

# Data Communication

Introduction

# Course Information

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# Text Book

Data Communications and Networking,  
Behrouz Forouzan, McGraw-Hill  
Science/Engineering/Math; 5<sup>th</sup> edition, ISBN-  
10: 0073376221

# Course Syllabus

- Data communication networks and open system standards
  - Standards-ISO
  - Open Systems
  - Network Models- OSI model
  - Physical Structures
- The Physical Layer
  - Analog and Digital Signals
  - Transmission Impairments
    - Attenuation and distortion
    - Signal propagation delay
    - Noise
  - Data Rate Limits and Performance
  - Analog Transmission and Modulation
  - Multiplexing and Spreading
  - Transmission Media Types
    - Twisted pair
    - Coaxial cables
    - Fiber optics
    - Radio waves
  - Public carrier circuits
    - Analog PSTN
    - ADSL
    - Cable TV Networks

# Course Syllabus (cont.)

- Error Detection and Error Correction
  - Types of Error
  - Hamming Distance
  - Parity Bits
  - Cyclic Redundancy Check (CRC)
  - Error Correction using Multiple Parity Bits
- Data Link Layer
  - Repeat Request (RQ)
  - Sliding Window (Go Back N, Selective Repeat)
  - Framing
  - Link management
  - Point-to-Point Protocol (PPP)
  - Ethernet
  - Fast Ethernet
  - Wireless LANs
- Connecting devices
  - Hubs/Repeaters
  - Switches
  - Bridges
  - Routers

# Lab Works

- MATLAB will be used for :
  - Computing and drawing waveforms
  - Computing error detection/correction codes
  - Computing frame header values for a given data
  - Simulating flow control
- Term project should be done using a network simulator (preferably OpNet)

# Evaluation

- Midterm 30%
- Final 30%
- Quiz 10%
- Exercise and Lab works 30%
- Term Project 10% (Bonus)
- Attendance in lab/lecture sessions is mandatory

# Introduction to Computer Networks

- What is a computer network?
- Why do we need a computer network?
- What are the main components of a computer network?

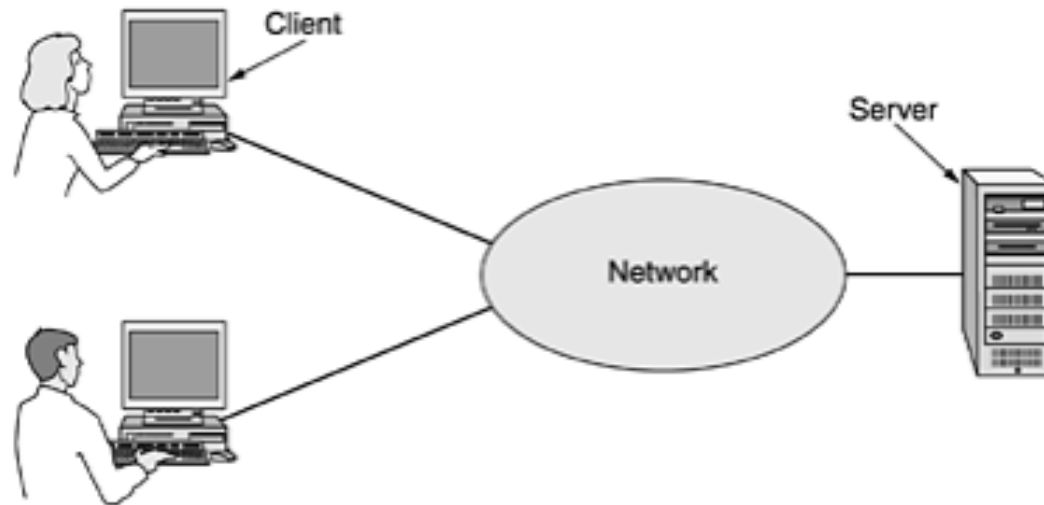


# What Is a Computer Network

- A network is a collection of autonomous computers interconnected by a single technology. Two computers are said to be interconnected if they are able to exchange information.

# Computer Network Applications

- Physical resource sharing
- Sharing information
- Sharing applications (Client-Server Model)



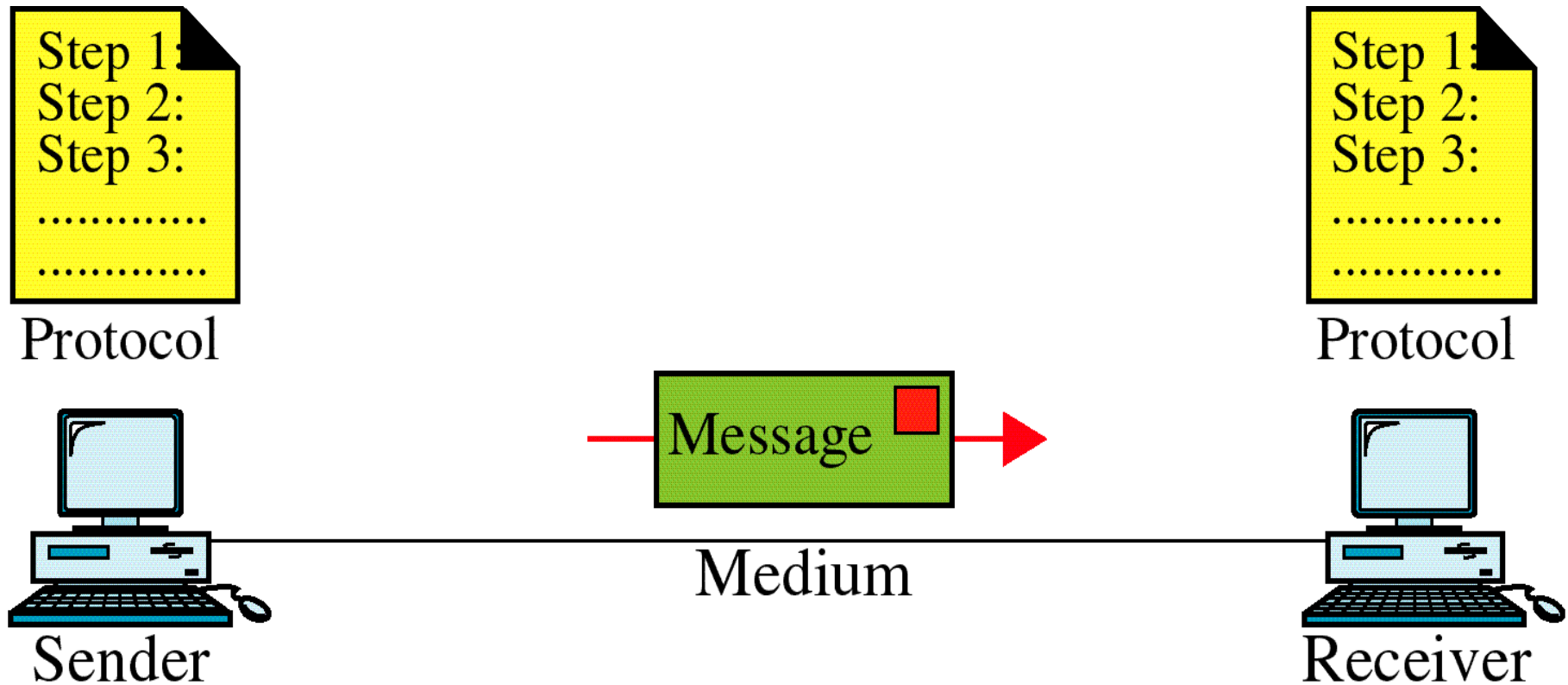
# Computer Network Applications

- Providing a powerful communication medium
  - Email
  - Video conferencing
- Doing business electronically
- Access to remote information
- Person-to-person communication (Phone calls, etc.)
- Interactive entertainment
- Many more

# Components of a Computer Network

- **Message.** The message is the information (data) to be communicated.
- **Sender.** The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.
- **Receiver.** The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.
- **Transmission medium.** The transmission medium is the physical path by which a message travels from sender to receiver.
- **Protocol.** A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating.

# Components of a Computer Network



# Data Communications

- 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.

# Some Issues

- What kind of media can be used for connecting computers?
- How can the computers in a network be arranged?
- How can digital data be transmitted over a medium?
- How can a message find its route to a destination?
- What if a message is lost or corrupted?

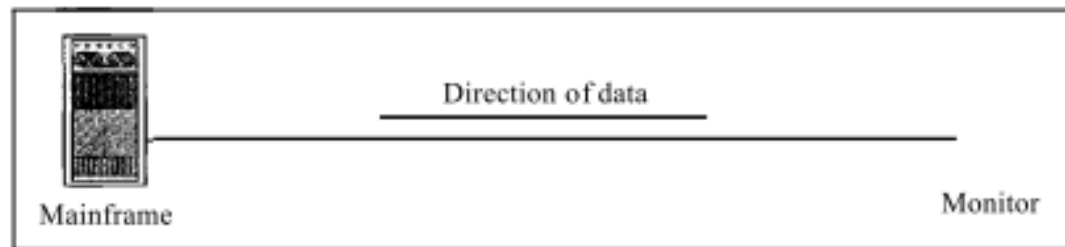
# Standards

- All above issues (and many more) are considered in network standards.
- Standards provide guidelines to manufacturers, government agencies, and other service providers to ensure the kind of interconnectivity necessary in international communications.
- Standards define network hardware and software

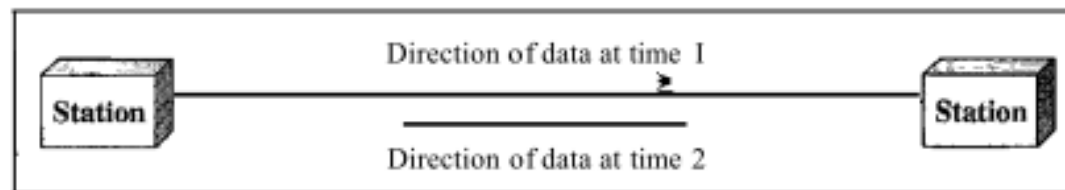


# Network Hardware

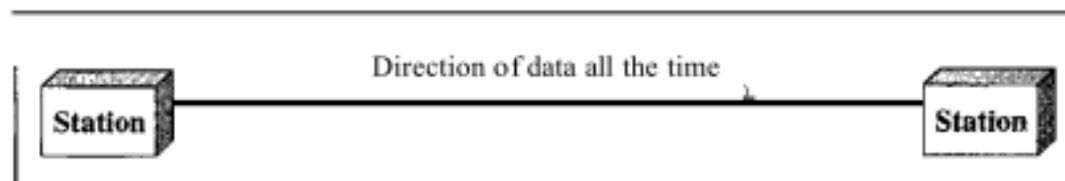
- Data Flow
  - Communication between two devices can be simplex, half-duplex, or full-duplex



a. Simplex



b. Half-duplex



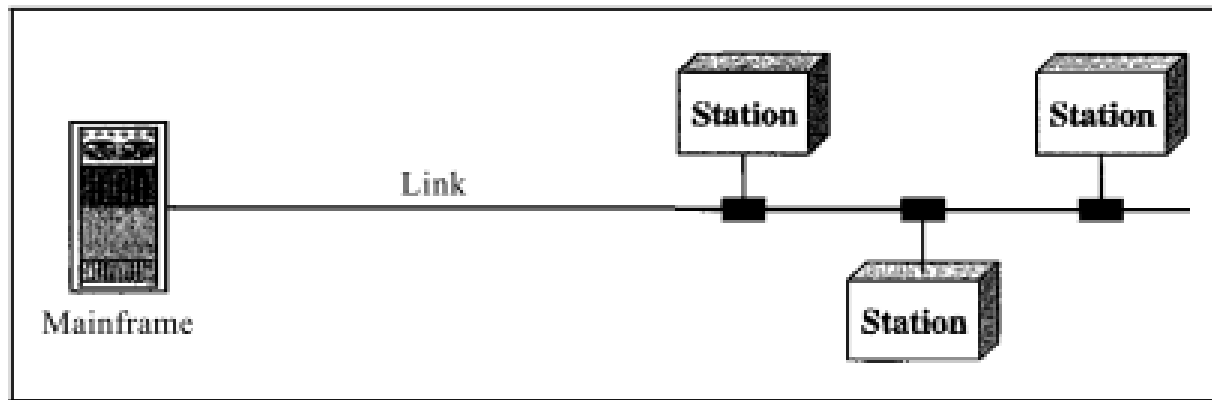
c. Full-duplex

# Network Hardware

- Type of Connection
  - Point-to-point: a dedicated link between two devices.
  - Multipoint : more than two specific devices share a single link



a. Point-to-point



b. Multipoint

# Network Hardware

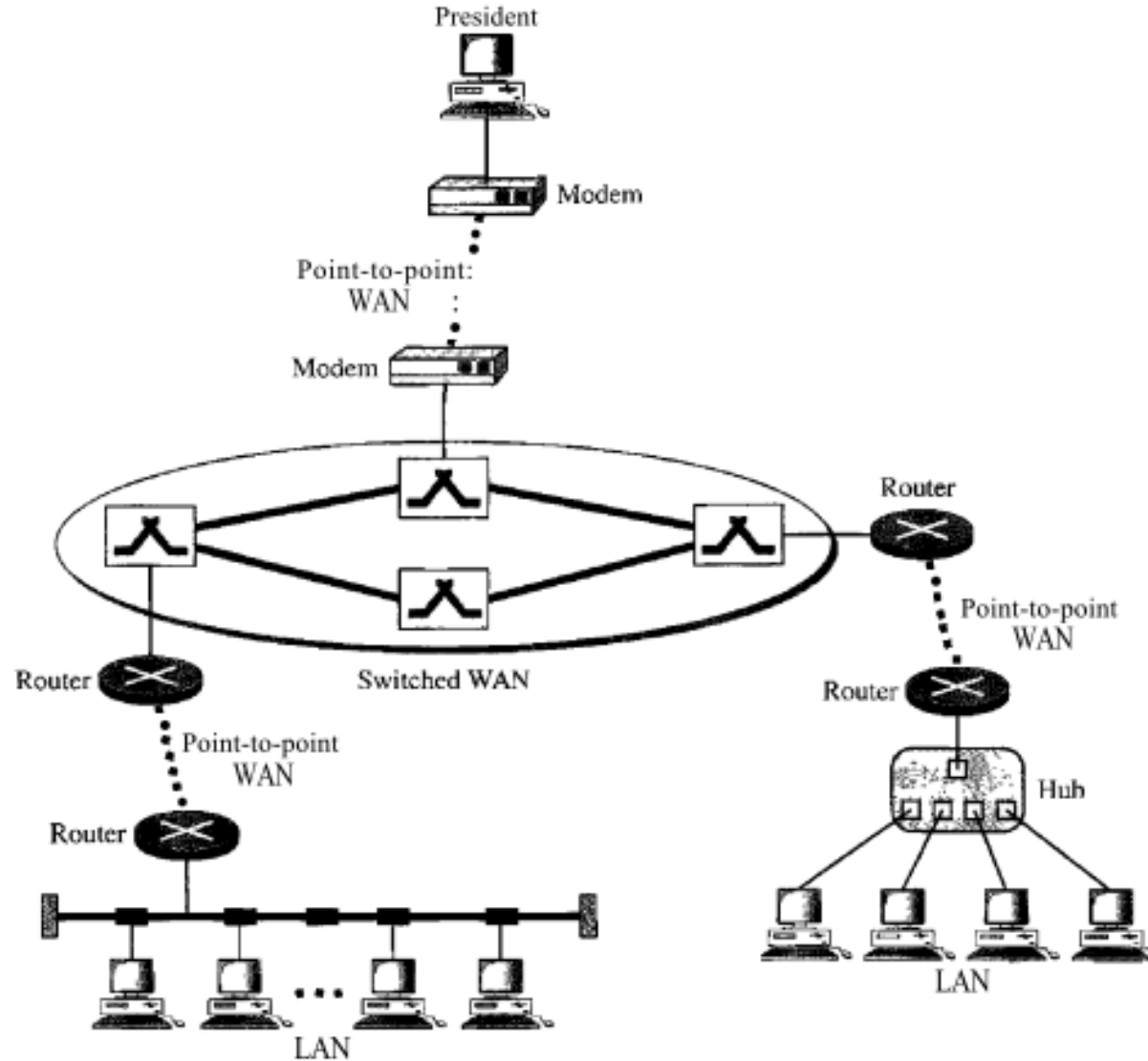
- Physical Topology: the way in which a network is laid out physically
  - Mesh
  - Star Topology
  - Bus Topology
  - Ring Topology
  - Hybrid Topology

# Network Hardware

- Network Models

- Local Area Network: A local area network (LAN) is usually privately owned and links the devices in a single office, building, or campus
- Metropolitan Area Networks: A metropolitan area network (MAN) is a network with a size between a LAN and a WAN. e.g. Cable TV
- Wide Area Network: A wide area network (WAN) provides long-distance transmission of data over large geographic areas that may comprise a country, a continent, or even the whole world.

# Interconnection of Networks: Internetwork



# Questions