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*Fundamentals Of
Telecommunications*

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Review Course Syllabus Here!

Communications

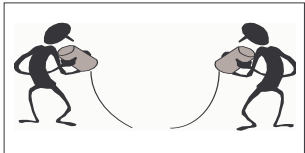
- Transmission of information from one location to another.
 - Cavemen drew pictures to tell others about events in their lives.
 - Native Americans created smoke signals from fires as warnings about danger.
 - Early American settlers used Pony Express to deliver mail across America.

Common Thread

- Each example used some physical means of delivering a message
- The means by which the messages were sent - whether cave paintings or courier mail - represented the most recent advance in communication for that time.

Elements of Communications

- Information Source
- Communications Channels
- Information Receiver



History of Communications

- Non-electric Communication
 - Unorganized Communications - non-verbal means such as facial expressions & gesturing.
 - Organized Communication
 - Verbal, disorganized but meaningful sounds (grunts & snarls).
 - Slowly developed into a system of organized, spoken language.
 - Writing - cave drawings, picture writings (hieroglyphics) and finally into the printed or typeset for used.

History

(continued....)

- Mail (Postal mail delivery)
- Pony Express - formed in 1860; defunct, 1861.
- **Electronic Communications**
 - Telegraph (Samuel F.B. Morse, 1837, 1845)
 - Relay stations (50 mi.) & Repeaters
 - Telephone (Elisha Gray, Alexander G. Bell, 1876)
 - Wireless Telegraph (Guglielmo Marconi, 1890)
 - Radio (i.e. voice communication: Marconi, 1895)
 - Television (video & voice, 1939)

Basic Forms of Information

- **Digital Computers, 1939**
 - Same year as television
 - Binary information, not unlike Morse code
- **Data vs. Information**
 - Voice
 - Data
 - Image

Regulatory Agencies

- During World War I (1914-1918), the United States government was concerned with national security and placed all telephones and telegraph companies under the control of the post office. The supervision lasted for one year, after which the government relinquished control and returned it to the private owners. Later, each state was left to handle regulation (via a PSC or PUC), and interstate communication was under the authority of the Interstate Commerce Commission (ICC).

Federal Communications Commission

- Created in 1934 by the Communications Act of 1934
 - Equipment certification
 - Radio Stations - airwaves
 - Cable
 - Fiber Optic
 - Satellite Communication
 - State Department & Commerce Department - international matters
- Interstate Commerce Commission (ICC) is out of TC

Public Utilities Commission (PUC)

Public Services Commission (PSC)

Intrastate Communications

- set rates & policies
- carriers ability to provide service
- negotiations between customers & companies

Standards Organizations

- Development of standards for communications not universally adopted.
- Many communications standards not compatible with other systems.
- Growing need for open systems for integration.
 - ANSI, ISO and others.

*American National Standards
Institute (ANSI)*

- Work with various organizations that develop voluntary national standards.
- 900 member companies, professional societies, industrial companies, trade associations, consumer groups and governmental bodies.
 - Developed computer standards: ANSI COBOL and ANSI C.ANSI. Currently working on standard for FDDI (Fiber Distributed Data Interface) and Sonet (Synchronous Optical Network).

*International Standards
Organization (ISO)*

- Founded in 1947.
- Works with national member bodies that submit proposals for standards based on specific industry needs rather than set actual standards.
- Made up of the national standards-setting organizations of each country.
 - Developed OSI (Open Systems Interconnection) Model.

Open Systems Interconnect

- Because data communications is such a complex process, protocols are built to handle only a small portion of the entire process.
- When protocols work together to “make data communications work”, they are called a protocol stack.

— (Ex: writing a letter to Grandma)

Protocol Stack
(A Letter to Grandma)

Idea	I love my grandma
Representation	My hand needs to write words in English
Format	Introduction, body, and conclusion
Ordering	Separate pages from notepad and number them
Packaging	Put paper into envelope
Addressing	Source & Destination Address and Stamp
Mailing	Give to Mail Carrier for Transport

The OSI Reference Model

Layer 7	Application	End user software (Word, Excel, etc.)
Layer 6	Presentation	Encryption, compression, and formatting
Layer 5	Session	Establish and terminate a connection
Layer 4	Transport	End-to-End conn. issues: reordering and acknowledging packets
Layer 3	Network	Routing over multiple links and congestion control
Layer 2	Data Link	Grouping bits together and addressing
Layer 1	Physical	Voltage, bit rate, medium, connectors

*Consultative Committee on International
Telegraph and Telephone (CCITT)*

- Technical recommendations concerning telephone, telegraph and data communication equipment worldwide.
- End-to-end between International connections. 150 organizations on committee.
- Terminated in 1992 and incorporated into the ITU (International Telecommunications Union).

Institute of Electrical and Electronics Engineers (IEEE)

- LAN (Local Area Network) standards.
- Professional society in the US and an ANSI member.
- Standards apply primarily to the lowest two layers of the OSI model (physical & data link)
 - Developed standards for LAN wiring, including IEEE 802.3 (ethernet), 802.5 (token ring) & 802.11{a, b, g} (wireless)
 - IEEE 1003.1 (portable operating systems standard)

Corporation for Open Systems (COS)


- Formed in 1986 to promote the international ISO standards.
- Members are representatives from computer and communication vendors and users.
 - Development of testing methods, testing facilities and certification procedures that can be used by all manufacturers.

Communications Satellite Corporation (COMSAT)

- Formed as a private company by Congress in 1962 to reach agreements with other countries concerning satellite communication.
- Has stockholders and the authority to issue stock. Unlike other standard operations, it is interested in making a profit for shareholders.
 - Represents the US in the INTELSAT (International Telecommunications Satellite Organization)

International Telecommunications Satellite Organization (INTELSAT)

- Formed by an international treaty in 1964 & Made up of 109 countries.
- Controls the placement and allocation of space for satellites around the world.
- Critical role in resolving international satellite dispute.



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Why study communications

Voice
Data

Banking Applications

- ATM Machines
 - Automatic Teller Machine to obtain cash or information about your checking or savings account.
- Remote Banking & EFT (Electronic Fund Transfer)
 - Process transactions (such as paying bills) without being dependent on the bankers' hours.
- Branch Offices

Security Systems

- A security system encrypts or scrambles information so that it can be used only by the intended receiver.
- Also provides backup systems to take over in case of equipment failures.
 - Companies can purchase these services to protect proprietary information that is sent over the telephone.

Government Applications

- NASA
- Department of Defense (DARPA, Internet)
- Department of Transportation

Retail Stores & Electronic Shopping

- Inventory
 - Wal-mart uses ATM to track products between stores
 - Dillard's uses ATM for bridal registry
- Credit Card Purchases
- Home Shopping Network & Amazon.com
- Mail Order Catalogs
 - use toll free numbers to accept and enter orders directly into computers miles away.

Travel Industry

- Travel Agencies
 - Reservations for hotel and transportation, Airline departure & arrival times, meals, arrange seating
- Air Traffic Controllers
- Hotels/Motels
- Car Rental Agencies
- Ship Lines
- Railroads

Investment Industry

- Stock Exchange
 - buyers & sellers transmit instructions via telecommunications lines to their agents at the stock exchange.
 - Large stock traders (mutual funds) use automatic computer programs to buy and sell stock by tracking the stock prices and using automatic margins. Some of the wild fluctuations in the 1987 market were blamed on these types of transactions.

Journalism (News & Media)

- Inauguration Day - FDR (March or November 1934)
- Super Bowl & Olympics
- Persian Gulf & Bosnia
- Oklahoma City
- September 11, 2001
- Stock Market
- Weather

Electronic Mail

- Transmit electronic mail messages (E-Mail) any hour of the day or night using a modem and a telephone line.
- Messages can be read, filed, stored, erased, printed and routed.

Bulletin Boards & Networks

- Another form of electronic mail.
- Available Information includes: travel, law, weather, news and stock market updates.
- Usually a charge such as subscription fee, cost of the telephone call and charge for the time the system is used.

Education & Libraries

- Electronic encyclopedia
- Data base for information on a specific topic: sports result, historical fact, college information.
- CBT (Computer Based Training)
- DLC (Distant Learning Center) - an interactive television to provide face-to-face instruction for those not able to travel to originating site location



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Trends in Communications

Trends


1. Continued Movement Toward the Deregulation of Telecommunications Services
2. Continued Expansion and Enhancement of Local and Wide Area Networks
3. Movement Toward Integrated Services Digital Networks
4. Movement Toward Standardization of Data Communication Protocols.

Trends continued...

5. Increased Use of Wireless Radio-Based Technology.
6. The Continued Growth of Fiber Optics (Photonics)
7. Expansion of Video Conferencing
8. Increased Power in Electronic Workstations
9. More Sophisticated Software

Trends
continued....

- 10. Continued Growth of Voice Processing
- 11. Greater Use of Optical Storage Technologies.
- 12. Multimedia in Integrated Systems.
- 13. Information as a Strategic Resource



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Careers in Communications

Communications

- Estimated by year 2004 over one trillion dollars spent on products & services.
- When the telecommunications revolution was very young, many positions were filled by employees already on the job who were retrained and placed in new areas of responsibility.

Career Types

- Entry level - terminal operator, receptionist & telephone operator
- Secondary level - telemarketing, systems analysis & repair technology
- More demanding occupations will call for engineering, physics, electronics & communications - telecommunications design specialist, network control operator, network analyst & telecommunications supervisor

Career Characteristics

- Most employers begin by looking for persons that exhibit traits such as intelligence, an analytical approach to problem solving, and interest in technology, a high degree of self-motivation and independence, and a good foundation in English skills (written and oral communication).

Communications Companies

- Manufacturing - Lucent Technologies, Nortel, Alcatel, Cisco
- Long Haul – AT&T, SBC, MCI, Williams, Time-Warner, etc.
- Short Haul - Southwestern Bell, GTE and Independents
- Resellers
- Equipment Sales & Services

Communications Companies

- Ideal location for nationwide and worldwide telecommunications/data processing operations.
 - SBC (Ameritech) - All 18 computerized switching centers in metro area are linked with high-capacity fiber-optic cable. They are all fully digital with the latest available technology, as well as a new software system called Common Signaling System 7.

Communications Companies

- Williams - designs, builds and operates large scale telemetry systems for utilities and other energy providers to monitor how much gas and electricity is used by each energy customer. They also provide CPE, national wireless networks, technical support and information processing services.
- WorldCom - owns and operates a worldwide fiber-optic network. They provide local and long distance service to large corporate users, government and long distance companies through a comprehensive package of voice, data, video and imaging services.

Chapter 7 or 11 Telecom Companies

- Reorganizing under bankruptcy protection:
 - Tyco
 - WorldCom
 - Global Crossings