ITM 100 Notes (For Midterm)

Foundation of Information Systems (Ryerson University)

ITM 100 Midterm Notes - OZGUR

LECTURE 1

Information System

- Set of interrelated components
- Collects data, and information
- Supports **d**ecision making, **c**oordination, and **c**ontrol

Information Technologies - the software and hardware that a company uses to achieve business objectives, foundation the the technological aspect of a company.

Data - raw facts
Information - data shaped into a meaningful form

Functions of an Info System

- Input - raw data por info from the organization
- Processing - converts the raw data into meaningful info
- Output - info to be supplied to people
- Feedback - output returned to the organization to help evaluate and make improvements

Dimensions of Information Systems

- Organization - (social business)
- Technology - (cloud computing)
- Management - (virtual meetings)

Interdependence Between Organizations and Information Systems

Business Strategies are part of Business Firms
Software = Information System → Hardware, Data management, Telecommunications

Roles of Info Systems Today

Operational Excellence	Improves efficiency **to attain** higher profitability (ex; Walmart, links suppliers to stores)
New Products, Services, and Business Models	(Example - Amazon went from retail books to online delivery
Customer Service/ Supplier Intimacy	Customer intimacy makes them come back again Supplier intimacy makes them give cheaper prices

Improved Decision Making	With information systems, you get more data and info, but without it businesses gotta guess, but with the data, you can get exactly what you need, no over/under production
Competitive Advantage	**Charging** less for products **Delivering** better performance **Responding** to customers and suppliers in real time
Survival	You need new information systems as tech grows, like banks need atm or nobody going there

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Contemporary Approaches to Information Systems

Technical Approach - emphasizes on mathematical products (computer science, operations research, management science)

Behavioural Approach - emphasizes on behavioural issues such as strategic business implementations (psychology, economics, sociology)

Socio-Technical Systems - management information systems (MIS). Combines both the technical approach and the behavioural approach

Contemporary Issues - everything is becoming more digital - e-commerce, AI replacing humans, increase in foreign trades, firms close to becoming fully digital -> produces both challenges and opportunities

LECTURE 2

How Information Technology Improves Business Processes

- Increasing efficiency of existing processes (automating manual steps, checking client's credit)
- Enabling new processes (Changing flow of info, replacing steps, eliminating delays, supporting new business models) -> Netflix

Business Processes

- Flows of material, info and knowledge, sets of activities
- Business can be seen as a collection of processes -> processes may be assets or liabilities

Examples of business processes

- **M**anufacturing & **P**roduction -> assembling the product
- **S**ales & **M**arketing -> identifying customers
- **F**inance & **A**ccounting -> creating financial statements

Types of Information Systems

Transaction Processing System (TPS) - for managers !

- Serve operation managers and staff
- Perform and record daily routine (sales, payroll)
- Allow managers to monitor the status

Management Information System (MIS) - sociotechnical systems

- Serve middle management
- Provide reports on firm's performance
- Provide answers to **routine** questions
- Have little analytic capability

Decision Support Systems (DSS) - MIDDLE MANAGEMENT

- Improved decision making
- Serve **middle management**
- Support **nonroutine** decision making
- May use external data such as TPS/MIS data

- Types of DDS
    - **Model driven** (voyage-estimating systems) (File → Analytical → Query)
    - **Data driven** (marketing analyst systems)
    - **Knowledge driven** (university admission)
    - **Communication driven** (collaboration management systems)

Executive Support Systems (ESS) - SENIOR MANAGEMENT

- Improved decision making

- Support **senior management**
- Address non-routine decisions (require judgment, insight)
- Incorporate data about external events
- Example -> Loblaw's going online, Ryerson opening a new campus

Enterprise Resource Planning (ERP)
- Collect data from different firm functions, and stores in a single storage
- Resolve problems of broken part data
- Enables -> coordination of daily activity
  -> efficient responses to customer orders
  -> decision making by managers about daily operations and long-term planning

Supply Chain Management Systems (SCM)
- Manage firm's relationships with suppliers
- Inter-organizational systems
- Share information about order, production etc.
  Goal -> **right amoun**t of products to destination with **lowest cost** and time

Customer Relationship Management Systems (CRM)
- Provides info to coordinate all of business that deals with customers
  -> Sales, marketing, customer service

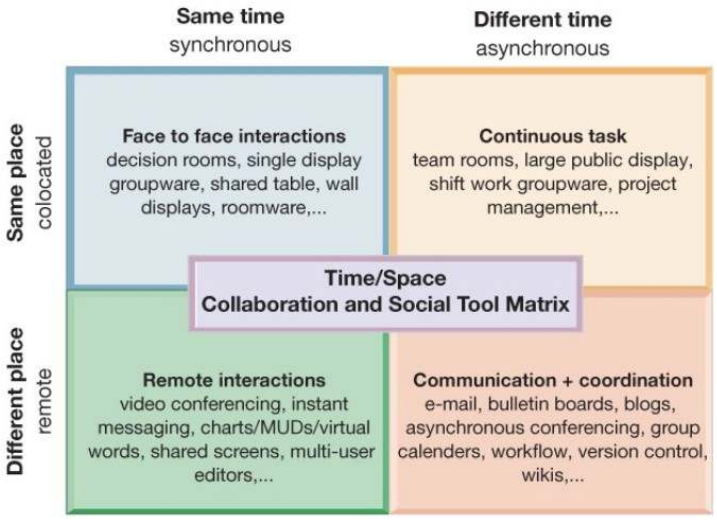
Knowledge Management Systems (KMS)
- Example – Ryerson Student Portal
- Support processes for capturing and applying knowledge expertise
- How to create, produce and deliver goods & services
- Links to external sources of knowledge
- Manages document, and other digital knowledge

E-Business - Digital Tech to drive major business processes
E-Commerce - Subset of E-Business, but for buying and selling goods through internet
E-Government - Using tech to deliver info and services to citizens

Intranets and Extranets (**intranet** is for **teachers**, ***extranets*** is for ***students***)
- Used to increase integration and expedite the flow of info
- Intranets – company website only accessible my employees
- Extranets – company website accessible only to vendors and suppliers

Social Business
- Use of social networking platforms (internal and external) to engage employees, suppliers and customers

Collaboration is Important because - adds growth, innovation, changes nature of work, culture and organization



Business benefits of collaboration and teamwork

- Returning high ROI (Rate On Line)
- Productivity, quality, innovation
- Customer service, financial performance (profits, sales, sales growth)

Tools and technologies for collaboration and social business

- E-mail and messaging
- Wikis
- Virtual meeting systems (telepresence)
- Cloud collaboration (Google Docs, Drive etc.)
- PCs, smartphones and other smart devices

LECTURE 3

IT Infrastructure

- Set of physical devices and software required to operate an enterprise
- Services Include: **Computing platforms** provide computing services.
  Physical Facilities, management services
  IT management, education and other services
- **Service Platform** perspective → More accurate view of value of investments

Computer Components

Intel Core 2 Duo - Processor -> handles all the basic system instructions such as a mouse
4GB Shared Dual Channel - RAM -> working memory of the computer
500GB SATA Hard Drive - (Serial Advanced Technology Attachment or **SATA**) is a

standard for connecting and transferring data from hard disk drives to computer systems
15.6’ HD LCD Display - monitor display size and visual quality
8X Slot Load DL DVD+/- RW Drive - CD slot
14.8” X 1.2”H X 10.1” D, 5.6 lbs - dimensions of the computer
512 ATI Mobility Radeon Graphics - graphics card -> controls the output to a display screen
85 WHr Lithium Ion Battery - type of battery
2 USB 2.0, HDMI, 15-Pin VGA… - computer ports
Microsoft Windows 7 - software
Microsoft Office - feature
36-Month subscription to McAfee Security Center Antivirus - anti-virus

Speed (*Faster* is better)
Ram and Harddrive (Storage) (*Bigger* is better)
Screen (*Smaller* is better)

Power of 10	Power of 2	Value of Power of 2	Prefix	Abbreviation	Derivation
10^{-12}			pico	p	Italian for *little*
10^{-9}			nano	n	Greek for *dwarf*
10^{-6}			micro	μ	Greek for *small*
10^{-3}			milli	m	Latin for *thousandth*
10^{3}	2^{10}	1024	kilo	K	Greek for *thousand*
10^{6}	2^{20}	1,048,576	mega	M	Greek for *large*
10^{9}	2^{30}	1,073,741,824	giga	G	Greek for *giant*
10^{12}	2^{40}	not enough room	tera	T	Greek for *monster*
10^{15}	2^{50}	not enough room	peta	P	Greek prefix for *five*

Hertz - the unit for frequency, one cycle per second

Random Facts

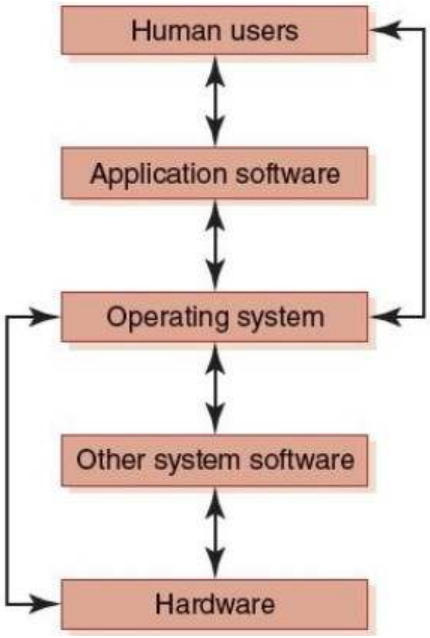
- In 2019, firms are expected to spend $1.2 trillion on computer hardware
- 30 billion transactions per day/80% corporate data

Application Software - Software written to address specific needs (to solve world problems) - Example -> Excel
System Software - Software that manages a computer system at a fundamental level - Example -> Microsoft Office

Roles of an Operating System ("share nicely")

Is a **system software** that

- manages computer resources (memory/input)
- provides an interface where humans can interact with computer
- allows an application program to interact with these other system resources



Resource Management

Multiprogramming - keeps multiple programs that compete for access to CPU at the same time so they can execute

Memory Management - keeping track of what programs are in memory and which aren't

Process - A program in execution

Process Management - Tracking progress of a process

CPU Scheduling - Determining which process in memory is being used by CPU at any given time

Batch Processing

- The first operating system was a **HUMAN operator,** organized bare jobs that needed the same resources

Time Sharing

Time Sharing System - Allows multiple users to interact with a computer at same time

Virtual Machine - The illusion created by a time sharing system that each user has his/her own machine

Useless Fact
- As computer speed increased, the human operator became the bottleneck

Real-time System - system where response time is crucial

Response Time - the time delay receiving a quality and producing a response

Device Driver - a small program that “knows” the way a device expects to receive and deliver info

Operating System Platforms

Corporate Servers - (Windows Server, Unixx, Linux)
Client Level - (Microsoft, Android, IOS, Google Chrome (Cloud computing)

Enterprise Software Applications

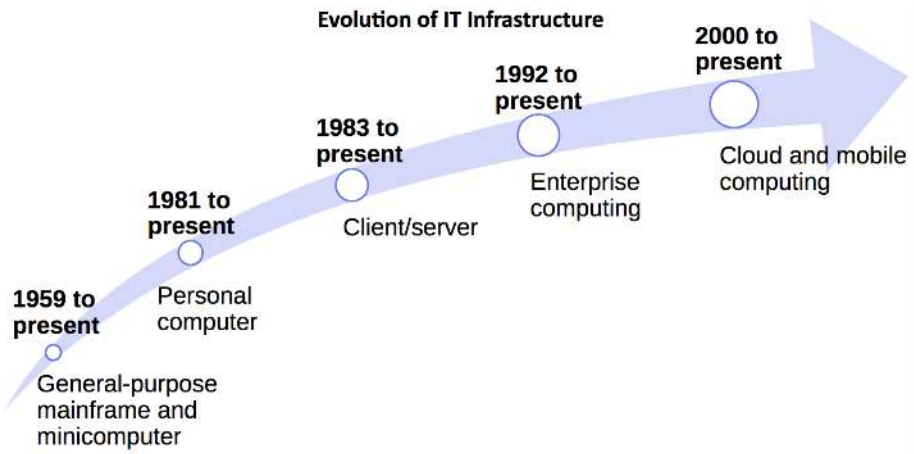
Largest Providers - SAP/ Oracle
Middleware Providers - IBM, Oracle

Networking/Telecommunications Platforms

Network operating systems - Windows Server, Linux, Unix
Network hardware providers - Cisco, Juniper Networks
Telecommunication Services - Telecommunications, cable, telephone (Bell/Rogers)

Data Management and Storage

Database Software Providers - IBM, Oracle, Microsoft
Physical Data Storage for Large Systems - EMC Corporation



Technology Drivers of Infrastructure Evolution

Moore's Law and Microprocessing Power - Computing power doubles every 2 years

Law of Mass Digital Storage - The amount of data doubles each year

Metcalfe's Law and network Economics - Value or power of network grows exponentially

Related Facts
Storage per dollar is rising exponentially
Internet Communication Costs declining exponentially

Dealing with Platform and Infrastructure Change
- IT needs to be flexible and scalable (Ability to expand to serve larger # of users)
- New policies and procedures for mobile/cloud computing
- New contract agreements to computing/ run softwares

Management and Governance

IT Departments should be Centralized
Business Unit IT departments are Decentralized

Total Cost of Ownership (TCO) Model

Analyzes direct/indirect costs, TCO can be reduced (Hardware, software account for only 20% of TCO)

LECTURE 4

Data
- Can be text, numbers, audio, video, etc.
- Generated by TPS (*transaction processing system*), employees, intelligent agents, IoT (*internet of things)*, etc. (more data has been generated in the last decade than the rest of human history)
- Building block for all kinds of information (processed, organized and contextualized to generate useful info)

A Database
- An organized collection of data stored to serve info and system apps

Basic Concepts
- Entity – person, place, thing, event which info is maintained
- Attribute – a particular characteristic all entities should possess (e.g. ID)
- Key Field – Identifier attribute used to uniquely identify a particular entity

File Organization Terms and Concepts
- Database – group of related files
- File – group of records of same type
- Record – group of related fields, all the things collected about an entity
- Field – group of characters as word(s) or number(s)
- Byte – group of bits that represent a single character (the letter “A” or the number “5”)
- Bit – smallest unit of data; binary digit (0,1)
- Hierarchy – Database, file, record, field, byte, by

Problems with the Traditional File Environment
- Files maintained separately by different programs/departments
- Data redundancy (repetitious)- the presence of duplicated data in multiple data files so that the same data are stored in. more than one space or location
- Data inconsistency – the same attribute may have different values (uppercase, lowercase, phone number etc.)
- Lack of flexibility
- Poor security – management may have no knowledge of who is accessing or naming changes to the org’s data
- Lack of data sharing availability – info cannot flow freely across different functional areas or parts of the organization

Data Redundancy - The presence of duplicate data in files
Data Inconsistency - The same attribute may have different values

Program-Data Dependence
- Changes in **data** require changes to the **program** (e.g. one program might be modified from five-digit to nine-digit ZIP code

Database Management Systems (DBMS)
- Interface between apps and physical data files
- Separates logical and physical views of data
- Solves problems of traditional file environment
- Controls redundancy -> not even allowed
- Eliminates inconsistency
- Uncouples programs and data
- Enables organization to centrally manage data and data security

Relational DBMS
- Represents data as two-dimensional tables
- Each table contains data on an entity and its attributes (GRID DATA)
- Table – grid of column and rows
- Rows (tuples) – records for different instances of an entity
- Fields (columns) – represents attributes for entity/records
- Key field – field that can uniquely identify each record
- Primary Key – the chosen/designated key
- Foreign Key – a subsection, basically is shit that's connected to Primary Key

Capabilities of Database Management System
- Data definition capability – specifies structure of the database
- Data dictionary – stores definition of data elements and their characteristics
- Querying and reporting – data manipulation language, structured query language (SQL)
- Many DBMS have report generation capabilities for creating polished reports (Microsoft Access)

Designing Databases
- Conceptual Design – abstract model of database from a business perspective
- Entity-Relationship Diagram – methodology for documenting databases illustrating relationships between database entities
- Logical Design – creating tables from the ERD -> normalization – process of creating small table data structures from complex groups of data
- Physical Design – detailed prescription of how the data will actually be arranged and stored on physical devices

Operations of a Relational DBMS
- Three basic operations used to develop sets of data
- Select – creates subset of data of all records that meet stated criteria
- Join – combines relational tables to provide user with more info than available on individual tables
- Project – creates subset of columns in table, creating. Tables with only the info specified

Business Intelligence Infrastructure
- Array of tools for obtaining info from separate systems and from big data

- Data Warehouse – stores current and historical data from many tps, consolidates and standardizes info for use across enterprise but data cannot be altered, provides analysis reporting tools
- Data Marts – subset of data warehouse, summarized firm's data for use by a specific user(s), typically focuses on single subject or line of business

Non-relational Databases (NoSQL)
- More flexible data model
- Data sets stored across distributed machines
- Easier to scale
- Handle large volumes of (un)structured data

Databases in the Cloud
- Appeal to smaller business
- Amazon relational database service, Microsoft SQL azure
- Private clouds

Hadoop (Business Intelligence Infrastructure)
- Enables distributed parallel processing of big data cross inexpensive cpu's
- Hadoop Distributed File System (HDFS) – data storage
- MapReduce – breaks data into clusters of work
- Used by Yahoo, NextBio
- In memory computing – uses RAM, big data, reduces processing time, requires optimized hardware
- Analytic Platforms – high speed platforms using both relational and non-relational tools optimized for large datasets

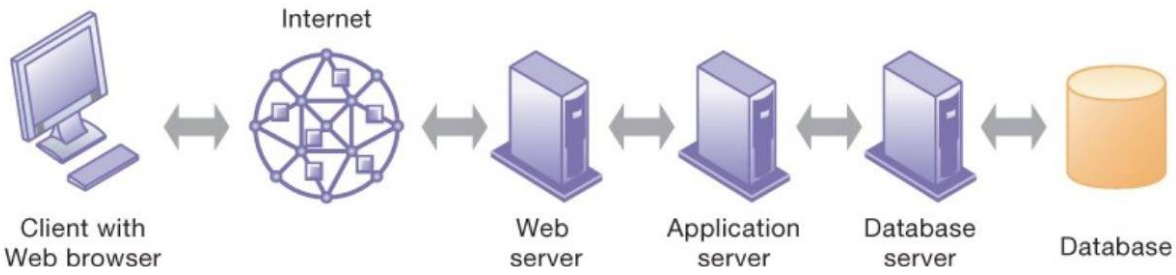
Analytic Tools – Relationships, Patterns, Trends
- Tools for consolidating, analyzing, and providing access to vast amounts of data to help users make better business decisions

-> Tools Include
- Multidimensional Data Analysis (OLAP) - uses multiple dimensions, each aspect of info (product, pricing, cost) is a different dimension. Example -> how many washers sold in the East in June compared with other regions
- Data Mining – finds hidden patterns, relationships in datasets (customer buying patterns for example). Infers rules to predict behaviour

-> Types of Info Obtained from Data Mining
- Associations, Sequences, Classification, Clustering, Forecasting
- Text Mining – extracts key elements form large unstructured datasets
- Web Mining – discovery and analysis of useful patterns and info form the web. Web

content/structure, usage mining
- Sentiment Analysis – opinions about a subject (product reviews). Help the business improve

Databases and the Web
- Many companies use the web to make some internal databases available to customers or partners
- Advantages – ease of use of software, requires few or no changes, inexpensive

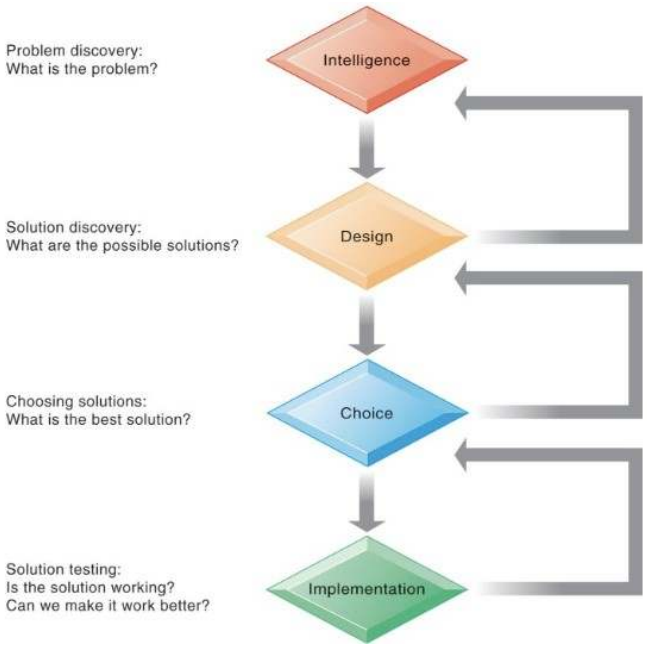


Establishing and Info Policy
- Firm's rules, procedures, roles for sharing, managing, standardizing data
- Data admin – establishes policies and procedures
- Data Governance – deals with policies and processes for managing availability, usability, integrity, security etc.

LECTURE 5

Managerial Roles

5 Functions - planning, organizing, coordinating, deciding, controlling
3 Categories - interpersonal, decision roles, informational roles



Types of Decisions

- Unstructured - decision maker must provide judgement, evaluation and insight to solve the problem (uses specialized tools such as softwares to collect, rank and edit responces)
- Structured - repetitive and routine -> have a definite procedure so they don't have to treat each time as new
- Semistructured - only part of the problem has a clear-cut answer (middle of both)

Support for Structured and Semi-Structured Decisions

- Structured - Management Information Systems (MIS), Exception Reports, Queries
- Semi-Structured - Decision support systems, “what if analysis”

High-Velocity Automated Decision Making

- Possible bc of computer algorithms -> humans taken out of decision
  - Example: Trades executed in 30 milliseconds, Google
- They require safeguards to ensure proper operation/regulation

Business Intelligence

- Infrastructure for collecting/storing data
- Business Analytics - Tools and techniques for analyzing data. Descriptive, predictive, prescriptive

The Business Intelligence Environment

1. Data from the business env.
2. Business intelligence infrastructure
3. Business analytic tool set
4. Managerial users and methods

5. Delivery platforms
6. User interface - data visualization tools

Business Intelligence Users
20% of Employees are Producers (IT Developers, Business Analysists, Modelers)
80% of employees are Consumers (Managers, Staff)

Business Intelligence and Analytics Capabilities
- Goal is to deliver accurate real time information to decision makers
- Main Function is to create reports/query/scorecards/forecasts

Predictive Analysis
- Uses bare data and technique to predict future trends and behaviour through data mining, statistical analysis, historical data and assumptions
- Incorporated into bare BI apps for sale, marketing, finance, fraud detection and healthcare

Big Data Analytics
- Big datasets collected from online, social media, and in store customer data, etc
- Help create real time personalized shopping experiences

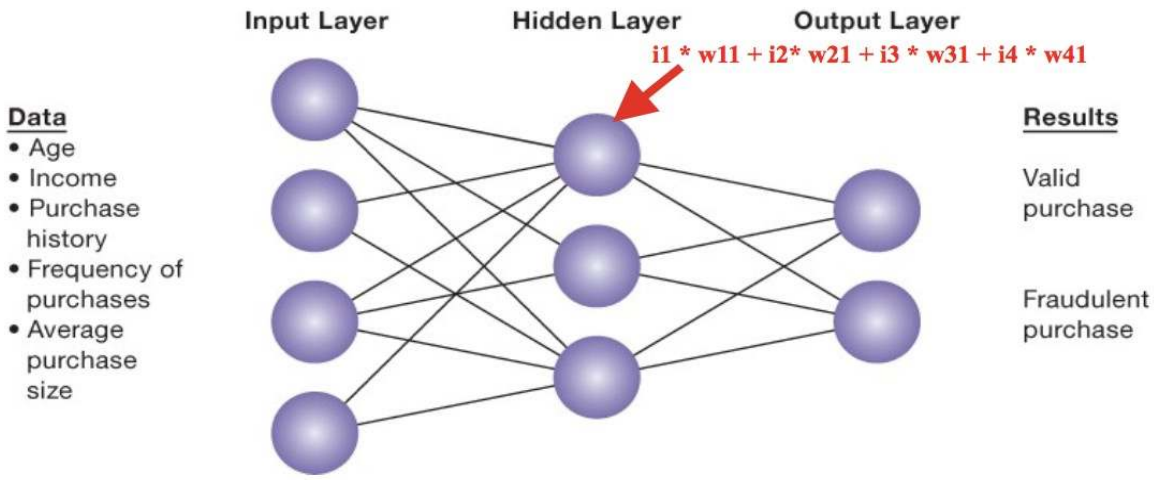
Intelligent Systems
- Expert System: An intelligent technique for capturing knowledge in a specifc/limited domain. It captures knowledge of skilled employees in the form of set rules in a system

Expert Systems
- Knowledge Based System - Software that uses Specific info where it extracts/processes info
- Expert System - Software system based on knowledge of human experts
- Rule based - System based on a set of “if then rules”
- Inference engine - The software that processes rules to draw conclusions

Related Example
LAST - the date of the last lawn treatment
CURRENT - current date
SEASON - the current season

Artificial Neural Networks
- Computer representation of knowledge that mimics the neural networks of a human body
- An element accepts a certain number of input values (dendrites) and produces a single output value

Training - the process of adjusting the weights in a neutral set (axon)
Neural Network
- Neuron - A single cell that conducts a chemically based electronic signal
- Pathway- Connected neurons



Natural Language Comprehension

Lexical ambiguity

Stand up for your country.

Take the street on the left.

Syntactic ambiguity

I saw the bird watching from the corner.

I ate the sandwich sitting on the table.

Referential ambiguity

The bicycle hit the curb, but it was not damaged.

John was mad at Bill, but he didn't care.

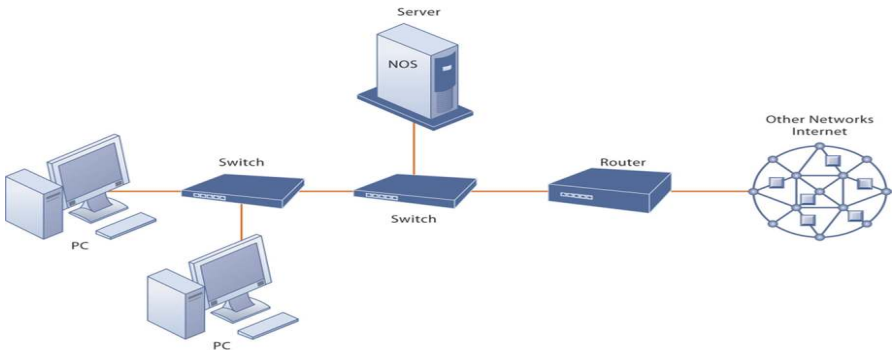
LECTURE 6

Telecommunications - the transmission of information, as words, sounds, or images, usually over great distances, in the form of electromagnetic signals, as by telegraph, telephone, radio, or television.

Communication - the imparting or interchange of thoughts, opinions, or information by speech, writing, or signs.

Computer Network

- Two or more connected computers
- Major components in simple network
- Software-defined networking(SDN)
    - Functions of switches and routers managed by central program



- Signals - digital vs. analog
- Modem turns digital signals into analog forms (vice versa)
- Type of networks - LAN (Local Area Network), Ethernet, CAN (Campus..), MANs (Metropolitics..), WANs (Wide..)

TRANSMISSION MEDIUM	DESCRIPTION	SPEED
Twisted pair wire (CAT 5)	Strands of copper wire twisted in pairs for voice and data communications. CAT 5 is the most common 10 Mbps LAN cable. Maximum recommended run of 100 meters.	10–100+ Mbps
Coaxial cable	Thickly insulated copper wire, which is capable of high-speed data transmission and less subject to interference than twisted wire. Currently used for cable TV and for networks with longer runs (more than 100 meters).	Up to 1 Gbps
Fiber-optic cable	Strands of clear glass fiber, transmitting data as pulses of light generated by lasers. Useful for high-speed transmission of large quantities of data. More expensive than other physical transmission media and harder to install; often used for network backbone.	15 Mbps to 6+ Tbps
Wireless transmission media	Based on radio signals of various frequencies and includes both terrestrial and satellite microwave systems and cellular networks. Used for long-distance, wireless communication and Internet access.	Up to 600+ Mbps

Networking in Large Companies

- Hundreds of LANs
- Powerful servers such websites
- Mobile wireless LANs (Wi-Fi networks)
- Video Conferencing system
- Telephone network, wireless cell phones

Key Digital Networking Technologies

Client/server computing

- Distributed computing model
- Server sets rules of communication for network and provides every client with an address so others can find it on the network

- The Internet is the largest implementation of client/server computing

Packet switching
- Method of slicing digital messages into parcels (packets), sending packets along different communication paths as they become available, and then reassembling packets at destination
- Packet switching more efficient use of network's communications capacity

TCP/IP and connectivity
- Protocols - rules that govern transmission of information between two points
- Transmission Control Protocol/Internet Protocol (TCP/IP) - common worldwide standard that is basis for the Internet
- Department of Defense reference model for TCP/IP

-> 4 layers: Application, Transport, Internet, and Network interface

What's the Internet?
- World's most extensive network (WAN)
- Internet service providers (ISPs) - Provide connections

Types of Internet connections
- Dial-up: 56.6 Kbps
- Digital subscriber line (DSL/FIOS): 385 Kbps–40 Mbps
- Cable Internet connections: 1–50 Mbps
- Satellite
- T1/T3 lines: 1.54–45 Mbps

IP Address
- Each device on Internet assigned Internet Protocol (IP) address

-> 32-bit number, e.g. 207.46.250.119

The Domain Name System (DNS)
- Converts IP addresses to domain names and vice versa

->172.217.4.195 <->www.google.ca
- Hierarchical structure
- Top-level domains

Network service providers
- Own trunk lines (high-speed backbone networks)

Regional telephone and cable TV companies
- Provide regional and local access

Professional organizations and government bodies establish Internet standards
- IAB - define the overall structure of the Internet
- ICANN - manage the domain name system

- W3C - standards for the Web

Internet Services and Communications Tools
- E-mail
- Chatting and instant messaging
- Newsgroups
- Telnet
- File Transfer Protocol (FTP)
- World Wide Web

Voice over IP
- Digital voice communication using IP, packet switching
- Providers: Cable providers; Google, Skype

Unified communications
- Communications systems that integrate voice, data, e-mail, conferencing

Virtual private network (VPN)
- Secure, encrypted, private network run over Internet
- Tunneling

The Web

Hypertext
- Hypertext Markup Language (HTML)
- Hypertext Transfer Protocol (HTTP):
- Uniform resource locator (URL) - http://www.megacorp.com/content/features/082602.html

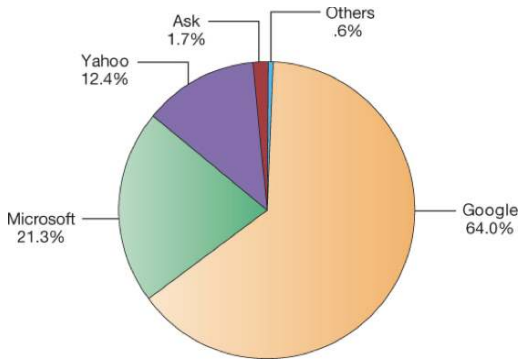
Searching for Info on the Web

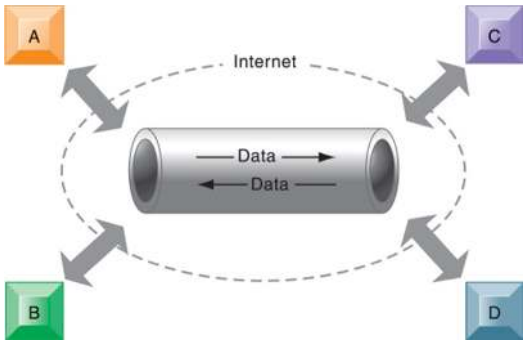
Search engines
- Started as simpler programs using keyword indexes
- Google's PageRank System

- **Mobile search** - 50% of all searches in 2016

Search engine marketing
- Major source of Internet advertising revenue

Search engine optimization (SEO)
- Adjusting Web site and traffic to improve rankings in search engine results

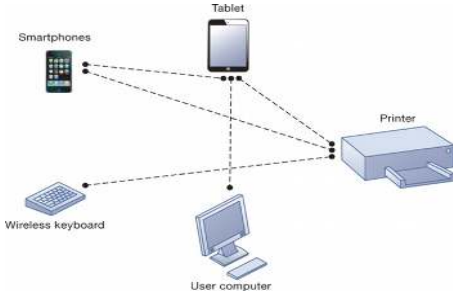




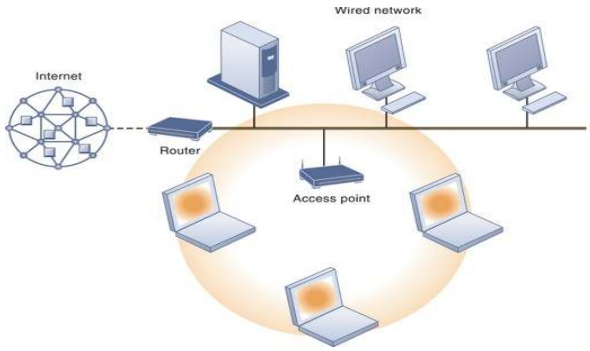
Principal Technologies and Standards for Wireless Networking

- Wireless devices
- Cellular systems
  - -> Cellular network standards and generations
  - -> Mobile wireless standards for Web access
- Bluetooth (802.15 networking standard)
- Wi-Fi (802.11) and wireless Internet access
- Hotspots
- WiMax (802.16)

A Bluetooth Network (PAN)



An 802.11 Wireless LAN



Wireless Sensor Networks (WSNs)

- Networks of hundreds or thousands of interconnected wireless devices
- Used to monitor building security, detect hazardous substances in air, monitor environmental changes, traffic, or military activity
- Devices have built-in processing, storage, and radio frequency sensors and antennas
- Require low-power, long-lasting batteries and ability to endure in the field without maintenance
- Major sources of “Big Data” and fueling “Internet of Things”

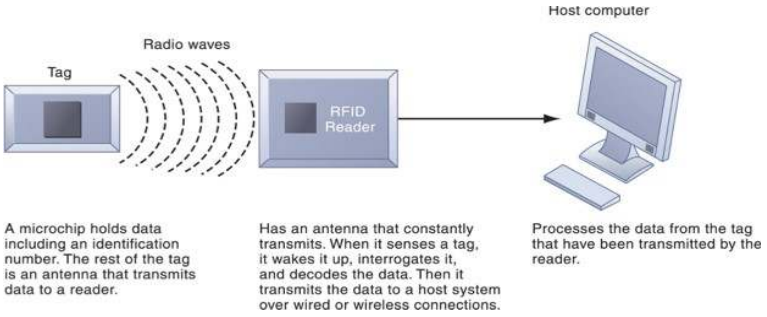
Radio Frequency Identification (RFID)

- Use tiny tags with microchips containing data about an item and location
- Tag antennas to transmit radio signals over short distances to special RFID readers
- Common uses:

-> Automated toll-collection

-> Tracking goods in a supply chain

- Reduction in cost of tags making RFID viable for many firms



Networking and Communication Trends

- **Convergence -** Telephone networks and computer networks converging into single digital network using Internet standards (Bell Fibe)
- **Broadband -** More than 74 percent U.S. Internet users have broadband access
- **Broadband wireless -** Voice, data communication are increasingly taking place over broadband wireless platforms