

General Items:

- ? Tests?
- ? Lab?
- ? Need to come to class
- ? Challenge / 80 /

Reading Materials:

?

Miscellaneous:**Communication technologies**

- Different technologies allowing us to communicate
- **Examples:**
 - o Voice mail, fax, email, instant message, chat rooms, news groups, telephony, GPS, and more
- Voice mail: Similar to answering machine but digitized
- Fax: Sending hardcopy of text or photographs between computers using fax modem
- Email: electronic mail – sending text, files, images between different computer networks
 - o Must have email software
 - o More than 1.3 billion people send 244 billion messages monthly!
- Chat rooms: Allows communication in real time when connected to the Internet
 - o Examples: voice chat, radio, etc.
- Telephony: Talking to other people over the Internet (also called VoIP)
 - o Sends digitized audio signals over the Internet
 - o Requires Internet telephone software
- Groupware: Software application allowing a group of people to communicate with each other (exchange data)
 - o Address book, appointment book, schedules, etc.
- GPS: consists of receivers connected to satellite systems
 - o Determining the geographical location of the receiver
 - o Used for cars, advertising, hiking, tracking, etc.

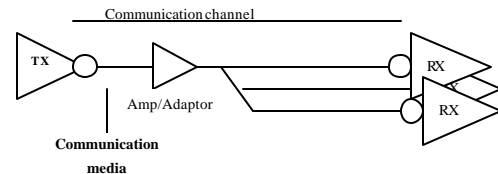
Which is your favorite communication technology?

Communications and networks

- Communication technologies
- Communication devices
- Communication Channels
 - o Physical medias
 - o Wireless
- Communication software
- Networks of communication systems
- Inside the telephone network

Communication systems

- Process describing transfer of information, data, instructions between one or more systems through some media
- Examples: people, computers, cell phones, etc.
- Computer communication systems:



- Signals passing through the communication channel can be **Digital**, or **analog**
 - o Analog signals: continuous electrical waves
 - o Digital signals: individual electrical pulses (bits)
- Receivers and transmitters: desktop computers, mainframe computers, etc.

Communication devices

- Any type of hardware capable of transmitting data, instructions, and information between devices
- Basic characteristics: How **fast**, how **far**, how **much data!**
- Functioning as receiver, transmitter, adaptor, converter
- Examples: Dial-up modems, ISDN, DSL modems, network interface cards
- **Dial-up modem:** uses standard phone lines
 - o Converts digital information into analog
 - o Consists of a modulator and a demodulator
 - o Can be external, internal, wireless
 - o Special applications: fax machine
- **ISDN and DSL Modem:** Allows digital communication between networks and computers
 - o Requires a digital model
 - o Digital is better than analog – why?
- **Cable modem:** a modem that transmits and receives data over the cable television (CATV) network
 - o Also called broadband modem (carrying multiple signals)
 - o The incoming signal is split
 - o Requires a cable modem
- **Network interface cards:** Adaptor cards residing in the computer to transmit and receive data over the network (NIC)
 - o Operate with different network technologies (Ethernet, wireless)

Communication software

- Programs allowing to establish a connection between computers or networks
- FTP (file transfer protocol)

Communication channels

- A channel is a path between two communication devices
- Channel capacity: How much data can be passed through the channel (bit/sec) – this is called channel bandwidth
 - o The smaller the pipe the slower data transfer!
- Consists of one or more transmission media
 - o Materials carrying the signal
 - o Two types:
 - ⚡ Physical: wire cable
 - ⚡ Wireless: Air
 - Can these communication systems work in vacuum?

Physical Transmission Media

- A tangible media
- Examples: Twisted-pair cable, coaxial cable, Fiber-optics, etc.
- Twisted-pair cable:
 - o One or more twisted wires bundled together (why?)
 - o Made of copper
- Coax-Cable:
 - o Consists of single copper wire surrounded by three layers of insulating and metal materials
 - o Typically used for cable TV
- Fiber-optics:
 - o Strands of glass or plastic used to transmit light
 - o Very high capacity, low noise, small size, less suitable to natural disturbances

Wireless Transmission Media

- Broadcast radio
 - o Distribute signals through the air over long distance
 - o Uses an antenna
 - o Typically for stationary locations
 - o Can be short range
- Cellular Radio
 - o A form of broadcast radio used for mobile communication
 - o High frequency radio waves to transmit voice or data
 - o Utilizes frequency-reuse
 - o Other terminologies:
 - ⚡ Personal Communication Services (PCS)
 - ? Set of technologies used for digital cellular communication
 - ? Includes cellular phones, voice mail, web browsing, email
 - ⚡ 3G
 - ? Faster than PCS
 - ? Used for multimedia and graphics
- Microwaves
 - o Radio waves providing high speed transmission
 - o They are point-to-point (can't be obstructed)
 - o Used for satellite communication
- Infrared (IR)
 - o Wireless transmission media that sends signals using infrared light-waves - Such as?

Where in the globe people use the most number of wireless devices?

Type of Cable and LAN	Transfer Rates
Twisted Pair	
• 10Base-T (Ethernet)	10 Mbps
• 100Base-T (Fast Ethernet)	100 Mbps
• 1000Base-T (Gigabit Ethernet)	1000 Mbps
• Token ring	4 - 16 Mbps
Coaxial Cable	
• 10Base2 (ThinWire Ethernet)	10 Mbps
• 10Base5 (ThickWire Ethernet)	10 Mbps
Fiber-Optic Cable	
• 10Base-F (Ethernet)	10 Mbps
• 100Base-FX (Fast Ethernet)	100 Mbps
• FDDI (Fiber Distributed-Data Interface) token ring	100 Mbps

Type of Line	Transfer Rates	Approximate Monthly Cost
Dial-up	Up to 56 Kbps	Local or long-distance rates
ISDN (BRI)	Up to 128 Kbps	\$10 to \$40
ADSL	128 Kbps - 9 Mbps	\$40 to \$80
Cable TV (CATV)	128 Kbps - 2.5 Mbps	\$30 to \$50
T1	1.544 Mbps	\$1,000 or more
T3	44 Mbps	\$10,000 or more
ATM	155 Mbps to 622 Mbps	\$8,000 or more

Networks

- Collection of computers and devices connected together
- Used to transfer information or files, share resources, etc.
- What is the largest network?
- Characterized based on their geographical coverage, speed, capacities
- Networks are categorized based on the following characteristics:
 - o Network **coverage**: LAN, MAN, WAN
 - o Network **topologies**: how the computers are connected together
 - o Network **technologies**
 - o Network **architecture**

Network coverage:

- Local Area Networks:
 - o Used for small networks (school, home, office)
 - o Examples:
 - ⚡ Wireless LAN
 - ⚡ Peer-2-PEER: connecting several computers together (<10)
 - ⚡ Client/Server: The server shares its resources between different clients
- Metropolitan Area Network
 - o Backbone network connecting all LANs
 - o Can cover a city or the entire country
- Wide Area Network
 - o Typically between cities and countries
 - o Examples:
 - ⚡ Internet P2P: Networks with the same network software can be connected together (Napster)

Network topologies

- Configuration or physical arrangement in which devices are connected together
- BUS networks: Single central cable connected a number of devices
 - o Easy and cheap
 - o Popular for LANs
- RING networks: a number of computers are connected on a closed loop
 - o Covers large distances
 - o Primarily used for LANs and WANs
- Star Network
- STAR networks: connecting all devices to a central unit
 - o All computers are connected to a central device called *hub*
 - o All data must pass through the hub
 - o What is the problem with this?
 - o Susceptible to failure

Network architecture

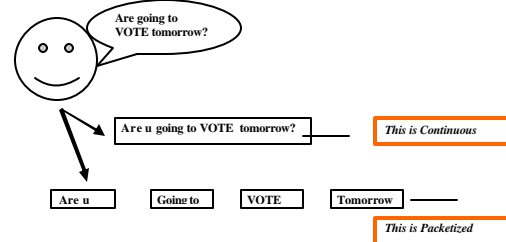
- ? Refers to how the computer or devices are designed in a network
- ? Two basic types
 - o Peer-2-Peer:
 - ⚡ Each computer (peer) has equal responsibilities, capacities, sharing hardware, data, with the other computers on the peer-to-peer network
 - ⚡ Good for small businesses and home networks
 - ⚡ Simple and inexpensive
 - o Client/Server:
 - ⚡ All clients must *request* service from the server
 - ⚡ The server is also called *ahost*
 - ⚡ Different servers perform different tasks: *File server, network server, etc.*

Network technologies

- Vary depending on the type of devices we use for interconnecting computers and devices together
- Ethernet:
 - o LAN technology allowing computers to access the network
 - o Susceptible to collision
 - o Can be based on BUS or STAR topologies
 - o Operates at 10Mbps or 100Mbps, (10/100)
 - o Gigabit Ethernet and 10-Gigabit Ethernet
 - o Fast Ethernet operates at 100 Mbps
 - o What is the difference between Ethernet and Internet?
- Token Ring
 - o LAN technology
 - o Only the computer with the token can transmit
 - o No collision

- o Typically 72-260 devices can be connected together
- TCP/IP
 - o Uses packet transmission – What is a packet?
 - o Example: VoIP
- 802.11
 - o Standard for wireless LAN
 - o Wi-Fi (wireless fidelity) is used to describe that the device is in 802.11 family or standards
 - o Typically used for long range (300-1000 feet)
 - o Variations include: **.11** (1-2 Mbps); **.11a** (up to 54 Mbps); **.11b** (up to 11 Mbps); **.11g** (54 Mbps and higher)
- Bluetooth
 - o Uses radio frequency
 - o Typically used for close distances (short range- 33 feet or so)
 - o Transmits at 1Mbps
 - o Used for handheld computers to communicate with the desktop
- IrDA
 - o Infrared (IR) light waves
 - o Transfers at a rate of 115 Kbps to 4 Mbps
 - o Requires light-of-sight transmission
- RFID
 - o Radio frequency identification
 - o Uses tags which are places in items
 - o Example: merchandises, toll-tags, courtesy calls, sensors!
- WAP
 - o Wireless application protocol
 - o Data rate of 9.6-153 kbps depending on the service type
 - o Used for smart phones and PDAs to access the Internet (email, web, etc)
- Intranet

- o Utilizing the web and the Internet technologies with a private organization



Network examples

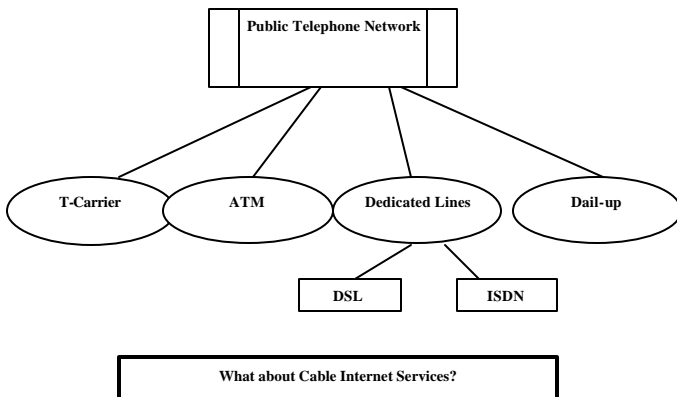
- Intranets
 - o Used for private networks
 - o May implement a firewall
 - ⚡ Hardware and software that restricts access to data and information on a network
- Home networks
 - o Ethernet
 - o HomePCL (using the home powerline cable)
 - o Phone line
 - o HomeRF (radio frequency- waves)
 - o Intelligent home network
- Telephone networks
 - o Called the Public Switched Telephone Network (PSTN)
 - o World-wide and voice oriented (handles voice and data)
 - o Data/voice can be transferred within the PSTN using different technologies (data transfer rate bps)
 - o Dial-up lines:
 - ⚡ Analog signals passing through telephone lines
 - ⚡ Requires modems (56 kbps transfer rate)
 - o ISDN lines:
 - ⚡ Integrated Services Digital Network
 - ⚡ Digital transmission over the telephone lines
 - ⚡ Can carry (multiplex) several signals on a single line
 - o DSL
 - ⚡ Digital subscribe line
 - ⚡ ADSL (asymmetric DSL)
 - ? receiver operated at 8.4 Mbps, transmit at 640 kbps
 - o T-Carrier lines: carries several signals over a single line: T1,T3
 - o ATM:

- ⚡ Asynchronous Transfer Mode
- ⚡ Fast and high capacity transmitting technology
- ⚡ Packet technology

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Some new merging technologies:

- ? m-Cash
 - o Pay using your cell phone
- ? Scan-free shopping using Radio frequency identification
- ? VeriChip
 - o Implanted computer chip in the body!
- ? Wearable computer technology
 - o Implanting a cell phone is in your tooth!



Remember Cable Internet is not in the public telephone network!