Networks and Collaboration / Social Networks

Information Technology For Management 6th Edition
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Telecommunications System

The communications media, devices, and software needed to connect two or more computer systems.
Cable Media

- **Twisted-pair**
  - Most prevalent form of communication wiring, because it is used for almost all business telephone wiring.
  - Inexpensive
  - Slow (low bandwidth)
  - Widely available
  - Subject to interference
  - Easy to work with
  - Easily tapped (low security)

- **Coaxial cable**
  - Consists of insulated copper wire surrounded by a metallic shield and wrapped in a plastic cover.
  - Higher bandwidth than twisted pair
  - Relatively expensive and inflexible
  - Less susceptible to electromagnetic interference
  - Easily tapped (low-to-medium security)

- **Fiber-optic cable**
  - Made of glass
  - Light pulses are used (laser)
  - Very high bandwidth
  - Relatively inexpensive
  - Resistant to corrosion
  - Difficult to tap (good security)
Wireless Communication

- Cable media (with the exception of fiber-optic cables) present several problems, notably the expense of installation and change, as well as a fairly limited capacity.
- The alternative is wireless communication. Common uses of wireless data transmission include pagers, cellular telephones, microwave transmissions, communications satellites, mobile data networks, personal communications services, and personal digital assistants (PDAs).
• **Microwave.** Microwave systems are widely used for high-volume, long-distance, point-to-point communication.
  - These systems were first used extensively to transmit radio signals at the speed of light in a line-of-sight path between relay stations spaced approximately 30 miles apart (due to the earth’s curvature).
  - To minimize line-of-sight problems, microwave antennas were usually placed on top of buildings, towers, and mountain peaks.
  - Long-distance telephone carriers adopted microwave systems because they generally provide about 10 times the data-carrying capacity of a wire without the significant efforts necessary to string or bury wire.
  - Compared to 30 miles of wire, microwave communications can be set up much more quickly (within a day) and at much lower cost.
Wireless Communication (con’t)

• **Communications Satellites**
  - A major advance in communications in recent years is the use of *communications satellites* for digital transmissions.
  - Although the radio frequencies used by satellite data communication transponders are also line-of-sight, the enormous “footprint” of a satellite’s coverage area from high altitudes overcomes the limitations of microwave data relay stations.
  - For example, a network of just three evenly spaced communications satellites in stationary “geosynchronous” orbit 22,241 miles above the equator is sufficient to provide global coverage.

• **WLAN**
  - LAN that uses high-frequency radio waves for transmission
  - Limited range
Wireless Communication (con’t)

- **Wimax**
  - Does not require a clear line of sight to function
  - It can deliver voice and data up to 30 miles
  - Is not available in portable devices yet

- **Global Positioning Systems (GPS)** is a wireless system that uses satellites to enable users to determine their position anywhere on the earth.
  - GPS software computes the latitude and longitude and converts it to an electronic map, supported by 24 U.S. government satellites that are shared worldwide. Each satellite orbits the earth in 12 hours.
  - At any point in time, the exact position of each satellite is known, because the satellite broadcasts its position and a time signal from its on-board atomic clock, accurate to 1-billionth of a second. Receivers' clocks are synchronized with those of the satellites. Knowing the speed of signals (186,272 miles per second), it is possible to find the location of any receiving station (latitude and longitude) within an accuracy of 50 feet by triangulation, using the distance of three satellites for the computation.
Analog Transmission of digital data
Analog Transmission of digital data

- Modems converts digital signals to analog signals that has amplitude and frequency
- Modem is an acronym for MOdulature / DEModulator
- Modulation
  - Amplitude Modulation (AM): one amplitude is defined to be a 0 and another is defined to be 1
  - Frequency Modulation (FM)
  - Phase Modulation (PM)
  - Multiplexing (Frequency division and Time Division)
- Digital transformation of analog data (ex: analog voice data can be sent over digital network using digital transmission)
  - Pulse amplitude Modulation: Analog signal is approximated using different Pulse levels
DSL (Digital Subscriber Line)

- DSL uses digital transmission techniques over copper wires to connect the subscribers to network equipment located at the telephone company central office (local loop).
- DSL network interface device is placed in customer location and carrier’s end office.
- The end office DSL device is then connected to a high speed digital line from the end office to elsewhere.
- Asymmetric DSL (ADSL) create three channels over the local loop. One analog (4000 Hz) and two digital (one for upstream and one for downstream data traffic).
LAN (Local Area Network)

- LAN is a network that connects computer systems and devices within the same geographic area.
- Topology is the basic geometric layout of the network – the way in which the computers are connected:
  - **Star**, all network nodes connect to a single computer, typically the file server
  - **Bus**, all network nodes connect to the bus, which is a single communications channel, such as twisted pair, coaxial cable, or fiber optic cable
    - Carrier Sense Multiple Access with Collision Detection (CSMA/CD) – Wait until the bus is free to avoid collisions of packets
  - **Ring**, network nodes are connected to adjacent nodes to form a closed loop
    - Messages pass around the ring in one direction.
    - Each Computer receives the message
    - Free Token
    - Busy Token
Telecommunications Devices

- Hubs are simple devices that pass all traffic in both direction between the LAN sections they link.
- Bridges connect two or more network segments that use the same data link and network protocol. They only forward those messages that need to go to other network segments.
- Routers connect two or more networks that use same or different data link layer protocol but the same network protocols.
  - The incoming message is specifically addressed to the router.
  - Routers choose the best route between networks when there are several routes available.
  - Because a router knows its own location as well as the packet’s final destination, it looks in a routing table to identify the best path.
- Gateways connect two or more networks that use same or different data link and network protocols by translating one protocol to another.
- All of the above devices also function as repeaters strengthening the signal.
Devices that are nodes in a network must access and share the network to transmit and receive data. These components work together by adhering to a common set of rules that enable them to communicate with each other. This set of rules and procedures governing transmission across a network is a protocol.

- **TCP/IP (Network layer protocol)**
- **Transport Control Protocol (TCP)** – a widely used transport-layer protocol that is used to in combination with IP by most Internet applications.
  - Packetizing, breaking the data into smaller packets (max 1492 bytes)
  - Numbering them
  - Ensuring each packet is reliably delivered
  - Putting them in the proper order at the destination
  - Needs to be active at the sender and receiver
- **Internet Protocol (IP)** – the communications standard that enables traffic to be routed from one network to another as needed (used by each intervening computer). IP performs
  - Routing
  - Addressing
Assigning Addresses

- In general, the data link layer address is permanently encoded as a part of the hardware (e.g., Ethernet card).
- Network managers can assign any network layer address (IP) and application layer address they want as long as they are unique.
- Virtually all internet servers have application layer address but most client computers don’t.
- Network layer (IP) and application layer addresses go hand in hand and assigned at the same time.
- On the internet InterNIC is responsible for network layer addresses:
  - Class A: The first byte is fixed (Ex: 128.X.X.X, 16M addresses)
  - Class B: The first two bytes are fixed (Ex: 128.23.X.X, 65000)
  - Class C: The first three bytes are fixed (Ex: 128.37.58.X, 254)
Addressing

● Subnets
  ○ IP address, in general, are assigned so that all computers on the same LAN have similar addresses (Ex: Business school LAN might be assigned 128.165.56.X).
  ○ Every computer in a LAN is given a subnet mask to enable it to determine which computers are on the same subnet. This is important for message routing.
Address Resolution

- **Server name Resolution: Application Layer address (URL, ex. www.boun.edu.tr) needs to be translated into network layer address (IP, ex: 124.134.65.32)**
  - This is done using Domain Name Server (DNS)
  - DNS has a database storing URL and corresponding IPs
  - When a computer does not know the IP number for the destination computer it sends a message to a DNS

- **Data Link Layer Address Resolution**
  - To send a message to a computer, a computer must know the correct data link layer address.
  - If the destination computer is located in the same LAN (which can be verified by subnet mask) TCP/IP sends a broadcast message “whoever is IP address xxx.xx.xxx.xxx, please send me your data link layer address
  - Sender stores IP and data link layer addresses for future use.
Routing

- Routing is a process of determining the route or path through the network that a message will travel from the sending computer to the receiving computer.
  - Centralized Routing
  - Decentralized Routing: All computers in the network make their own routing decisions
- Routing table specifies how messages will travel through the network.
- Internet Control Message Protocol (ICMP) is a dynamic routing protocol used in Internet.
  - Initial routing table is created by the network managers, but is continuously updated by computers (requiring additional capacity)
  - It attempts to improve network performance by avoiding busy circuits.
  - Prioritizing messages (video conferencing gets higher priority than email)
Routing (cont’d)

• Connectionless Routing: Each packet is treated separately and makes its way through the network (TCP/IP).

• Connection oriented routing sets up a virtual circuit between the sender and receiver. The connection appears to be a point to point circuit (UDP – User Datagram Protocol).
  ○ Only one routing decision is made by network layer.
  ○ All the packets arrive at the destination in the same order in which they were sent (Sequence number is not needed)
  ○ Virtual Private Network (VPN) is based on connection oriented routing. Two computers believe they have a dedicated point to point circuit. A VPN may include more than two computers. It also utilizes encryption methods to provide security.
### Internet, Intranet, and Extranet Users

<table>
<thead>
<tr>
<th>Type</th>
<th>Users</th>
<th>Need for User ID and Password</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet</td>
<td>Anyone</td>
<td>No</td>
</tr>
<tr>
<td>Intranet</td>
<td>Employees and managers</td>
<td>Yes</td>
</tr>
<tr>
<td>Extranet</td>
<td>Business partners</td>
<td>Yes</td>
</tr>
</tbody>
</table>
**Intranets and Extranets**

- **Intranet** – an internal corporate network built using Internet and WWW standards and products.

- **Extranet** - a network based on Web technologies that links selected resources of the company’s intranet with its customers, suppliers, or other business partners.

- **Internet** - composed of thousands of interconnected networks, managed by multiple Internet service providers (ISPs) who control the routing of packets and their performance.

- The same protocols are used in all of the above.
**Privacy & Security**

- **Cryptography** – the process of converting a message into a secret code and changing the encoded message back to regular text (encryption/decryption).
  - Public/private key methods

- **Firewall** - a router, gateway or special purpose computer
  - Examines flowing into and out of a network, limiting access into organization’s network
  - Only allows the packets with acceptable source and destination
  - Spoofing is done by changing the source address on incoming packets from their real address to an address inside the organization’s network
  - Proxy server is a new type of firewall. It uses an address table to translate network addresses inside the organization into fake addresses. This way systems outside the organization never see the actual internal PI addresses.
The Internet

- **Uniform Resource Locator (URL)** – an assigned address on the Internet for each computer.
- **Hypertext markup language (HTML)** – the standard page description language for Web pages.
- **Web browser** – the software that creates a unique, hypermedia-based menu on a computer screen, providing a graphical interface to the Web.
- **Search engines** – a Web search tool.
  - Some new search engines do nothing but search. Google is the largest search engine and the first search engine to index more than 1 billion pages.
  - Google’s method of searching the Web and ranking the results is called PageRank. The more links there are to a page, the higher it moves in Google’s ranking.
  - When a user enters a search query, the engine searches its database for relevant Web pages.
The Internet

• Discussion
  ○ Do you think search engines, and especially Google, could be fooled or manipulated? If yes, how so?
**IT Communication Support**

**Time and Place** form categorization

- **Same Time / Same Place**: People meet, but are supported by group support systems (management cockpit, real-time collaboration tools,...)

- **Same Time / Different Place**: Videoconferencing, Instant Messaging, Screen sharing, Chat rooms, VOIP,...

- **Different Time / Same Place**: E.g. shifts, e-mail, workflow, voice messages,...

- **Different Time / Different Place**: E-mail, bulletin board, workflow,...
IT Communication Support

**Discussion**

- What is the type of communication you have most often?
- Which type(s) will be more important in the future, especially in companies?
Web 2.0

● Second generation of internet applications
  ○ reciprocity between user and provider emphasized
  ○ transition of websites from isolated information silos to interlinked computing platforms
  ○ main ideas
    • web as a platform
    • data as the driving force
    • innovation in assembly of systems and sites composed by pulling together features from distributed, independent developers
    • software is a service not a product (above level of single device)
    • some rights reserved
    • perpetual beta
Blogs (Weblogs)
- Started as personal publishing tools
- Also used today by companies to broadcast information
- Lots of software available

Wikis
- Users can freely create and edit web pages, Content and structure can be edited
- Complete history available
- Example: wikipedia.org
- Important as group communication and collaboration tool in companies
- Keeps track of knowledge created, changes, discussions,...
Applications and Technologies

- **Podcasts**
  - Audio or video content is distributed (made available)

- **RSS (Really Simple Syndication)**
  - Web feed format automating delivery of content
  - Receive newly updated information by subscribing to a page, blog,...

- **Instant messaging, Voice-over-IP**

- **P2P**
  - Peer-to-Peer, different paradigm than client-server (client requests service from server)
  - Every node in network can act as client and server
  - e.g. BitTorrents for filesharing (also includes a centralized component)
Applications and Technologies

- **Tagging**
  - Process to annotate some content (web pages, pictures,...) with keywords in order to categorize, classify and describe
  - Choice of keywords is free, no hierarchical categories
  - Allows to find content based on your, or others' tags

- **Social Networks**
  - Web sites that allow people to build a page to present themselves (using blogs, pictures,...) and link to other content (based on friendship, business association, interest,...)
  - Examples include Facebook, myspace, LinkedIn,...
Activity

- Where and how could Web 2.0 be added to Bogazici University online services (like the registration system)?
Applications and Technologies

• Discussion
  ◦ Do you use social networking sites? If yes, why?
  ◦ Do you see any problems or dangers in this?
Case Studies

- Prepare Mini Case Chapter 4 (Dresdner Kleinwort Wasserstein) and 8 (Eastern Mountain Sports) for next class session.