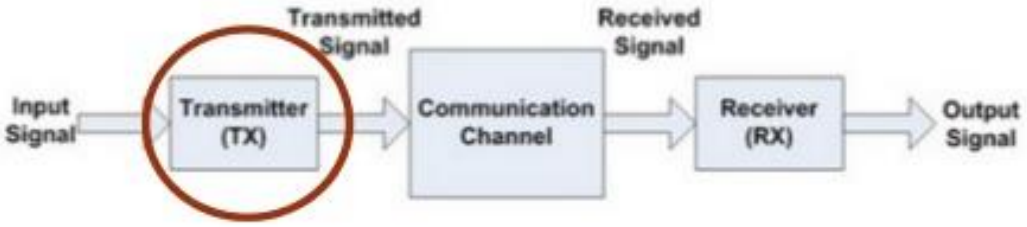
- **Source (input signal):**
  - The source originates a message, such as (human voice, the television picture, data).
  - If the data is non-electrical (analogue) it must be converted by an input transducer (microphone, camera…) into an electrical waveform (baseband modulation) referred to as the baseband signal or message signal.



Basic Elements

Parts of Communication System

- **Transmitter (TX):**
  - The transmitter modifies the base-band signal for efficient transmission.
  - Characteristics: Modulation, amplification, transmission frequency (TX), transmission power, coding…
  - MW modem, WiFi Card, Bluetooth Card, RF transmitter..



Basic Elements

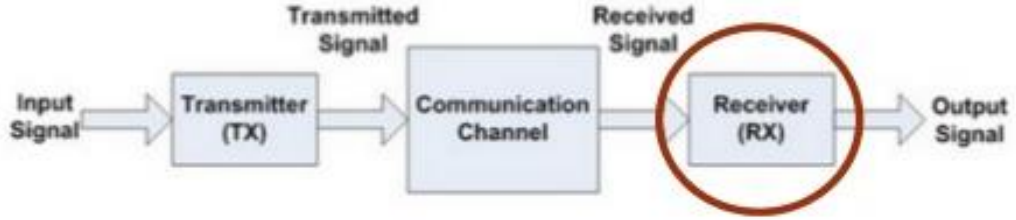
Parts of Communication System

- **Channel:**
  - The Channel is a medium, such as wire, coaxial cable, a waveguide, an optical fiber or a radio link (air interface), through which the transmitter output is sent.
  - Channel characteristics, ability for transmission, noise, interference, power needed, fading, multipath…

Basic Elements

Parts of Communication System

- **Receiver (RX):**
  - The receiver reprocesses the signal received from the channel by undoing the signal modifications made at the transmitter and the channel.
  - Characteristics: Demodulation, receiver frequency (RX), receiving power (threshold), decoding…
  - MW modem, WiFi Card, Bluetooth Card, RF receiver..



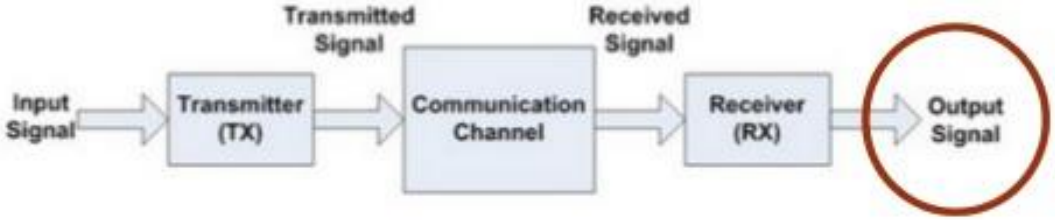
Basic Elements

Parts of Communication System

- **Destination (output signal):**

The destination is the unit to which the message is communicated.

The receiver output is fed to the output transducer (Monitor, Speaker…), which converts the electrical signal to its original form.



Data Transmission Modes/Data Flow

- **Ways for transmitting data from one point to another**
- **1.Simplex:**
  - In simplex mode the communication can take place only in one direction.
  - The receiver receives the signal from the transmitting device.
  - This mode of flow of information is Unidirectional.
  - **Example**: Radio, T.V

Figure : A Simplex Transmission (Only one-way transmission

Data Transmission Modes

- **2.Half-duplex**:
  - In half-duplex mode the communication channel is used in both directions, but only in one direction at a time.
  - **Example:** walkie-talkie

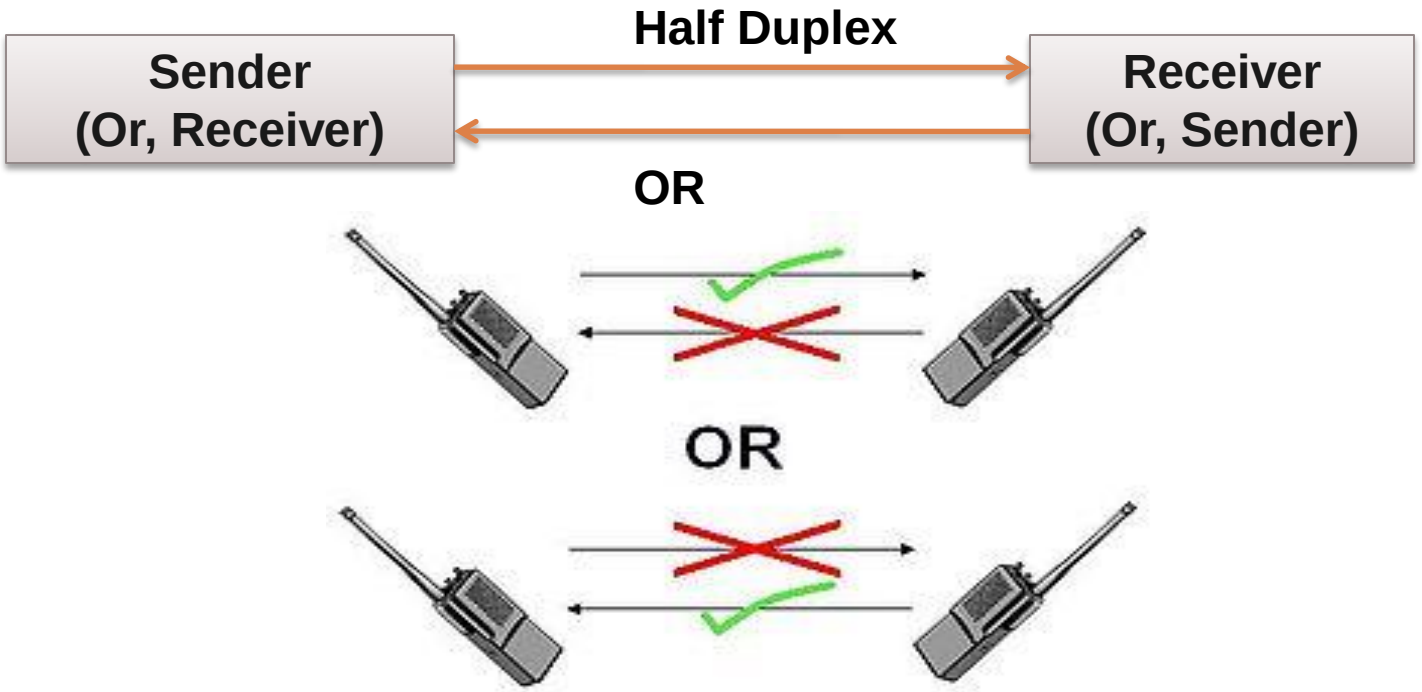
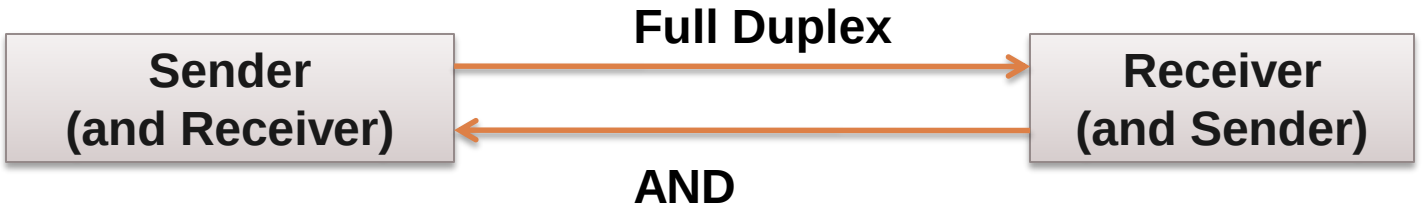


Figure : Half-duplex transmission (One-way transmission at a time)

Data Transmission Modes

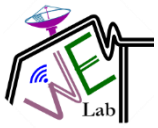
- **3.Full-duplex:**
  - In full duplex, the communication channel is used in both directions at the same time.
  - **Example** of this mode of transmission is the telephone line.



re : Full-duplex transmission (Two-way simultaneous transmission

Information Delivery

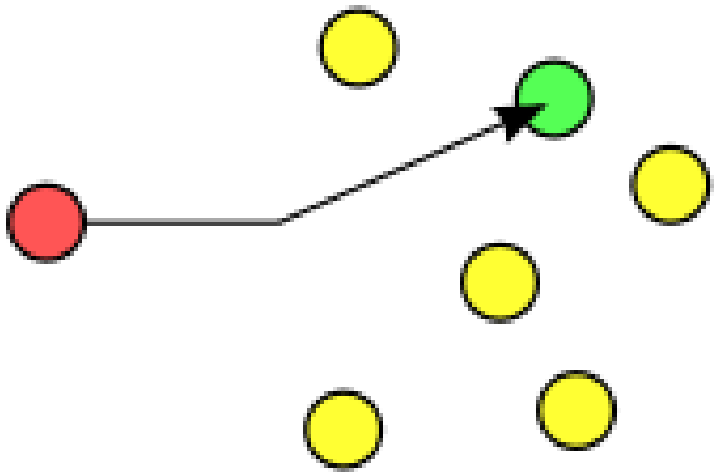
- **Information is delivered over a network by the following methods:**
  - **Unicast**
  - **Multicast**
  - **Broadcast**
  - **Anycast**
  - **Geocast**



Information Delivery

Unicast

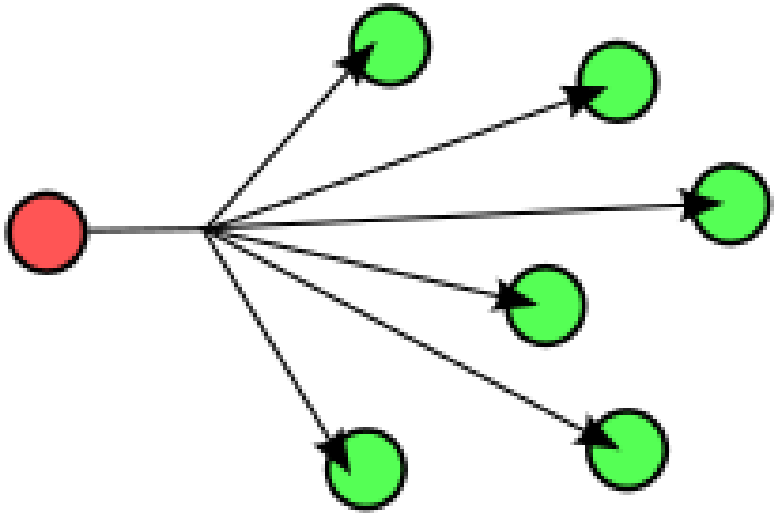
- Unicast is a type of transmission in which information is sent from only one sender to only one receiver.
- In other words, unicast transmission is between one-to-one nodes(involving two nodes only).
- Examples of Unicast transmission are http, smtp, telnet



Information Delivery

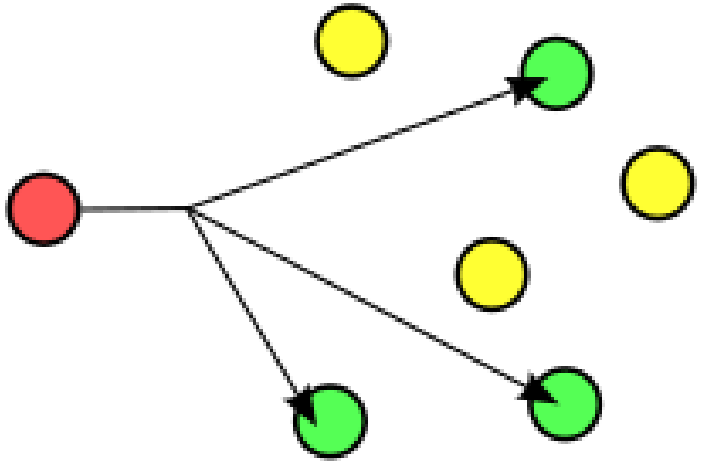
Broadcast

- Broadcast is a type of transmission in which information is sent from just one computer but is received by all the computers connected to the network.
- **Example:**
  - Computer booting up and requesting for a IP address
  - ARP (Address Resolution Protocol)



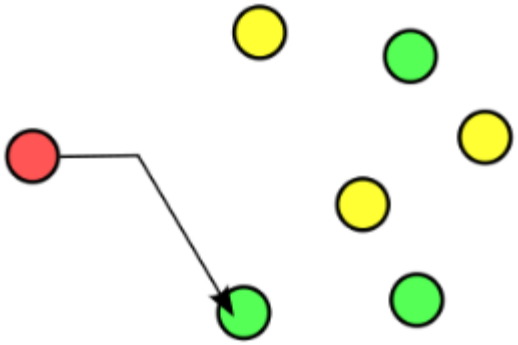
Information Delivery
Multicast

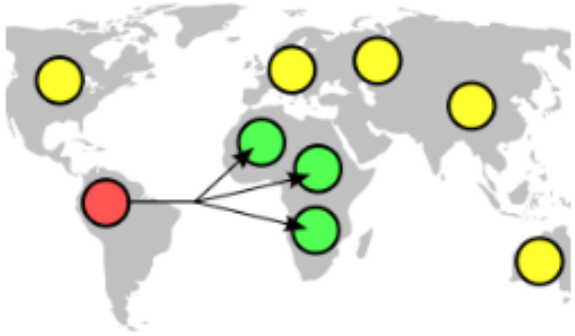
- **Multicast** is the delivery of a message or information to a group of destination computers simultaneously in a single transmission from the source
- **One good example** of Multicast based network is video transmission network in which one computer needs to transmit video channel to a specific group of computers.



Information Delivery
Anycast

- **Anycast** addressing is a *one-to-one-of-many* association where datagrams are routed to any single member of a group of potential receivers that are all identified by the same destination address.
- The routing algorithm selects the single receiver from the group based on which is the **nearest according to some distance measure.**



Information Delivery
Geocast

- **Geocast** refers to the delivery of information to a group of destinations in a network identified by their geographical locations.
- It is a specialized form of multicast addressing used by some routing protocols for mobile ad hoc networks.