# Lecture (1)
# " Data Communication“
## Chapter 1: Networking Fundamentals

**Presented by : Dr. Maha Fathy**

# Course Information

- Lecturer : Dr. Maha Fathy
- Credit hours (2)
- Requirements & Grading (Total 100 marks)
  - Class work and attendance (30 marks)
  - Midterm exam (20 marks)
  - Final Exam during finals week (50 marks)
- Textbook: Data Communications and Networking | 5th Edition: Behrouz Forouzan

# Course Aim

This course aims to provide a broad introduction to the fundamentals of data communication and network technology. The emphasis is on data communication from the perspective of computer scientists and information technologists. The course covers the underlying mechanisms and their characteristics that need to be considered by communicating application software .

# Introduction

This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols .

# Learning Outcomes

By the end of this unit students will be able to :

- Explain the basic concepts of data communication
- Demonstrate knowledge of higher level aspects of data communications and network technology, details of the underlying mechanisms, principles, reference models, protocols, error handling, appropriate for the development of software applications in a networked environment
- Describe emerging networking technologies
- Analyze communications systems that use the TCP/IP protocol suite and the abstract 7-layer OSI reference model.
- Apply knowledge of data communication concepts to solve problems involving data communications.

# What is Communication?

Communication is the process of exchanging information between two or more entities.

In its simplest form, communication involves:

Sender →Message →Communication Medium/Channel →Receiver

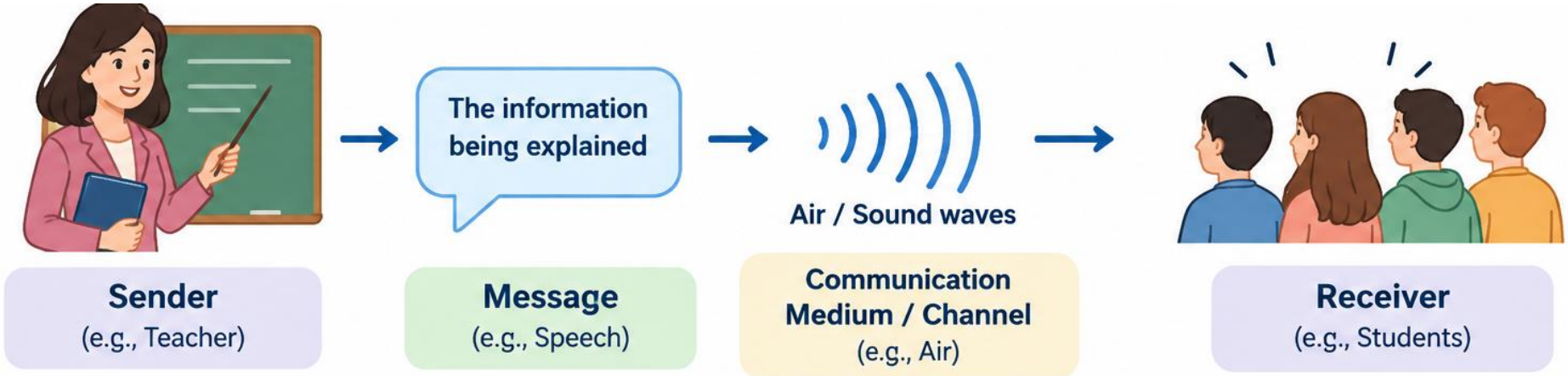
For example, when a teacher speaks to students:

Sender: Teacher

Message: The information being explained

Medium: Air/sound waves

Receiver: Students



# Data & Information

- **Data** refers to the facts that are collected while **information** refers to processed data that enables us to take decisions.
- Ex. When result of a particular test is declared it contains data of all students, when you find the marks you have scored you have the information that lets you know whether you have passed or failed.

# Data Communications

The term of **telecommunication** means communication at a distance.

The word **data** refers to information presented in whatever form is agreed upon by the parties creating and using the data.

**Data communications** are the exchange of data between two devices via some form of transmission medium such as a wire cable.

# Data Communications

The effectiveness of any data communications system depends upon the following four fundamental characteristics:

1.Delivery 2. accuracy 3. timeline 4. jitter

# Characteristics of Data Communication

1. **Delivery:** The data should be delivered to the correct destination and correct user.
2. **Accuracy:** The communication system should deliver the data accurately, without introducing any errors. The data may get corrupted during transmission affecting the accuracy of the delivered data.
3. **Timeliness:** Audio and Video data has to be delivered in a timely manner **without any delay**; such a data delivery is called real time transmission of data.
4. **Jitter:** It is the variation in the packet arrival time. Uneven Jitter may affect the timeliness of data being transmitted.

# Introduction of Data Communication

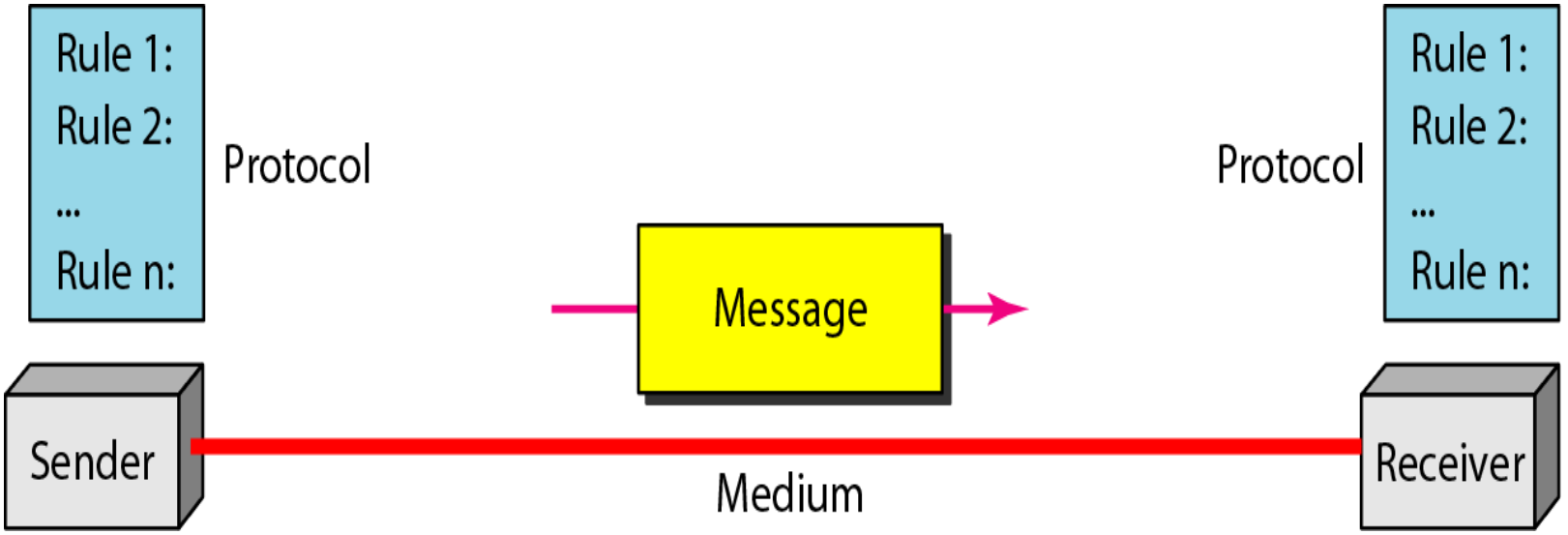
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***Topics discussed in this section:***

- **Components of a data communications system**
- **Data Flow**

# Components of Data Communication system

1 **Sender**
2 **Receiver**
3 **Message** (Data that is sent between the sender and receiver)
4 **Protocols** (Set of rules that control the communication)
5 **Medium** (Transmission medium either wired or wireless)



# Data Representation

- There may be different forms in which data may be represented.
  1. Text
  2. Numbers
  3. Images
  4. Audio
  5. Video

# Data Flow of Data Communication

1 **Simplex** (One direction-sending or receiving)

2 **Half-duplex** (sending and receiving but not at same time)

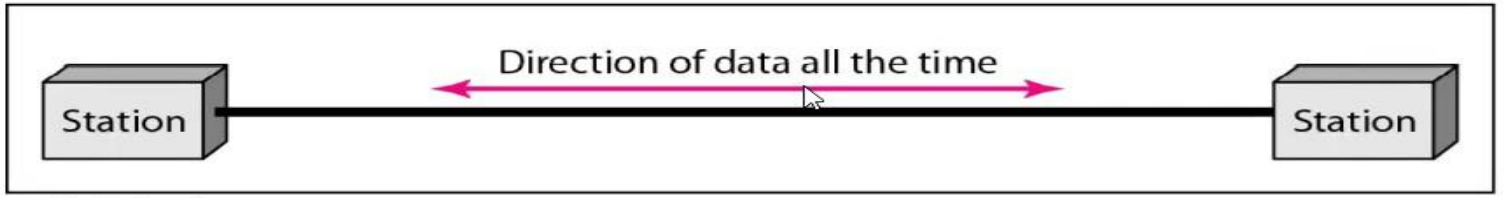
3-**Full-duplex** (sending and receiving at the same time)




a. Simplex




b. Half-duplex




c. Full-duplex

# Networks

- 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.

# Network Criteria

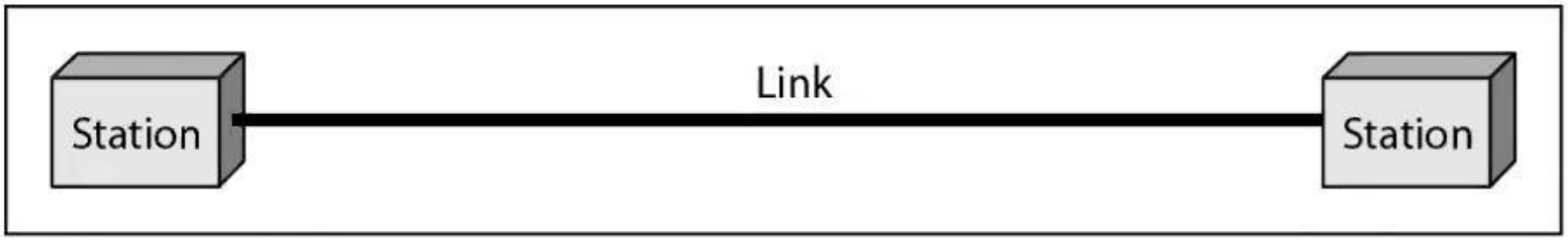
- A Compute network should ensure
  - Reliability of the data communication process

[Reliability refer to the ability of a data communication system to deliver data consistently and correctly over time, with a low probability of data loss, corruption, duplication, or failure.]

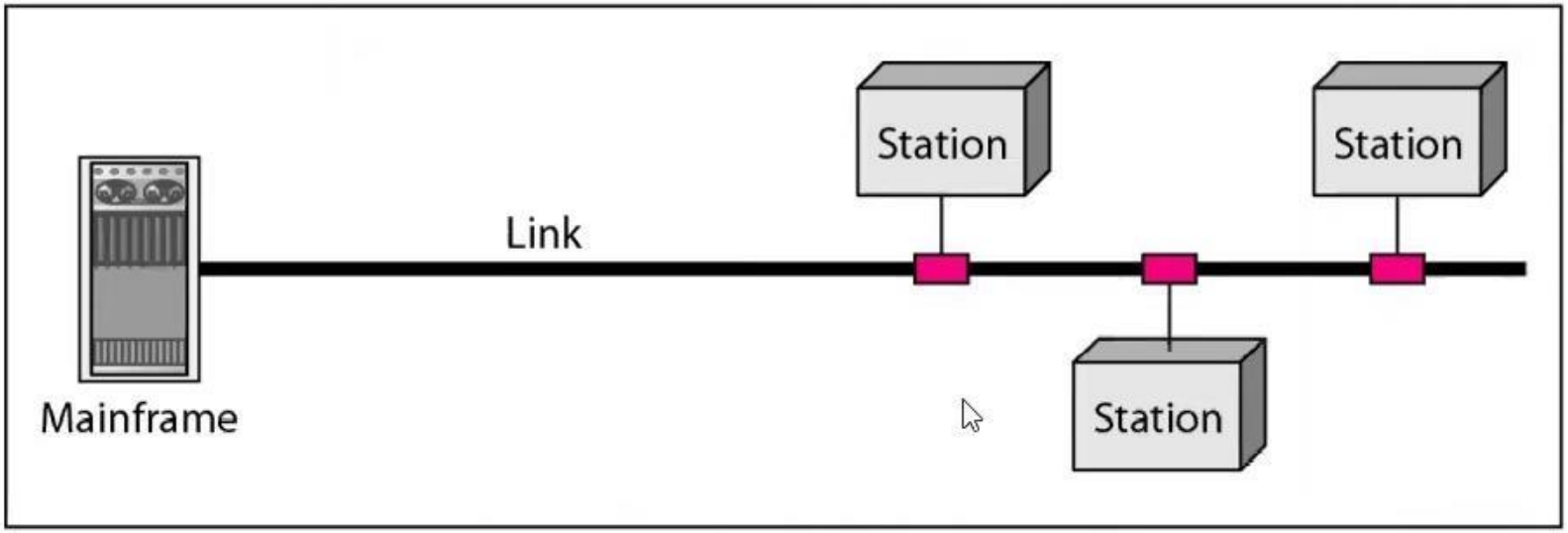
  - Security of the data
  - Performance by achieving higher throughput and smaller delay times.

[Throughput in data communication, is the actual amount of useful data successfully delivered from the sender to the receiver per unit of time.]

# Types of connection




a. Point-to-point




b. Multipoint

# Categories of Netwoks

- Networks are categorized on the basis of their size.
- The three basic categories of computer networks are:

A. Local Area Networks (LAN)

B. Wide Area Network (WAN)

C. Metropolitan Area Network (MAN)

# Introduction of Data Communication

- A. Local Area Networks (LAN)
  - is usually limited to a few kilometers of area. It may be privately owned and could be a network inside an office on one of the floor of a building
  - LAN could be a network consisting of the computers in a entire building.
- B. Wide Area Network (WAN)
  - is made of all the networks in a (geographically) large area.
  - The network in the entire state like Egypt could be a WAN
- C. Metropolitan Area Network (MAN)
  - is of size between LAN & WAN. It is larger than LAN but smaller than WAN.
  - It may comprise the entire network in a city like Alexandria.

# Protocol

- For successful communication to occur, the sender and receiver must agree upon **certain rules** called protocol.
- A Protocol is defined as **a set of rules that governs data communications**.
- A protocol defines what is to be communicated, **how** it is to be communicated and **when** it is to be communicated.

# Question Of the Lecture!! Think!!

**Can data be transmitted without a physical cable? How?**

# Thank you!