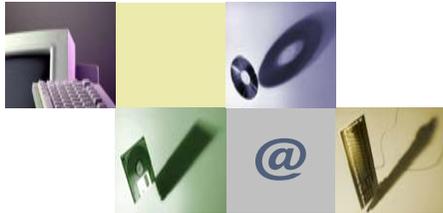
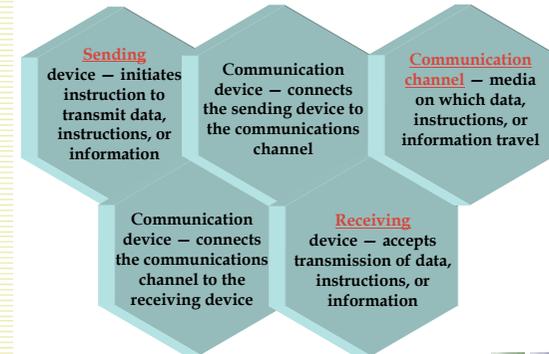


## Data Communications



Digital Computer Concept and Practice

## Data Communications



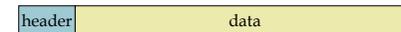
## Data Communications

- Data communications
  - Process in which two or more computers or devices transfer data, instructions, and information
- Components
  - Source, destination, and communication channel

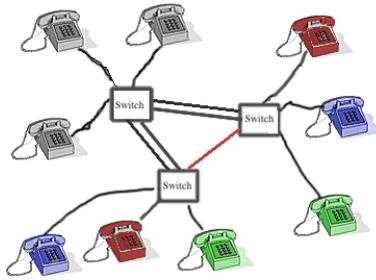


## Features

- Digital data
  - Durability of noise
  - Advanced IC technology → cheap
  - Fiber-optics → high speed
- Packets
  - A packet is a formatted block of data carried by a packet mode computer network.
  - Header and data
- Circuit switching / packet switching

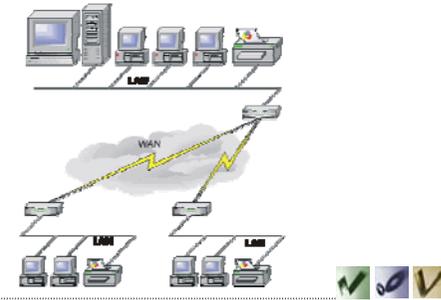


## Circuit Switching

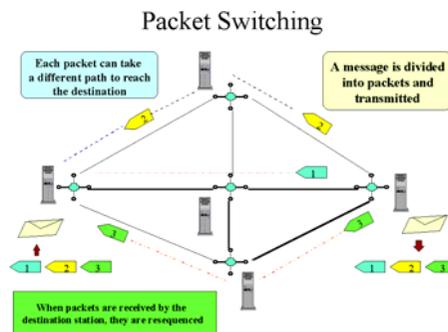


## Data Communication Networks

- Collection of computers and devices connected via communication devices and transmission media.



## Packet Switching



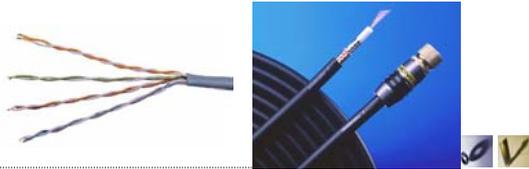
## Components

- Source + Destination + Communication channel
- Transmission media (cable/wireless)
  - Transmission quality
    - Cable: media itself
    - Wireless: frequency
- Hardwares
  - Modem, Hub, Router, etc.



## Cable Media

- Twisted pair
  - Telephone systems or local area network (LAN)
- Coaxial cable
  - As a high-frequency transmission line to carry a high-frequency or broadband signal
  - Long-distance telephone network, cable TV (CATV), short-distance network



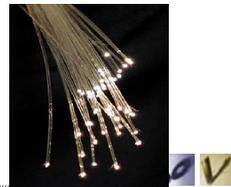
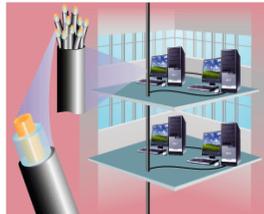
## Wireless Media

- To transport information through the atmosphere or outer space without wires.
- Used when inconvenient, impractical or impossible to install cables
- Types
  - Radio waves
  - Infrared waves
  - Ground microwaves
  - Satellite microwaves



## Cable Media

- Fiber optics
  - Capable of carrying significantly more data at faster speeds than wire cables
  - Less susceptible to interference (noise) and therefore more secure
  - Thinner and lighter
  - Expensive



## Wireless Media

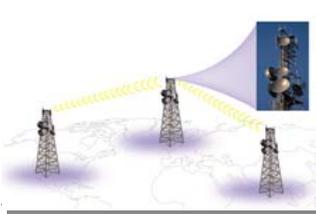
- (1) Radio waves
  - Relatively long wavelength in the electromagnetic spectrum
  - AM / FM radio broadcasts
- (2) Infrared waves
  - Short distance communications (remote controls of TV, video and audio)
  - Directional, cheap



## Wireless Media

### (3) Ground microwaves

- Earth-based reflective dish used for microwave communications
- Must transmit in straight line with no obstructions
- Using 2 ~ 40 GHz bandwidth
- TV, PCS, wireless LAN, bluetooth



## GSM (Global System for Mobile communications)

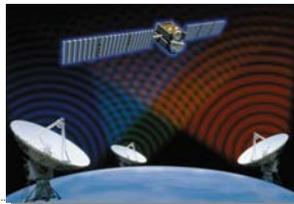
- GSM is the most popular standard for mobile phones in the world.
- GSM uses a variation of TDMA (Time Division Multiple Access).
  - It digitizes and compresses data then sends it down a channel with two other streams of user data, each in its own time slot.
  - 900 MHz or 1800 MHz frequency band



## Wireless Media

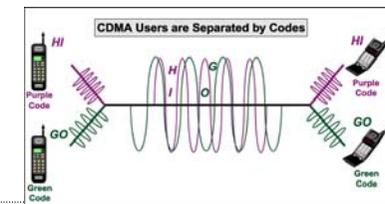
### (4) Satellite microwaves

- Space station that receives microwave signals from earth-based station, amplifies signals and broadcasts signals back to a number of earth-based stations
- Transmitted waves can be received on the all ground through a satellite antenna. → security issue



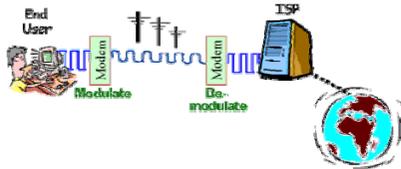
## CDMA (Code Division Multiple Access)

- A channel access method utilized by various radio communication technologies.
- It is a form of multiplexing, which allows numerous signals to occupy a single transmission channel, optimizing the use of available bandwidth.



## Hardware

- Modem = **MO**dulation + **DE**Modulation
  - Modem is a device that modulates an analog carrier signal to encode digital information and demodulates such a carrier signal to decode the transmitted information.



## Hardware

- Router
  - Connects computers and transmits data to correct destination on networks.
  - Routers forward data on internet using the fastest available path.
  - Some routers have a built-in hardware firewall.



## Hardware

- Hub
  - Device that provides a central point for cables in network
  - Passive hub/active hub
  - cf.) IP sharer



## Types of Communication Networks

- LAN (Local Area Network)
  - LAN is a computer network covering a small geographic area, like a home, office, or group of buildings, e.g. a school
  - Metropolitan area network (MAN) connects LANs in a city or town
- LAN < MAN (Metropolitan Area Network) < WAN (Wide Area Network)



## Types of Communication Networks

- WAN (Wide Area Network)
  - Network that covers large geographic area using many types of media
  - Internet
    - World's largest WAN

