Management Information Systems

Basics of Telecommunications and Networks

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(Adapted from Introduction to IS, Rainer and Turban)

Telecommunication Outline

The Telecommunications System
Communication Media
Transmission Technologies
Types of Networks
Network Fundamentals

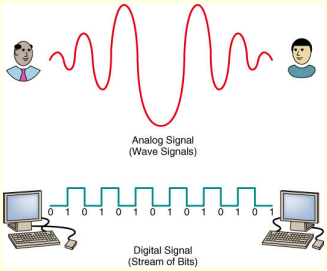
OBJECTIVES

- Understand the basic telecommunications system.
- Understand the different media used in telecommunications
- Understand the transmission basics
- Describe the major types of networks.
- Describe the Ethernet and TCP/IP protocols.
- Differentiate between client/server computing and peer-to-peer computing.

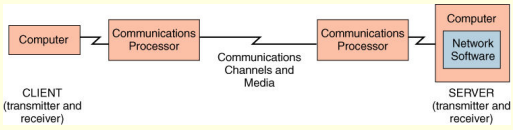
The Telecommunications System

- A **telecommunications system** consists of hardware and software that transmit information from one location to another.

Analog and Digital Signals



Typical Telecommunications System



Communications Processors

- Modem
  - device that converts digital signals to analog signals and vice versa.
- Multiplexer
  - an electronic device that allows a single communications channel to carry data transmissions simultaneously form many sources.
- Front-End Processor
  - a specialized computer that manages all routing communications with peripheral devices.

Communications Media and Channels

- Twisted-pair wire
  - most prevalent form of communications wiring; consists of strands of copper wire twisted in pairs.
- Coaxial cable
  - insulated copper wire used to carry high-speed data traffic and television signals.
- Fiber optics
  - thin filaments of glass fibers that transmit information via light pulses generated by lasers.

Transmission Speed

- Bandwidth
  - the range of frequencies available in any communications channel
- Narrowband
  - low-speed transmission speed transmissions up to 64 Kbps
- Broadband
  - high-speed transmission speeds ranging from 256 to several terabits per second.

Telecommunication Basics

- Units of information
  - bit (smallest unit of information 0 or 1) notation - b
  - byte is 8 bits (1 character) notation - B
  - KB, MB, GB, TB, PB (storage)
  - Kbps, Mbps, Gbps, Tbps (transmission)
- Mode: Analog, Digital
- Synchronous, Asynchronous
- Transmission Media

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Transmission Technolgies

- Integrated Services Digital Network
  - data transmission technology that allows users to transfer voice, video, image, and data simultaneously over existing telephone lines.
- Digital Subscriber Line
  - a high-speed, digital data transmission technology using existing analog telephone lines.
- Asynchronous Transfer Mode
  - data transmission technology that uses packet switching and allows for almost unlimited bandwidth on demand
- Synchronous Optical Network
  - an interface standard for transporting digital signals over fiber optic lines that allows users to integrate transmissions from multiple vendors.
- T-Carrier System
  - digital transmission system that defines circuits that operate at different rates, all of which are multiples of the basic 64 Kbps.

Storage & transmission

Object	Size (speed)
Page of text / monitor screen	2 KB
Page of graphics	2 MB
1 second voice	8 KB (64 Kbps)
1 second video	3.5 MB (27.7Mbps)
MPEG stream	(1.2 Mbps)

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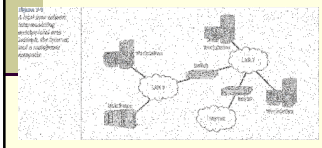
Types of Networks

A **computer network** is a system that connects computers via communications media so that data can be transmitted among them.

- Local area networks
  - connects two or more devices in a limited geographical region
- Wide are network
  - networks that cover large geographical areas
- Value-added network
  - a type of wide area network that are private, data-only networks managed by third parties that provide telecommunication and computing services to multiple organizations.
- Enterprise network
  - the entire network of an organization, usually consisting of multiple local area networks and multiple wide area networks.

Local Area Networks

- A local area network is a communication network that interconnects a variety of data communicating devices within a small geographic area and broadcasts data at high data transfer rates with very low error rates.
- Since the local area network first appeared in the 1970s, its use has become widespread in commercial and academic environments.



- Primary function of LAN
- To provide access to hardware and software resources that will allow users to perform activities such as:
  - File serving - A large storage disk drive acts as a central storage repository.
  - Print serving - Providing the authorization to access a particular printer, accept and queue print jobs, and providing a user access to the print queue to perform administrative duties.
  - Video transfers - High speed LANs are capable of supporting video image and live video transfers.
  - Manufacturing support - LANs can support manufacturing and industrial environments.
  - Academic support – In classrooms, labs, and wireless
  - E-mail support
  - Interconnection between multiple systems

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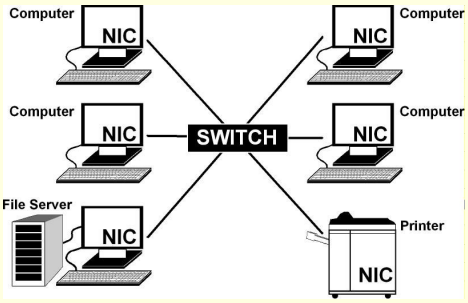
Local Area Network



Internetworking Local Area Networks

- Many times it is necessary to connect a local area network to another local area network or to a wide area network
- To separate / connect one corporate division with another
- To connect two LANs with different protocols
- To connect LAN to Internet
- To break LAN into segments to relieve traffic congestion
- To provide a security wall between two different types of users
- Local area network to local area network connections are often performed with a bridge-like device
- Local area network to wide area network connections are usually performed with a router
- A third device, the switch, can be used to interconnect segments of a local area network

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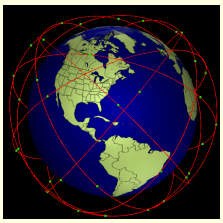
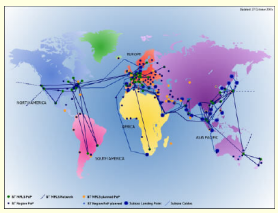
Wide Area Network

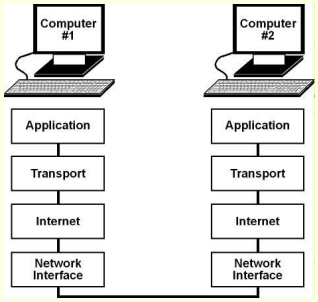




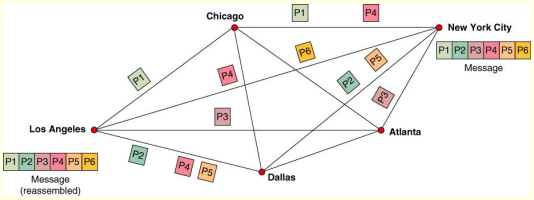
Network Fundamentals

- Network Protocol
  - a set of rules and procedures that govern transmission across a network.
  - Ethernet
  - a common LAN protocol.
  - **Transmission Control Protocol/Internet**
    - a file transfer protocol that can send large files of information across (unreliable) network with assurance that the data will arrive uncorrupted; the protocol of the Internet

The Four Layers of the TCP/IP Protocol



Packet Switching



Types of Network Processing

- Client/server
  - links two or more computers in an arrangement in which some machines (called servers) provide computing services for user computers (called clients).
- Peer-to-Peer processing
  - a type of client/server distributed processing where each computer acts as both a client and a server.