COMPSCI 1032: Course Review (Professor Louis Magguilli)

Lecture 1 - 12 (5a)

Chapter 1: Information Systems and You

Pages: 4 - 23

What An Information System Is

-*System*: group of components that interact to achieve some purpose

-**Information system** (**IS**): group of components that interact to produce information; not all information systems require computerization (technology)

-computerized information system is known as an *information system*

-Information system comprises of a (5) **component framework**

-(1) *computer hardware*: electronic components and the associated gadgetry that constitute a computer system (personal computers, tablets, smartphones)

-(2) *software*: programs/*applications* that run or operate on computer systems

-(3) *data*: basic building blocks of information (facts, observations, identification numbers); usually stored on *servers* (can be accessed anywhere)

-(4) *procedures*: instructions or processes followed to achieve desired objective; formal/documented policies or less detailed, informal instructions

-(5) *people*: actors who want to achieve a particular outcome by interacting with system (users, creators); people = often most crucial part of 5 component framework

-5 components are often linked together through networks (range from easiest to most complex in order from 1 [easiest] to 5 [most complex])

What Management Information Systems (MIS) Is

-**Management information systems** (**MIS**): comprise development and use of information systems that help organizations achieve their goals and objectives; has 3 key elements (*development and use*, *information systems*, *goals and objectives*)

-Information systems are found in almost every type of: enterprise, social, non profit organization, all levels of government (all businesses = organizations, *not* all organizations = businesses)

Development And Use Of Information Systems: information systems are designed and created by business analysts and systems designers at the request of senior managers or entrepreneurs in order to solve particular problem or meet a perceived need (very important to learn in all aspects of life, throughout your career [regardless of career] you will need new information systems)

-*Active role*: must take an active role in a system's development to have it meet your needs; must also have an active role to play in the *use* of information systems (will also have other important functions [protecting security of system and data, backing up data])

Achieving Business Goals And Objectives: information systems exist to help organizational actors achieve the goals and objectives of that organization
-Organizations frequently acquire and develop information systems for the wrong reasons (make company more modern, joy of exploring technology, because *every other business has one*)
    -also happens when a technology vendor's sales teams (or business article) convinces a business manager they need to upgrade to latest, greatest high-tech gadget/application
-Must look at information systems and technologies only through lens of *organizational need*

MIS In Use: social media = changing the relationship between customers and business; people get connected through social media and so they talk, share, and let friends know what they think about the world
-When social media (IM, blogs, vlogs, podcast, social networking sites) first became popular, many business organizations responded by simply ignoring them
-All of the social media channels help businesses connect with customers and increases size of the network familiar with their products; so it changes the way businesses connect with customers (all businesses now know this)

<u>How An Information System (IS) Differs From An Information Technology (IT)</u>
-**Information technology** (**IT**): methods, inventions, standards, and products; refers to raw technology, and concerns only hardware, software, and data components of an IS and how these are networked together
-IT and IS are two closely related terms (often used interchangeably); except IS includes people, important to know difference (if you include people and the way that they work in how you think about IS, it makes a *big* difference in how you design and implement systems)
    -IT is only useful when it's embedded into an IS (IT alone won't help organization achieve goals); because IS includes people which impacts how a system is designed and implemented (IS makes IT far more useful)
-Successful businesses take advantages of these differences to improve their systems (it's what people/businesses do with IT that make it useful)

<u>Importance Of Information Systems (IS) To Economy</u>
-IS's are an increasingly important part of Canadian economy
-**Information and Communications Technology** (**ICT**) **sector**: provides products and services that other industries (retail, banking) rely on to get their work done (this sector is most closely related to use of IS's in Canada, not well-known sector [is very large and growing though])

-includes companies involved in: software/computer services, cable/program distributors, telecommunication services, ICT manufacturing, ICT wholesaling
-sector also has a high growth rate in Canada (also largest % of R&D in Canada)
-*jobs*: resulted in a lot/increasing number of jobs; gains have occurred mainly in software and computer-services industries (software publishers, data processing)

-Likely will be more jobs in future in *service industries* (industries that supply services that improve business processes); companies that make software are realizing much of revenue is based on services (more than half from services they provide)
-Understanding how to choose and use IT effectively is an increasingly important skill to have
-Need high level of education to be in ICT sector (paid higher than average in Canada); highest paid = in **software and computer services industries** specifically

<u>How Successful Business Professionals Use Information Systems</u>

-Essentially everybody in today's world uses or interacts with a variety of IS's on a daily basis (email, web pages, word processors, word spreadsheets, instant messaging)
-To be effective in today's economy, must know how to do more than basics (everyone knows basics); expand knowledge on important systems (**mobile devices** [applications], **project management software**, **business graphics** [MS Visio], **collaborative systems** [Google Docs])
-Most important task is to understand technologies and businesses well enough that you can identify opportunities for innovation through emerging technology and understand the risks
-Almost all business majors (any specialization) are developing core skills that will continue in high demand throughout Canadian economy (range of skills necessary in each industry)
-Information and Communications Technology Council (ICTC) of Canada: has report laying out 3 major core skills that are in need of individuals = technical skills, specific technology and industry experience, satisfactory communication and other business skills (business skills = core of competitive advantage even in ICT sector)
-*ICT user industries*: all industries other than those companies in ICT sector (companies, organizations, public sector bodies that use ICT in operations)
-ICTC also has 3 major occupations that will have above-average growth rates: manager for computer and IS, IS analysts and consultants (business jobs), user-support technicians
-Business professionals gain competitive advantage by learning technical skills
-Much of innovation organizations do is driven by IT (need skills to take advantage of this trend)
-Example: *Amazon* = innovated through use of the internet, one of the first to sell goods over the internet; began as an online book store (now sells much more)

<u>Shape Of Things To Come</u>

-Are (4) general underlying ideas that continue to affect IT (important for people to know)
-(1) Technology keeps getting easier to use: speech recognition, global positioning system (GPS)

-**moore's law**: density of circuits (number of transistors per square inch) on an integrated chip doubles every 2 years; has proven to be accurate for almost 5 decades
-(2) Network effects and lock-in of certain technologies: value that is received increases significantly as the number of users increases (value for joining facebook increases once there is already a lot of users, more use for you); also makes it harder to switch (QWERTY keyboard might not be best, but number of existing devices and large investment required prohibits adoptions of any new ones proven to be more beneficial)
-(3) General shrinking of device size (tied to *moore's law*): tendency for ubiquity (existing everywhere), people carry cell phones everywhere
-*price/performance ratio*: dramatically fallen over the years; computers are now smaller and cheaper (links to [2] and [3])
-(4) Adoption of location-based services: facilitated by GPS technology and mobile use
-Reason IT is so difficult to predict: IT is all about innovation (which brings unexpected results)
-*Creative destruction*: overturning of established industries (video stores) by new industries (video on demand); ICT sector has enabled this
-For business people, ability to handle (find, process, understand, visualize, than communicate) data is going to be an important skill for decades to come
-Canadian economy is undergoing significant changes because of (past and future) shifts in technology (traditional marketing industry must use internet more and spend more dollars there)
-need to innovate and adapt to changing world
-(**David Ticoll** suggested) within next decade: unlimited storage will almost be free, analytical software will reveal hidden information, and real world and virtual world will collide as wide-area networks (WANs) become cheap, reliable, and widely available (huge changes)
-Example: *The Running Room* (running at the speed of internet) has over 90 stores in North America and it extends services provided by a traditional retail business; information provided in an efficient manner; services not found in store (discussion groups, online purchase, training)
-Example: *Google* (knows best) has millions of people worldwide daily log into Gmail (free web-based mail service launched over 10 years ago); Gmail is supported entirely by advertising and can be considered a success by almost any standard (when an email is sent or received, a fresh column of advertisements appear on right-hand side of screen)

Chapter 2: Business Processes And Decision Making

Pages: Lecture Slides

Business Processes

-Part of our lives every day lives (morning coffee at *tim hortons* [coffee, milk, sugar])

-Interaction of business processes: manufacturing, marketing, selling, purchasing, delivering, ordering, receiving, storing…; *being profitable*
-Businesses processes must work together
-Each business must: *obtain payment*, *cover costs*, and *make profit*
-Business processes are a network of (4) components; all interacting to achieve a business function (*examples* = inventory management, manufacturing, sales and support)

-(1) **activities**: they transform resources and information of one type into another, follow rules and procedures, and they are manual and/or automated (counter sales, purchasing, receiving, accounts payable)
-(2) **resources**: are items of value, and external to the organization (workers, customers, suppliers)
-(3) **facilities**: structures used within business process (inventories, databases, factories, equipment)
-(4) **information**: used by activities (order, sales information, items sold, quantity received, purchase order, shipping invoice)

Data Vs Information: important to understand the difference
-Data: facts or figures that are collected, recorded, stored, and processed; not meaningful on its own
-*Good* **information**: accurate, timely, relevant (to context, to subject), just sufficient, worth cost
-Role of information in business processes: business processes generate information by bringing important items of data together in a context at a higher level (useful for management and strategy decisions)

Business Process Management (BPM): a field of management that promotes the development of effective and efficient processes through continuous improvement and innovation
-3 Methods of BMP: *total quality management* (*TQM*), *six sigma*, *lean production*
-**Automating a process activity**: transfer of work done by people to computers (automation moves work from human side to computer side); people follow *procedures*, computers follow *software* instructions

-*actors* (people, hardware) take on actions, *instructions* (procedures, software) tell what to do, *bridge* (data) is the middle of automation

<u>Information Systems (ISs) And Decision Making</u>
-Data is an important part of any IS; *data is transformed into information*

-*information*: important starting point for decision making
-IS support decision: providing the information (the raw material) to make decisions

Decision Making: is varied and complex, and many levels and processes of it

-In decision making, there are (3) decision levels

-(1) **operational decisions**: day-to-day activities (coffee to purchase, invoices to pay)

-*transaction processing system* (*TPS*): an IS that collects, stores, modifies, and retrieves transactions

-*timeframe*: days to weeks (days - weeks)

-(2) **managerial decisions**: allocation and utilization of resources (budget for computer hardware, number of people to assign for project)

-*management information system* (*MIS*): an IS that is support of management decision making (this is a narrower definition)

-*timeframe*: days to week to months (days - months)

-(3) **strategic decisions**: broader-scope, organizational issues (deciding to start new product line or not, or if a new warehouse should be built)

-*executive information system* (*EIS*): an IS, more specifically a MIS for senior executives; it provides easy access to information, it supports decision making processes, and provides access to internal and external information

-*timeframe*: days to week to months to years (days - years)

-In decision making, there are (2) decision processes; terms refer to decision making process, **not** to the subject (forecasting weather = structured decision, whether = **unstructured** subject)

-(1) **structured decisions**: understood and accepted decisions; occurs when applying knowledge to make an informed decision (formula for computer recording quantity, standard method for allocating furniture)

-(2) **unstructured decisions**: no agreed-on decision-making method; occurs when not standardized (predicting future direction of company, assessing employee's performance)

-(3) *Relationships* between decision levels, decision processes, and IS type

-(1) *operational decisions* are usually *structured* with *automated systems* (TPS)

-(2) *managerial decisions* can be *structured* or *unstructured* (can be both) with *automated systems* or *augmented* (*manual*) *systems* (can be both) (MIS)

-(3) *strategic decisions* are usually *unstructured* with *augmented* (*manual*) *systems* (EIS)

-There are (5) decision steps: (1) **intelligence gathering** (what is to be decided, what are the criteria, what data is available), (2) *alternatives formulation*, (3) *choice*, (4) *implementation*, (5) *review*

Our Role: we are part of the system as **people**, which is the most important component of the IS

-We must be to use information system, (want high) quality of thinking

-*Our information*: do we weigh more with information, and is it always the same information (given to your employer, given to your friend)

Things To Consider: there are (2) important areas to consider

-(1) **The internet** and **social networking sites**: processes used to evaluate employees, and methods of seeking employment

-impact of social networking on **employment**: reference checks (search engines), staying employed (blogs and stuff), facebook and myspace (looking at personal profile and page, and viewing friends and families pages)

-(2) **ISs** used: competitive advantage in job search, effective tool when used to your advantage

-*Ethics of misdirected information*: should you listen and/or use the information you hear when you overheard a conversation between a real estate agent and someone competing with you to purchase a condo

-should you read an email and/or use the information to your advantage when you receive same information through an email accidentally sent to your inbox

---

Chapter 3: Productivity, Innovation, And Strategy

Pages: 58 - 79

Why We Should About Productivity And Innovation

-*(Labour) productivity*: gross domestic product (GDP) of a country / total paid hours worked by people in country; primary indicator of per capita income in country (important measure)

-measures value Canadian workers generate per hour; to improve the country must be able to innovate and adapt to changing economic conditions (working smarter)

-Canada has not been doing well in increasing its labour productivity (used to be good, has been getting worse and worse)

-Canada must: foster a culture of innovation, open its industries to more competition, and increase amount of machinery and equipment (M&E) in economy (in **ICT sector**)

-raising economy's ICT capital intensity = increasing amount of technology that supports people working

-**Productivity paradox**: how does IT add to **productivity** (how can IT be used to create **business value** is the paradox); issue is over 25 years old

-throughout the paradox, most organizations still invested a lot of money into IT

-mismeasurement: many invisible/intangible benefits with IT

-3 ways value of IT investment can be realized: **productivity** (IT allows company create more and/or better outputs with same inputs), **structure of competition** (corporations compete through software/technical support they offer), **benefits to end customer** (consumers get cheaper goods as a result of IT; consumers benefit a lot)

-Successful organizations need to understand specifically what business value they are seeking and how IT can help secure the value (not just investing in IT because everyone else is [technology for technology's sake strategy = bad])

Business Technology Management, How It's Related To Productivity And Innovation

-ICT industry sector is an important industry for *productivity* and *innovation* because it includes technologies that can enhance individual and organizational productivity across many industries ICT industry sector indirectly supports activities in other industries with tools that make these other industries more productive (reason it's known as *invisible* industry sector)

-Recently, types of skills demanded in ICT industry have broadened; businesses are increasingly looking for people who can drive technological innovation

-Jobs that combine business and technology will be in high demand in future

-**Canadian Coalition For Tomorrow's ICT Skills (CCICT)**: created an industry-led group of Canadian employers, institutions, and industries that could ensure ability of Canadian organizations to hire ICT professionals for 21st century workforce (also designed a set of learning outcomes for new program called **business technology management (BTM)**

-due to this, many universities are developing BTM programs

How Information Systems Improve Productivity

-Productivity for organizations can be increased either through increased efficiency or more effective business processes

-**Increasing efficiency**: business processes can be accomplished either faster or with less resources and/or facilities (or both); do this to work towards using the right amount of everything

-*Doing things right*: increasing and maximizing efficiency (regardless of customer's want/value)

-*Doing the right things*: makes changes so to accommodate for what customer's want (as a result operate relatively inefficiently and are at a cost advantage); more **effective** though

-Sometimes, *doing things right,* and *doing the right things* can be in conflict in a company; successful companies long-term find the balance between the **efficiency** and **effectiveness**

Business Processes And Value Chains: business processes are closely related to value chains

-**Value chain**: network of activities that improve the effectiveness (or value) of a good/service; it's made up of one or more business processes (process goods go to from raw to finished and sold is an example of this; each step in process adds some value [reason it's called a chain])

-value chains have directions: moving upstream/backwards integration (coffee store decides to grown own coffee) and moving downstream/forwards integration (mining company finished own diamonds instead of selling raw stones wholesale)

-**Margin**: difference between price customer is willing to pay and cost company has in moving the goods/services through value chain (more value a company adds = higher price charged)

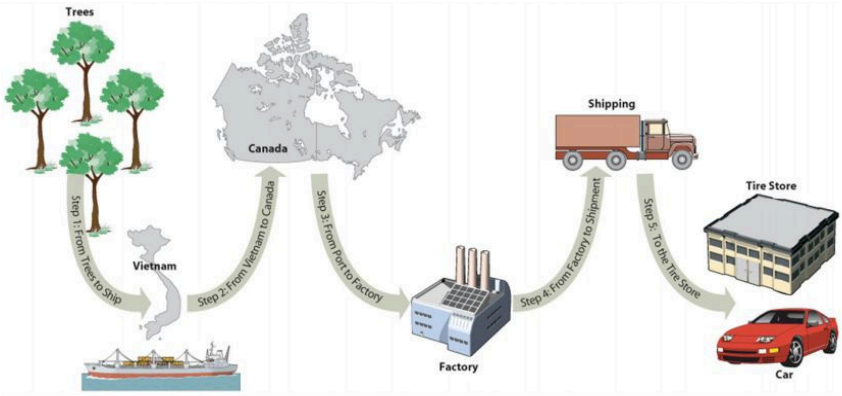
-**Primary activities**: activities in which value is added directly to product (shipping materials)

-**Support activities**: activities that support primary activities; indirect value (workers salaries)

-can make company more efficient, critical to success of organization still

-Enabling development of more efficient or more effective supporting activities can increase productivity (HR systems); increases profit margin for company
-Offering new and improved services (primarily activities that wouldn't be available without IT) can increase productivity as well (customer shopping through web); adds value for customers and can increase company's margin and ability to compete

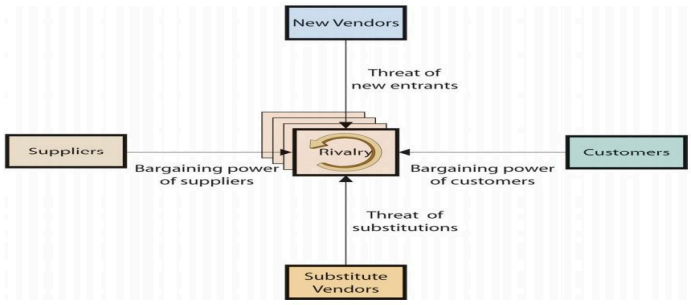
Value Chain



How Organizational Strategy And Industry Structure Are Related

-Company's strategy is influenced by competitive structure of company's industry
-Company's ISs strategy should support or be aligned with overall company strategy
-**Five forces model**: model used to assess an industry's structure (organizational strategy begins with doing this); 5 competitive structures (bargaining power of customer's, threat of substitutes, bargaining power of suppliers, threat of new entrants, rivalry among existing firms) determines characteristics of industry, how profitable is, and how sustainable that profitability will be
-**Competitive strategy**: an organization's response to the structure of the industry (based on examining the five forces)
-**Four competitive strategy model**: firm can engage in any of (4) fundamental competitive strategies = organization can (1) focus on being the cost leader, (2) focus on differentiating its product from those of competition, (3) employ the cost or differentiation strategy across an industry, (4) focus its strategy on a particular industry segment
-To be effective: organization's goals, objectives, culture, and activities must be consistent with strategy; so all IS's in organization must facilitate and be aligned with competitive strategy

Porter's Five Force Model Porter's **Four Competitive Strategy Model**



	Cost	Differentiation
Industry-wide	Lowest cost across the industry	Better product/service across the industry
Focus	Lowest cost within an industry segment	Better product/service within an industry segment

Relationship Between Innovation And Information Technology

-Technology has enabled much of the innovation we see in our economy today (it's around us = telephones, automobiles); changes to industry structure are often through innovation

-**Sustaining technologies**: changes in technology that maintain the rate of improvement in customer value (better tires = improved experiencing of being in car); help make processes more efficient/more effective and create value for organization

-**Disruptive technologies**: introduce a very new package of attributes to accepted mainstream products (MP3 files resulted in end of CDs and tapes to iPods); when companies gain a competitive advantage through disruptive technologies, potential to alter structure of industry is created (companies must react to stay competitive; sometimes it's so large that it leads to new industry [microcomputer industry])

-Rate of innovation in IT has been staggering; IT acts as sustaining technologies (improved size and speed of phone) and disruptive technologies (RBC releasing ATM made other banks also release ATM to respond and stay competitive)

-**Diffusion of innovation** (theory by *Everett Rogers*): process by which an innovation is communicated through certain channels among members of a social system; (5) step process

- -(1) knowledge: people first hear about innovation but don't know details
- -(2) persuasion: people become interested in innovation and find more about it
- -(3) decision: consider pros and cons, and make decision to accept or reject innovation
- -(4) implementation: use it and determine whether to keep using it or find better method
- -(5) confirmation: use innovation to it's full potential
- -companies can drop process at any point (don't necessarily have to through all 5 steps)

How Information Systems (ISs) Provide Competitive Advantage

-Organizational strategy **determines** information systems (IS's)

-**Organizational strategy**: (examine) *industry structure* → (determine) *competitive strategy* → (competitive strategy determines) *value chains* → (determine) *business processes* → (nature of business processes determines structure of) *information system*

-8 principles (3 = through product implementations, 5 = through system implementations) for the response of the organization to the five competitive forces

-Competitive advantage through products implementations: 3 principles relating to this (creating new product/services [expanding product line], enhancing products/services [improve existing], differentiating product/services [unique solutions to customers needs)

-IS can be part of product or can provide support for a product/service; IS that provides instructions = part of product, IS that schedules maintenance = supports product

-Competitive advantage through system implementations: 5 principles relating to this (lock in customers by making it difficult/expensive to switch to another product [**switching costs strategy**], lock in suppliers by making it difficult for them to switch or easy for them to stay and work with, creating entry barriers that make it difficult/expensive for new competitors to enter market, establish alliances with other organizations, reducing costs [increases profitability])

-These all = competitive advantage, which = decreased prices and/or increased profitability, which = greater shareholder value and more cash, which can = greater competitive advantage

Competitive Advantage And Sustainability Through Information Systems (ISs)

-Almost impossible to keep competitors from developing competing technology that provides organization with competitive advantage (patents can provide initial protection [but difficult/expensive to enforce, and not permanent])

-The more ubiquitous (existing everywhere) IT becomes, less competitive advantage IT provides

-Hardware and software have become readily accessible to almost all companies and largely commoditized (these investments aren't source of long-term competitive advantage)

-ISs are different: same IT installed in different organizations might result in different outcomes; organizational procedures and people in organizations aren't standardized (some companies can adapt to new technology quickly, other companies are less willing to do so)

-Long-term competitive advantage lies in how a company and its people adapt to technology (*when it comes to IT, people make all the difference*)

Sustained competitive advantage: comes from developing people and procedures that are well supported by underlying technology; companies new to find a distinctive way to compete (way of competing that will change over time), companies must work to integrate many activities (marketing, customer service, product design, and product delivery)

-when companies successfully integrate many technology systems with its people and procedures, competitors have to match whole system (can purchase stuff right away, people need experience and stuff and this part takes time [uphill climb/battle])

Chapter 4: Hardware And Software

Pages: 102 - 131

Reason We Need To Know About IT

-A true understanding of technology starts from technology we have today and the technology that our technology emerged from
-Knowing basics of modern IT will make you a more knowledgeable consumer of technology and will help you consider how it can be used in business, recognize its positive and negative effects on society, and think about what its future could be
-Understanding and applying IT to everyday life is a fundamental building block for success
-Important to know about: *computer hardware* (components, client and server), *software* (types), *purchasing considerations* (hardware and software), *security* (issues)

Where IT Came From

-History of IT is recent and rich (started in 1940s, has progressed since); still developing new IT in today's society

Early Computers (1939 - 1952): first computer was the **ENIAC** (electronic numerical integrator and computer) which was originally designed to calculate missile firing tables (financed by United States military); large, complex, expensive, and could only run one program at time
-*Computer bug/bug*: term arose from when a moth was caught between mechanical relays at Harvard (1947), removal led to the term *debugging*
-Access to computers was very limited; main availability was for businesses and universities
-Input was also still laborious (punch cards, batch jobs)

Mainframes (1952 - Present): first commercial digital computers, which were large, room-sized devices based on now-obsolete vacuum tube technology (used by businesses/government)
-Second-generation mainframes (late 1950s): used **transistors** (greatest invention of 20th century [smaller, easier to maintain, more reliable]); were often sold without software (assumed companies would build/use own)
    -*transistors* were originally designed to be used in airborne radar
-Third generation mainframes (mid-1960s): included operating systems and multiprocessing capability (big step)
-Mainframes have been mainstay of business computing since early 1960s (some still made today); larger organizations still run on mainframe systems
-Mainframes are designed for fast processing and massive storage

Microcomputers (1975 - Present): microprocessor was developed in early 1970s; incorporated a central processing unit (CPU) and some short-term memory into a single silicon chips using integrated circuits (ICs), microprocessor was small
-CPU contains = arithmetic logic (ALU), program counter
-First **microcomputer** was developed in 1975; early one didn't have a display screen or monitor and required users to develop own programs (were designed for one person to use at a time)

-**intel 8800 microchip** (originally designed for calculators): used to make first home computer in 1975, which obviously started a revolution (led to creation of *Microsoft* in 1975 [creating operating systems and programming languages], *Apple* II in 1977, and IBM PC in 1981 [easy to use and became very popular])

-As hardware developed, companies (Microsoft) created operating systems (QDOS) and programming languages that could be used by some microcomputers (BASIC)
-In 1981, companies launched personal computer (PC); easier to use and became very popular (PC revolution, had = monitor, keyboard, floppy disk, word processors, software)

Networking Personal Computers (1985 - Present): local area network (LAN) technology gave each device a specific address, and so it revolutionized business computing by providing shared access to data, printers, and more (small networks at first, got huge)
-Ethernet was a set of rules/protocols that provided ability to connect many PCs together
-Wide area network (WAN) came next; this made networking become so firmly ensconced and is now taking for granted and something we assume to have

Mobile And Tablet Computing (late 1990s - Present): end of 20th century was an important period for (2) technological reasons
-(1) High cost of early computer technology encouraged computer programmers to save resources by using only last 2 digits of the year (created problem when changing decades) Y2K problem: K is computer term for 1024 but it's commonly incorrectly used to for 1000); this problem significantly raised profile of computer technology
-(2) Dramatic lowering of costs for cellular technology and mobile telephones meant that these technologies become commonplace and adopted by large groups of people
-Microsoft dominated at first, Apple came in with MP3 iPOD and this changed company and they've been huge ever since; technology has shown though that dominance is rarely unchallenged and frequently fleeting (google, samsung, sony = all competing and stuff)

-not clear which companies/which devices will survive overtime (computer, cellular phones, smartphones, tablets)

Cloud Computing (2010 - Present): shared or virtual storage and computing services (amazon); promises flexible, secure, and scalable low fixed cost computing available anywhere (at anytime)
-Rise of internet and websites like amazon brought movement away from privately owned technology towards cloud computing (customers don't usually own the computers)
-Hardware, software, and applications are provided as a service through web browser (similar servers supply applications and data)
-Use provides reduction of cost per MB for storages and network bandwidth, and user only pays for what they use

-**Grid computing**: several computers used to address a single problem at same time (cloud computing builds upon this concept)

3 Main Points From History: *price and performance advances* (IT is always evolving), *small is powerful* (IT is getting smaller and smaller), *network is the thing* (most machines have network)

What A Manager Needs To Know About Computer Hardware

-(4) basic components computer consists of (input, processing, output, storage hardware)

-(1) **Input devices**: one of two most visible/familiar parts of computer (keyboard, touchscreen, scanners, and can be almost anything else [microphones, cameras {in video games}])

-often evaluated and compared on basis of physical dimensions or according to how they will be used (because they can vary so greatly)

-(2) **Processing devices**: including **central processing unit** (**CPU**), called brain of computer (contains machines smarts and main processing unit), CPU selects instructions, processed them, performs comparisons, and stores results of operations in memory (has core and memory chip)

-CPU is measured in **Hertz** (**Hz**) or cycles and counted in *gigahertz* (*GHz*), a measurement that is approximately a billion cycles per second (CPUs can vary in terms of speed, function, and cost, and type needed depends on type of computing)

-investment required to be competitive computer chip designer or fabricator = significant

-**random access memory** (**RAM**): computer's *main memory*, CPU reads data and instructions from RAM (faster, but holds less memory) , disappears when you shut off computer, made of switches of either 0 or 1, holds program currently running

-(3) **Output hardware**: more familiar/visible part of computer; almost have devices have it (video displays, printers, audio speaker), evaluation output hardware depends on type

-(4) **Storage hardware** (**hard drive**): saves data and programs (magnetic disks = most common type, CDs, DVDs [decreasing though]); USB and SSD storage is more expensive but better overall (but can completely fail with no prior indication on occasion)

-**special function devices**: personal computers have these, they can be added to augment each of its components (video cards)

Computer Data: computers represent data using *binary digits* (*bits*)

-**Binary digits** (**bits**): used for computer data because they are easy to represent physically; a bit is either 0 (open switch) or 1 (closed switch), orientation of magnetic field can also represents bits (magnetism in 1 direction = 0, opposite direction = 1), or through optical media (reflection = 1, no reflection = 0)

-**Sizing computer data**: bits are grouped into 8-bit chunks called **bytes** (majority of data requires one byte for one character)

-bytes are also used to measure sizes of non-character data as well; **kilobyte** (**K**) = 1024 bytes, **megabyte** (**MB**) = 1024 K, **gigabyte** (**GB**) = 1024 MB, **terabyte** (**TB**) = 1024 GB

-many people think 1K = 1000 bytes, isn't important really, but good to know as consumer/person it could have 2 potential meanings

How Computer Works: CPU first transfers program or data from storage to main memory, then instructions move from main memory to CPU (via **data channel** or **bus**), computer's main memory contains instructions for **operating system** (**OS**) and pieces of programs (excel; loads it all in sections)
-When user wants to open something else the CPU removes something and places requested program into space (if there isn't enough space, otherwise just opens)
-**Cache**: CPU's small amount of very fast memory; CPU keeps instructions in here

Why Managers Should Care How Computer Works: knowing about memory is important
-**Volatile**: contents are lost when power goes off (cache and main memory)
-**Nonvolatile**: contents survive even when power goes off (USB, CDs and DVDs [optical disks])
-Data may not be removed from hardware if information is deleted; data may still exist even if you've deleted it and can't access it yourself
-Computers can be bought with a number of different configurations (different types, speeds)
-Ability and capacity of particular computer to process given amount of work in set period depends on more factors than speed of processor (direct one-to-one comparisons are hard)

<u>Difference Between A Client And A Server, And What Cloud Computing Is</u>
-**Client** computers: users employ them for word processing, spreadsheets, database access; also have software enabling them to connect to a network
-**Servers**: provide services; servers are used to publish websites (facebook), sell goods, host databases, support printing (often need to be faster, larger, more powerful)
-**server farm**: when server is large collection of computers that coordinate all activities
-**Cloud computing**: in cloud computing, hardware, software, and applications are provided as a service (usually through web browser), save a lot of money through storage costs (google docs = example, store a lot of stuff, no actually space is taken up); no installation or hardware required
-relatively new, a lot of business and technical considerations managers need to be aware of (if cloud providers goes bankrupt, where is data actually stored)

<u>What A Manager Needs To Know About Software</u>
-Generally (some exceptions), computer software can be categorized into 2 varieties (operating systems [large and complicated programs that control computer's resources], application software [programs that perform user's specific tasks]
-2 important software constraints: each version of an operating system is developed for a particular type of hardware (majority of time, can't use operating system designed for one

environment in another), application programs are written to use a particular operating system (safest to assume a particular application runs on just one operating system)

-(4) major operating systems

-(1) **windows**: (microsoft windows) most important operating system for business users, majority of desktops and business users have it, has different versions

-(2) **mac OS**: apple has tightly controlled all aspects of its computer systems, which are only available from apple (average selling price of computer is higher than windows, making them a highly profitable business); easy to use interface

-(3) **unix**: operating system has been workhorse of the scientific and engineering communities (difficult to use); not used by average user, really good though if advanced

-(4) **linux**: version of *unix* that was developed by the **open-source community** (loose group of programmers, mainly volunteer, they own linux); mainly used for (web) servers

-IBM = primary proponent; developed many of business system solutions

-Owning vs licensing: when people *buy* software, they are actually purchasing a **license** to use the program; prevents companies from reselling right to use software that they no longer require

Types/Categories Of Applications And How Organizations Obtain Them: **application software** consists of programs that perform a business function (some are general purpose, some specific)

-(3) different categories of application programs

-(1) **horizontal market application**: software provides capabilities common across many organizations and industries (spreadsheets); applications used in a variety of businesses, are purchased off the shelf, and little customization of features is necessary/possible

-(2) **vertical market application**: software serves needs of a specific industry (used by dental offices); can be altered/customized, usually company that sells application software provides customization services or offers referrals to consultants who do

-includes dual-category software (don't perfectly fit though)

-(3) **one-of-a-kind application**: software is developed for a specific, unique need (CRA); some application software doesn't fit into horizontal/vertical categories

-(3) ways for organizations to buy computer software

-(1) **off the shelf**: quickest and least riskiest option; get software immediately at set cost (might not be a perfect fit though), (horizontal and vertical applications)

-(2) **off the shelf with alterations**: takes more time, cost more, some risk that alteration will result in poor match; usually will be better off, (vertical applications)

-(3) **tailor made**: (**custom-developed software**) describe what you want, be available for multiple tests, and pay more; excellent chance of great match, could still not workout

-this is done when organizations are so unique that no horizontal/vertical application fits needs (difficult and risky though), (one-of-a-kind applications)

-Every application software needs to be adapted to changing needs and technologies, can be very expensive (costs = spread across users of software); for custom software developed in-house, developing company must pay costs (usually last choice due to costs)

Browsers: ongoing debate about whether web browsers are application software or operating software (hard to group everything into 1 of 2 categories); currently though to be part of operating systems (so operating software)

Firmware And Utility Software: **firmware** = computer software that is installed into devices (printers, controllers), coding of the software is installed into read-only-memory (ROM) of the device (so program becomes part of device's memory); **utility software**: type of software that doesn't fit into operating or application software (disk optimization, data recovery)
-**Basic input/output system** (**BIOS**): used when a computer is initially started or booted up, required because all *volatile memory* is lost when computer shuts down
-checks to make sure memory and input devices are functional
-firmware can be changed/upgrades, usually done by IS professionals

Difference Between A Thin Client And Thick Client: some applications don't need any network to run them, but some applications required code on client and server (email, websites)
-**Thick client**: applications that requires other than browser on user's computer; may provide features and functions that compensate for installation or administration of client software
-still available if network goes down
-**Thin client**: application that requires nothing more than a browser; are preferable because they don't need installation or administration of client software
-unable to run software if network goes down

<u>Buying Decisions Managers Need To Make</u>
-Business managers play a role in the specification of client hardware and software for employees whom they manage; large organizations = less work (have IS departements), medium/small organizations = managers take active role (these 2 size organizations standardize on single client operating system because it's too expensive to support multiple)
-Managers have role in specifying horizontal application software/other software appropriate for operating system and and in specifying requirements for vertical market/custom applications
-Manager has no role in specification of server hardware other than maybe budget

Purchasing Decisions: regarding software, need **OS** (included in hardware purchase) and application (license from site, can upgrade for cheaper also)
-Need a lot of hardware: desktop *or* laptop, CPU, main memory, storage (magnetic disks), monitors (video displays)
-*Technology continues to change*: need to be up-to-date (don't ignore technology, go to professional events and get involved), don't always need every little update

What Viruses, Worms, And Zombies Are: serious threats in hardware and software security
-**Virus**: computer program that replicates itself; consumes computer's resources and many take unwanted and harmful actions
-**Payload**: program code that causes unwanted activity; can delete or modify data in undetectable ways; virus publishes data in harmful ways
-**Macro-viruses**: attach themselves to documents; places itself in startup files of application when it is opened, it infects every file that application creates or processes
-**Worm**: virus that propagates using the internet or other computer network; spread faster than other virus types because they're specifically programmed to spread (actively use network to spread), ability to *choke* networks by making them unusual
    -**zombies**: subsequent computers that are infected with worms/viruses (used to send emails, allowing spammers to avoid detection)
    -**botnet**: set of computers and applications that are coordinated through a network and used to perform malicious tasks; a compromised machine is only one of many *botnets*
-**Patches**: program modifications created by vendors once they find security holes viruses are taking advantage of to fix the problem (download patches to avoid viruses and stuff)
-**System vulnerabilities**: weaknesses in system design that can be exploited by knowledgeable people
-**Antivirus program**: every computer should also have this (should use a copy)
-Tips: *never download from unknown sites, follow steps if have virus, don't open unexpected attachments, check vendors regularly*

Chapter 5: Database And Content Management

Pages: 132 - 155

What Content Is
-**Content**: something of value and can be considered an asset, like other items of property (varies by industry)
-**Intellectual property**: form of creative endeavour that can be protected through a trademark, patent, copyright, industrial design, or integrated circuit topography (closely related to *content*)
    -varies by industry
-Organizations have databases that store a lot of content (related to customers, employees, orders) on computers (data, documents, spreadsheets, presentations, web pages, text from blogs and discussion boards, graphics, video files, audio files); before advent of computers, content was only available on physical assets (paper, film, photographs)
-Word-processing documents are apart of everyday work

-*Content management challenge*: processing and storing the right content, and getting the right content to the right person in the right format (presentation) at the right time (stakeholders)
-Managing content is an important challenge for businesses to understand and appreciate (very difficult for individuals and corporations to effectively utilize all the content)
-Website = very important source of content for company's (for customers and employees)

How Content Can Be Organized
-*Database management systems* (DBMSs): central to the management of content data; effectively and efficiently storing and processing data (management of content data)
-*Content management system* (*CMS*): seeking out and organizing documents, and organizing access (presentation of content)

Purpose Of A Database
-Database keeps of track **multiple** things (spreadsheet = single theme [less data], database = multiple themes [email, grades, visits]); database is also much easier to develop and maintain
-Lists that involve single them can be stored in spreadsheet; lists that involve multiple themes require a database

What Database Contains
-Database design: specialized skill that everyone in field of management information systems (MIS) or business who plans to work with corporate data should understand familiar with
-**Database**: self-describing collection of integrated records
-**Byte**: character of data; grouped into **columns/fields** (student number and student name)
    -**columns/fields** are grouped into **rows/records**
-**Table/file**: group of similar rows or records
-*Metadata*: describes the structure of the database (data that describes data)

Relationship Among Records: database = tables/files + relationships among those rows in those tables + special data (metadata)
-*Relationship among rows in tables*: values in one table relate rows of that table to rows in a second table (one has student number and name column, second just has student number column, can still figure out who it is)
-**Key**: column or group of columns that identifies a *unique* (must only be 1) row in table; every table must have a key (student number = key of student table, using number you can determine only one row in student table)
-**Foreign keys**: columns that fulfill a role in the table; such columns are keys, but they are keys of a different (foreign) table from the one in which they reside (student number is column from student table, so it's a foreign key on the other tables)

-**Relational databases**: databases that carry their data in form of tables and that represent relationships using foreign keys (relational because more formal name for table = *relation*)
-all databases these days are relational (had some that weren't in past)
-conceptually simple, easy to understand, relationships aren't predefined, database can evolve as required, relationships are implied in the data

Metadata: *self-describing* (in database definition) = a database contains, within itself, a description of its contents (databases contain normal data and data about the data in the database)
-**Metadata**: are data that describe data (format of metadata depends on software product that is processing the database)
-F*ield name* = name of column, *data type* = type of data column may hold, *description* = notes that explain source or use of column, *field properties* = provides more metadata (these are all metadata, metadata = always part of a database)
-Metadata makes databases easy to use for authorized and unauthorized purposes; just look at metadata to find out what is inside database (nobody needs to guess or remember)

<u>What A DBMS Is And Does</u>
-Database by itself isn't very useful (format = unwieldy)
-**Database application system**: consists of = forms, formatted reports, queries, and application programs; this system makes database data more accessible and useful
-user → database application → DBMS → database

Database management system (**DBMS**): program used to create, process, and administer a database; no companies make DBMSs, they license DBMS products from vendors (*Microsoft* = Access and SQL server, *Oracle*: Oracle, *IBM*: DB2, *Open Source*: MySQL)
-DBMS (software program) and database (collection of tables, relationships, and metadata) = 2 different things

Creating The Database And Its Structures: database developers use the DBMS to create tables, relationships, and other structures in database
-Developer fills out new metadata form to create new table; developer opens metadata form for table and makes desired adjustments (adding new column _____ = add label [___] under field name column) to modify an existing table

Processing The Database: second function of DBMS is to process the database; applications use DBMS for 4 operations (*read, insert, modify,* or *delete* data)
-Applications can call upon DBMS in different ways

Administering Database: third function of DBMS is to provide tools to assist in the administration of the database; involves a lot of activities (setting up security system [passwords, usernames], backing up database data, improving information, removing unwanted data)
-*Database security*: has permissions and authorizations
-**permission**: can be limited in specific ways (only certain users can read specific information); role-based access, user-based access, context-based access
-**authorization**: column access control, row access control, type of access (read/write)

What A Database Application Is

-**Database application**: collection of forms, reports, queries, and application programs that process a database; database may have one or more applications, and those applications may have one or more users (applications all process same inventory data stored in common database)
-Applications have different functions, purposes, and features

Forms, Reports, Queries (standard functions): data entry **forms** are used to read, insert, modify, and delete data; some also compute values as they present the data
-DBMS programs provide comprehensive and robust features for querying database data; DBMS can find any record quickly (search engine kind of)

Database Application Programs: most applications have unique requirements that a simple form, report, or query cannot meet; application programs process logic that is specific to a given business need (application reads breakdown points for grades and then gets marks [bell curve])
-Application programs also enable database processing over the internet; serves as an intermediary between web server and database (reads, inserts, modifies, deletes data)
-Users with browsers connect to web server via internet, web server directs user requests to the appropriate application program, each program then processes the database (as necessary)
Multiuser Processing: multiple users processing the database (common), but creates problems managers should be aware of
-**Lost-update problem**: first persons customer wants to purchase 5 widgets, second person's customer want to purchase 3 widgets (occurring at same time); DBMS shows 10 widgets in inventory for both, both record sale in form, first person's database says there are 5 widgets in inventory, second person's says 7 widgets in inventory (really there is 2)
-some type of locking must be used to coordinate activities of users who are unaware of each other (shows that systems usable by multiple users are very complex)
-logic of underlying application processing needs to be adjusted as well
-Be aware of data conflicts when managing business activities with multi user processing

Difference Between An Enterprise DBMS And A Personal DBMS

-DBMS products fall into (2) broad categories

-(1) **enterprise DBMS products**: process large organizational and workgroup databases; support = a lot of users and database applications, 24/7 operations, and huge disks
-examples: *DB2, SQL Server, Oracle*
-(2) **personal DBMS products**: designed for smaller, simpler database applications for personal or small workgroup applications; less than 100 users (usually less than 15, primarily 1 user), (only 1 remaining personal DBMS product today [a lot more before])
-examples: *Access, dBase, FoxPro, Paradox, R:Base*

Big Data: has (3) characteristics
-(1) **volume**: big data means a lot of dat
-(2) **velocity**: data must be analyzed quickly
-(3) **variety**: big data includes = structured and unstructured data, audio, video, and more
-Big data raises 2 challenges: storage and analysis (one solution = **Hadoop**)
-IBM estimates that 90% of data now stored in computers worldwide didn't exist 2 years ago; collectively we generate new data rate of 2.5 quintillion bytes per day (enough to fill disk drives of 20,000 new PCs weekly)
-much of this data can be of value, but earlier approaches to organizing and analyzing data don't work with big data

---

Chapter 5a: Database Design

Pages: 157 - 172

How Database Application Systems Are Developed

-The database application system development process is a (5) step process
-(1) developers interview users and develop requirements for new system
-(2) requirements for database are summarized in a **data model** (logical representation of both the data and relationships among the data [like a blueprint])
-(3) data model is transformed into a database design
-(4) design is implemented in a database
-(5) database is then filled with user data
-Users have crucial role in success of any database development: must validate and approve the data model (only users know what should be in database); so it must include all the data necessary for users to perform their jobs (ideally that amount, and no more)

Components Of The Entity-Relationship Data Model

-**Entity relationship** (**E-R**) **data model**: with it, developers describe the content of a database by

defining the things (*entities*) that will be stored in database and the *relationships* among these entities (most popular technique for creating a data model)

Entity: something that the user wants to track; some represent physical objects (*salesperson*), some represent a logical construct or transaction (*order*); entities = always singular
-**Attributes**: describe characteristics of the entity (*order number*)
-**Identifier**: an attribute (or group of attributes) whose value is associated with one and only entity instance (*salesperson name* = identifier if each sales staff has unique name)
-Data model needs only to show how users view their world; designers will deal with missing identifiers by adding columns, or hidden identifiers to implement the user's view

Relationships: entities have *relationships* to each other (*advisers* have relationships to *students*; advisers can advise many students and students can have many advisers)
-**E-R diagrams**: database designers use these diagrams to organize data
-all entities of one type are represented by a single rectangle
-a line is used to represent a relationship between 2 entities
-forked lines on a rectangle signify that an entity can have a relationship with multiple of other entity; **crow's foot** = little lines that are shorthanded for the multiple lines between the 2 entities
-**one-to-many (1:N) relationships**: more than one entity is allowed on 1 side of the relationship and only entity is allowed on the other side (when there is *forked lines* on 1 side)
-**many-to-many (N:M) relationships**: more than one entity is allowed on each side of the relationship and that the number of entities on each side can be different (when there is *forked lines* on both sides
-**one-to-one (1:1) relationships**: only one entity is allowed on each side of the relationship so the number of entities on each side is the same (no *forked lines*)
-**crow's-foot diagram** (version of E-R diagram): shows the maximum number of entities that can be involved in a relationship, 1:N, N:M, 1:1 (called relationship's **maximum cardinality**; opposite of this = **minimum cardinality** [another version of E-R diagram], [minimum number of entities required in the relationship])
-third version of E-R diagram: shows both minimum and maximum cardinalities; vertical bar on line = at least one entity of that type is required, small oval = entity is optional (relationship doesn't need an entity of that type)
-Only users can determine which model is good/best in any particular situation (based on needs)

<u>How Data Is Transformed Into A Database Design</u>
-Database design: process of converting a data model into tables, relationships, and data constraints (this is a complicated subject)

Normalization: process of converting poorly structured tables into two or more well-structured tables (many ways a table can be poorly structured)
-**Data integrity problems**: department changes name and only changes it on some of the rows in the table (large tables develop serious data integrity problems)
-table with data integrity problems produces incorrect and inconsistent information; so users lose confidence in information, and system develops a poor reputation
-**Normalizing for data integrity**: data integrity problem can occur only if data are duplicated, so a way to eliminate this problem is to eliminate the duplicated data (only store all datas once)
-normalized tables can slow down the process; most join (single topic/theme tables) again (DBMS product have been programmed to perform it efficiently, still a lot of work)
-good tables only have a single theme (if multiple, divide into single theme tables)
-**normal forms**: classifications according to the kinds of problems they have; transforming table into normal form to remove duplicated data and other problems is called *normalizing* the table
-tables not normalized are subject to data integrity problems

Representing Relationships: (5) step in transforming a data model into a relationship design
-(1) Database designer creates a table for each entity; identifier of the entity becomes the key of the table (each attribute of the entity becomes a column of the table)
-(2) Resulting tables are normalized so that each table has a single theme
-(3) Represent the relationship among those tables (using relational mode, must add a foreign key to one of the [two] tables)
-strategy used on 1:N for placing foreign keys won't work for N:M relationships; instead must create a third table (2 columns, one representing each), each row of table means that entity A connects with entity B with the given number
-If data model is wrong, database design will also be wrong (direct correlation)

<u>What Users Role Is</u>

-Users are final judges of what data the database should contain and how the records in that database should be related to one another (model of how user view their business world)
-Easiest time to changed database structure is during data modelling stage; after this making changing is a lot of work (1:N to N:M = easy before, hard after)
-because: table will have thousands of rows (transforming format of database is hard), and application components will need to be change (other costly consequences as well)
-Data model must accurately reflect business; otherwise database will be designed incorrectly applications will be difficult to use/worthless (must make sure it's accurate)

<u>Who Volunteers</u>

-Hard to determine who will volunteer for anything (volunteers to staff phones during annual drive), want experienced volunteers, that brought in the most donations
-Computer database keeps good track of all this (roster doesn't)
-Consultants create data models based on interview with users
-Then, the data model is reviewed and approved
-Next, database tables are constructed; primary/foreign keys are selected based on interviews
-Finally, Microsoft Access database is created; has relationships indicated and forms and reports constructed (*can use DBMS to help manage a company or business*)
-Worked well this year, overtime though still gonna make several new requirements/changes

---

Chapter 6: Networks And Collaboration

Pages: 192 - 225

Why I Should Care About Networks

-Virtually everything we do has to do with networks (phoning, banking, wireless)
-When connected to internet, you're part of a network of networks comprising millions of computers and devices that allows you to send and receive email, browse web pages stored across globe, download files, and talk to people on phone
-Knowledge will make you more informed user of networks and technology

Networks And Collaboration: **collaboration** occurs when two or more people work together to achieve a common goal, result, or product (results should be greater than sum of results from individuals [if effective]); **communication network** = collection of communication links with ability to route messages among devices attached to the network
-Effectiveness of a collaborative effort is driven by (4) critical factors
- -(1) communication skills and culture: ability to be part of group and give/receive feedback is important (communication = most important skill for employers)
- -(2) **communication systems**: availability of email, virtual private networks, messaging, and other communication systems is critical (all depends on organization's network)
- -(3) content management: keeping track of and synchronizing and integrating various versions of data (documents, schedules) is crucial (to avoid flicts/errors)
  - -content management systems track and report information about data changes
  - -plays key role in enforcing members permission (who can edit, touch, use what)
- -(4) workflow control: a **workflow** is a process/procedure by which content is created, edited, used, and discarded (focuses on *internal* delivery of good/service to other employees); specifies ordering of tasks and includes processes for changes/exceptions
- -*all 4 factors are important, each situation determines hierarchy of factors (importance)*

Network Externalities: in general, larger number of people using a network, more valuable that network becomes; as more and more users join, benefit for newer user's increases (youtube)
-*Critical mass*: point at which value of being part of network is larger than cost of being on it it; growing rate increases nce network hits this point (people are interested in this point)
-*Natural monopoly*: where one network can support all users and switching is hard
-However, as network gains users, congestion can result or market may become saturated or change; growth rate diminishes or flattens or goes negative (important to understand life cycle)

<u>What A Computer Network Is</u>
-**Computer network**: collection of computers that transmit and/or receive electronic signals through transmission media
-**Transmission media**: can be physical media (copper cable) or wireless media (cellular systems)
-(3) major types of networks
    -(1) **local area network** (**LAN**): connects devices within a relatively small, single geographic location (range from 2 - hundreds); *single location though*
        -property controlled by company operating network
    -(2) **wide area network** (**WAN**): connect devices at different geographical locations
    -(3) **internet**: network of networks; connects LANs, WANs, and other internets; **the internet** = collection of networks that we use for emails/websites (most famous)
        -*intranets*: private networks of networks
-**Protocol**: set of rules that communicating devices must follow (to communicate); many different ones (or all types of networks), *layered protocol* is used to provide seamless flow
    -internet: has *protocol*, and uses many different communication *methods* and *conventions*
    -**hypertext transfer protocol** (**HTTP**): transmits files on the WWW (www.___.ca)
        -default protocol if blank, default file name/webpage = index.html
    -*file transfer protocol* (*FTP*): exchanges files over internet (ftp.__.ca)
    -*simple mail transfer protocol* (*SMTP*): sends emails over internet (mailto:__.ca)

<u>Components Of LAN</u>
-**Switch**: special-purpose computer that receives and transmits messages on the LAN (computers connect via switch); some devices more than 1 switch (1 centrally located switch), some just 1
-**Network interface card** (**NIC**): connects the device's circuitry to the network cable (all devices on LAN have this hardware component); works with programs to implement protocols necessary for communication
    -**media access control** (**MAC**) **address**: unique identifier each NIC has
-**Unshielded twisted pair** (**UTP**) **cable**: wires are twisted to reduce signal interference; most connections are made using this

-**Optical fibre cables**: wrapped in protective covers and use special connectors; have increased capacity, resistant to signal interference (fragile though), greater transmission distance, more secure due to having optical pulses rather than electrical signals

-all devices on a LAN are connected using 1 of these 2 *media's/cable types*

The IEEE 802.3, Or Ethernet, Protocol: for a LAN to work, all devices on the LAN must use the same protocol

-The Institute for Electrical and Electronics Engineers (IEEE): sponsors committees that create and publish protocols and other standards (IEEE 802 committee addresses LAN standards)

-**IEEE 802.3 protocol**: most popular protocol for LANS is based on this; **ethernet** (this standard) specifies how messages are to be packages and processed for transmission over LAN

-**Onboard NIC**: most personal computer are equipped with this; it supports **10/100/1000 ethernet**; for communication equipment, k = 1000, M = 1 000 000, G = 1 000 000 000; communication speeds are expressed in *bits* (**not bytes**)

Wireless LAN: computer network that allows users to connect to a network without using a network cable; **wireless NIC** (**WNIC**) lets users stay connected to network without plug in

-**Access points** (**AP**s): wireless LANs require one or more of these that wireless devices connect to; AP connects users to wired network (range = 40m - 100m usually, depends on factors)

-Most wireless LAN's use wifi, which still uses routers that are physically connected to a router (operate by sending and receiving a radio frequency signal to and from the router)

-*Repeaters* and *reflectors*: devices used to amplify and reflect signals to extend range

<u>Why Mobile Computing Is Important</u>

-(2) trends have become well established: (1) computer is more likely to be a portable laptop than a desktop, (2) new smartphone or other highly portable device (tablet) is being used more often, especially when on the go

-**Mobile commerce** (**m-commerce**): new applications that smartphones are enabling, to allow users to conduct new kinds of transactions (mobile coupons as well)

-also provides aspects of collaboration (voting on choices, ask professors questions)

-Advancement allows workers to take computing power with them when they leave the office (office *is* home); smartphones/tablets allow you to access organization's network and all the data and services available on WANs (internet), harder to leave office behind (can work better though)

-Balancing personal and professional lives is increasingly important for business professionals

Smartphone Basics: smartphones are designed to be easy to use so that users don't have to know the intricacies of mobile device networks to get their work done;

-Leaving country may limit usage of phone, speed/bandwidth is important factor (4G is best)

-Two main operating systems (google's android, apple ios); application built for specific operating system won't be compatible for other phones (important thing these days)

eReaders And Tablets: eReaders were originally designed for reading books and magazines, some have expanded to support internet access (still mainly reading)
-Tablets have gone from being used for consumption of information to legitimate enterprise data collection and analytic devices
-Besides support and security issues, (2) other big issues arise; (1) complexity in synchronization (email sent from one working on another), (2) ownership
-**Bring your own device** (**BYOD**) **approach**: employees are encouraged to use own devices for work rather than being provided; adds variety of issues, hard to determine what's for work/leisure

<u>What I Need to Know About Connecting To The Internet</u>
-WAN connects computers located at physically separated sites (internet is a WAN)
-**Router**: special-purpose devices that implement the protocol for WANs
-**Internet service provider** (**ISP**): router normally connects computer to computers owned and operated by your ISP
-(3) important functions: (1) provides computer or router with an internet address (IP address), (2) serves as gateway to internet (information goes from ISP to internet), (3) helps pay for internet (collect money from customers and pay access fees and other charges on consumers behalf)
-**Internet**: communications infrastructure that supports *all* application-layer protocols (http, smtp, ftp)
-**web**: subset of internet and consists of sites and users that process the **hypertext transfer protocol** (**HTTP** = transmits files on WWW**)**; web and internet *aren't* same
-**Browsers**: programs that implement the HTTP protocol

Names And Addresses: are rules for how sites are named on internet
-Top-level domain (TLD): last letters in any domain name (.ca)
-**Uniform resource locator** (**URL**): address on internet that is in a way humans can remember and contains information about *protocol* used to access document and *address* of a document on internet
-*IP address*: a logical address (real address, URL isn't real address) and not a physical address; it's 4 numbers all separated by periods (195.321.124.40), **IPv6** = same but 6 numbers (not 4)
-*http://www.csd.uwo.ca*/**course/CS1/First.html** (*italicized* = not case sensitive, **bold** = case sensitive)

Obtaining An IP Address: (2) kinds of **IP addresses** exist

-(1) Public IP addresses: used on internet, assigned to ISPs and major institutions in blocks; each IP address is unique across all computers on internet
-(2) Private IP addresses: used within private networks and internets; controlled only by organizations that operates the private network or internet
-When you plug computer to a LAN, program in operating system finds a dynamic host configuration protocol (DHCP) server; then computer requests a temporary IP address from the DHCP server (IP address is only loaned to you when you're connected to the LAN)
    -when disconnected, IP made available again (re-assigns IP addresses as needed)
-**Security options**: *wired equivalent privacy* (*WEP*) = security over wireless networks but hard to use in public places, *wi-fi protected access* (*WPA*) = improved version, *WPA2* = newest version

Finding Domain Names: **domain name system** (**DNS**) converts URLs into IP addresses
-*Domain name resolution*: process of converting a domain name into a public IP address; *domain name resolvers* are computers that do this process (used to be humans)
-Home and small-business computers are connected to an ISP by a *DSL line* (a special type of telephone line) or through a cable TV line
-**Modem** (*modulator/demodulator*): converts digital data in computer to an **analog** (wavy) signal before being sent; also converts analog signal to a digital signal before computer can read it
    -digital signals are preferred over analog signals (be reproduced with no distortion/loss)
-**Dial-up modem**: operates on same lines as voice telephones, **does** interfere with telephone signals, converts between analog and digital; dial *ISP* for connection
-**Digital subscriber line** (**DSL**) **modem**: operates on same line as voice telephones, but DSL signals don't interfere with telephone signals (both can happen at same time); uses own protocols
    -always maintain a connection, no need to dial in (faster than dial-up modem)
    -**asymmetric digital subscriber lines** (**ADSL**): DSL lines that have different upload and download speeds
    -**symmetric digital subscriber lines** (**SDSL**): offers same fast speed in both directions
-**Cable modem**: provides high-speed data transmission using cable television lines (*coaxial cable* = connects subscriber to distribution centre); signals don't interfere with TV signals (so they are also always on), also has high-capacity optical fibre cable (connects neighborhood distribution centers), uses own protocols
    -performance varies depending on how many other users are sending/receiving data
-Process: personal computer → modem → switch at telephone or cable company → internet service providers

Wireless WAN (WWAN): covers a large area (larger than wireless LANs), and uses cellular networks to transfer data (usually nationwide for monthly usage fee)
-Signal works just like cell phone (connects to base station via radio waves, radio tower then carries signal, and data is passed on to network and you)

-Can also make voice calls over WWAN

How Email Works

Network Layers: (4) layer **transmission control program/internet protocol** (**TCP/IP**)
-*Username* = person's mailbox, *hostname* = name is host computer followed by domain(s)
-(1) *Network access layer*: getting internet access and pressing *send/receive*; when you get onto a LAN, and a program in your operating system searches the LAN for a DHCP server, then you find the server and obtain an IP address (then press send/receive to start process)
-(2) *Internet layer*: break apart message and get ready for transport; transmission control program (TCP) examines email and breaks apart large messages into *segments*, puts content in order, and makes sure people on different types of computers can view message in proper format
-(3) *Transport layer*: send and receive packets(broken down messages and attachments that are sent); internet protocol (IP) sends all segments of email to a *router* by packaging each segment into a *packet* (adds to/from data), router then uses rules defined in IP to decide where to send each packet; routers bounce packets to another (random) router until it reaches proper destination (all segments could take different paths)
-(4) *Application layer*: reassemble packets and display message; TCP unpacks packets back into segments once they arrive at correct destination, also verifies information is correct (if missing information, TCP resend missing segment), then assembles segments in sequential order
-*Emails come very fast once you consider process*
-**Communication Protocol**: means for coordinating activities between communicating computers (computers agree on protocol to use); broken down into eyes (**protocol** = used for coordinating activities [standardized means])

The Internet = Packet Switching Networks: message is first disassembled into packets, then packets are numbered and sent individually, then message is reassembled at the destination allowing for sharing of communication lines, when entire message is available at the destination host it is delivered to its destination requestor; packets can be routed independently and still find their way to the destination
-Benefits: provides for an efficient and resilient network (fast, reliable, does error correction)
-**Arpanet**: provided access to geographically separate computers (1st packet switching network)
-*Web 1.0*: flat, non interactive information retrieval mechanism
-*Web 2.0*: interactive multi-purpose user content versus user interaction E-commerce

Firewalls, Encryption, VPNs

Firewall: computing device that prevents unauthorized network access; can be a special-purpose computer, a program on a general-purpose computer, or on a router, and it restricts in (3) ways
-always must be aware of **phishing** (attempt to obtain sensitive information [password]) and ransomware (software designed to block asses until money is paid)

-**only** way to have total/absolute security: *no internet and no cell phone*
-(1) **Port**: number that is used to uniquely identify a transaction over a network (port number specifies service provided, like 25 = SMTP, 80 = HTTP); can be used to create firewalls
-(2) **Access control list** (**ACL**): keeps track of which IP addresses are allowed access and which are prohibited (firewall often has this)
-(3) **Packet-filtering firewalls**: examines each part of a message (source and destination address) and determines whether it (acts as filter) should let that part pass (simplest firewall)
-Firewalls can also filter outbound traffic (prohibit employees from viewing specific sites)
-Many ISPs provide firewalls for customers (home routers usually include, third parties sell also)
-Minimum standard to have some form of firewall protection

Encryption: process of transforming clear text into coded, unintelligible text for secure storage or communication (difficult to break); based on encryption keys (number used to encrypt data), used for secure storage or communication (many common encryption algorithms)
-*Decryption (decoding)*: key is applied to coded message to recover original text
-*Asymmetric encryption*: different keys are used to encode and decode
-*Symmetric encryption*: same key is used to encode and decode (simpler, faster, preferred)
-but sender and receiver must both know key and keep secret (can screw each other over if it becomes public), difficult to know who created document
-Most secure communication over internet uses a protocol called *HTTPS*; encrypted using a protocol called *secure socket layer* (*SSL*)/*transport layer security* (*TLS*)
-two parties don't share symmetric key (but uses symmetric encryption); (6) step process
-(1) computer obtains public key of website to which it will connect
-(2) computer generates a key for symmetric encryption
-(3) computer encodes that key using website's public key; sends encrypted symmetric key to the website
-(4) website then decodes symmetric key using its private key
-(5) computer and website communicate using symmetric encryption
-(6) computer and secure site discard keys at end of session
-Most of the time, email and instant messaging (IM) don't use encryption (bad thing)

Virtual Private Network (**VPN**): communications alternative that uses internet or private internet to create what appears to be private point-to-point connections (always very secure)
-First establish an internet connection (LAN), than VPN software on remote user's computer establishes a connection with the VPN server wherever it may be
-**Tunnel**: virtual, private pathway over a public or shared network from VPN client to VPN server (point-to-point connection)
-VPN client *encrypts* original message to ensure security and contents are hidden
-VPN server *decrypts* **coded message**, and sends plain text message to original address on LAN

How A Search Engine Works

-Search engine: tool used to to search for information on the internet (1st = Archie in 1990)
-Web search engines require 2 things: a way to collect URLs and a method for storing/accessing the URLs so that they can be searched
-**Web crawler** (*web spider*): software program that browses web in a very methodical way; starts with list of seed URLs, finds hyperlinks, email addresses (for spam), full text and images
    -*crawl frontier*: make sure links are active and validate HTML code on corporate website
-*Search engine indexing*: organizing information received; done by different programs (provide the ability to make fast searchers from a lot of information)
-If a page is on the web, doesn't mean the page has been indexed by, and is accessible through, search engines (not all pages are)
-When person enters query into search engine, it examines its index, and then provides a listing of web pages that best match the query (search engines all have different process)
-Most search engines are operated by private companies that make money primarily through advertising revenue; might let advertisers pay to put listings higher or have them on side
-*Human networks are still more important than computer networks*

Chapter 7: Competitive Advantage and Business Processes

Pages: Lecture Slides

Competitive Advantages

Information Systems (IS's) Effect On Competitive Advantage: IS's make the primary and support activities **more productive** than those of competitors
-The increased productivity is realized when the business processes become more **effective** and more **efficient**
-True for commercial companies, non-profit organizations and government

Business Functions And Functional Systems

-A reorganized *Porter Value Chain Model* shows the scope and purposes of different types of information systems within the organization

Value Chain Activities: have (2) groups of activities
-(1) **Primary activities**: relate directly to organization's customers and products; (5) primary activities = (1) inbound logistics, (2) operations or manufacturing, (3) outbound logistics, (4) marketing and sales, (5) service and support

-(2) **Support activities**: *primary activities* are facilitated by support activities; (3) support activities = (1) human resources, (2) accounting and infrastructure, (3) procurement **and** technology (technological activities)

Functional Systems: are interrelated in reality (purchasing *influences* inventory, which *influences* production, which *influences* customer satisfaction, which *influences* future sales)
-*Examples of functional systems*: accounting systems, human resource systems, operations systems and manufacturing systems, sales systems
-Decisions that are appropriate for only a **single** business function may be inefficient for an entire business process
-**Functional silos**: systems designed to work independently of one another; with *functional silos*, the manager must query separate functional systems and integrate the data manually
-Cross-departmental systems operate across departmental boundaries
-Transition from functional systems to integrated cross-functional systems is difficult
-Most organizations today have a mixture of functional and integrated systems
-Functional systems are **changing** because although they do provide tremendous benefits, they are limited because they operate in isolation

Integrated Functional Systems: there are (2) integrated functional systems
-(1) **Enterprise application integration** (**EAI**): an approach to combining functional systems, which uses layers of software as a bridge to connect different functional systems together; (5) important points
    -(1) the data stay in the functional system
    -(2) the manager accesses the data through the EAI interface
    -(3) the manager sees a single database
    -(4) the EAI interface send data to the EAI server
    -(5) the functional systems still exist separately and store actual data
-(2) **Enterprise resource planning** (**ERP**): one central database is combined with a set of standard processes built on top of the database to ensure integration between functional area; (5) important points
    -(1) there is a single database
    -(2) the manager access the data through this one database
    -(3) people in the functional areas use ERP to send and receive data directly from the central database
    -(4) no functional system exists
    -(5) they were replaced by the ERP modules

Cross-Functional Systems: designed to overcome problems in functional systems; there are (2) cross-functional systems

-(1) **Enterprise resource management systems** (**ERP**): (4) important points
-(1) *support*: primary business processes, human resources, account support processes
-(2) enterprise-wide, and cross-departmental
-(3) *integrates*: sales, orders, inventory, manufacturing, and customer service activities
-(4) *based on documented, tested business models*: provide software, pre-designed databases, procedures, and job descriptions for organization-wide process integration

-(2) **Customer relationship management systems** (**CRM**): (5) important points
-(1) *organization customer centered*
-(2) *support processes*: attracting, selling, managing, delivering, supporting customer's
-(3) *direct value chain activities involving customer*
-(4) *integrates 4 customer life cycle phases*
-(5) *single repository for customer data*: eliminates inconsistent data, all departments access to all customer information
-there are (3) components of a CRM system: (1) solicitation, (2) lead-tracking, (3) relationship management

Supply Chain: network of organizations and facilities that transforms raw materials into products delivered to customer's
-involves customers, retailers, distributors, manufacturers, suppliers, transportation companies, warehouses, inventories, and some means for transmitting messages and information among the organizations involved

-**Supply chain management** (**SCM**) **systems**: interorganizational systems that enable companies to efficiently handle the flow of good from suppliers to customer's

-*Supplier relationship management* (*SRM*): business process for managing contacts between an organization and suppliers; supplier any organization that sells something to an organization that has a SRM application (*example* = manufacturer supplier to distributor)
-*supports*: in-bound logistics primary activity and the procurement support activity

-(6) Benefits of *information systems* on *supply chain* performance
-(1) reduce costs of buying and selling
-(2) increase supply chain speed
-(3) reduce size and cost of inventories
-(4) improve delivery scheduling (enable JIT)
-(5) fix bullwhip effect
-(6) do not optimize supply chain profitability

Chapter 8: Decision Making And Business Intelligence

Pages: Lecture Slides

Decision Making

Challenges Of Making Decisions: decision making is a daily occurrence for business managers; (3) factors that make business decisions challenging

-(1) *Uncertainty* and *complexity*: of making the business decision

-(2) *Information overload*: faced information overload; 3.3 exabytes (*exabyte* = 10^18 bytes) of data generated in 2010 (expect 30% growth per year [7.24 = 2013, 9.44 = 2014])

-due to the information overload, storage capacity has increased while costs have decreased; basically unlimited storage today, have had exponential growth (both inside and outside of organizations, used to improve decision making)

-**business manager's challenge**: to find appropriate data and incorporate this data into decision making

-*IS*: help and hinder

-(3) *Data quality*: (processed) data from operational systems can be used for *basic reports* (current sales, sales projections)

-raw data is usually **unsuitable** for sophisticated reporting or data mining (dirty data, missing values, inconsistent data, data not integrated, wrong granularity [too fine, not fine enough], too much data [too many attributes, too many data points])

Online Transaction Processing (**OLTP**) **System**: collects data electronically, and process the transactions online

-OLTP system is the backbone of all functional, cross-functional, and interorganizational systems in an organization

-OLTP system supports decision making: it provides raw information about transactions, and provides information about status for an organization

-*Data resource challenge*: while data may be collected in OLTP, the data may not be used to improve decision making

-*data as an* **asset** (a resource from which future economic benefits may be obtained); data needs to be treated as an important resource (depends on how is data valued in an organization, who manages it, and where the data is)

Online Analytic Processing (**OLAP**): focus on making *OLTP*-collected data useful for decision making

-It provides the ability to sum, count, average, and perform other simple arithmetic operations on groups of data

-Report has measures or facts, and dimensions

Business Intelligence (BI)

BI Systems: provide information for improving decision making; (4) different primary systems

-(1) **Reporting systems**: integrate data from multiple sources; they process data (sorting, grouping, summing, averaging, comparing); results are formatted into reports

-*competitive advantage*: improves decisions by providing relevant, accurate, and timely information to the right person/user at the right time

-(2) **Data-mining systems**: process data using statistical techniques (*regression analysis*, *decision tree analysis*); looks for patterns and relationships to anticipate events or predict outcomes (*market-basket analysis*, *predict donations*)

-**data-mining**: application of statistical techniques to find patterns and relationships among data, represents convergence of disciplines, and takes advantage of developments in data management to process enormous databases; (2) data-mining categories

-(1) *unsupervised data mining*: analysis run before model is created; data-mining technique applied and then results are observed, hypotheses is created after analysis to explain results; (1) example

-(1) cluster analysis: technique to identify groups of entities that have similar characteristics

-(2) *supervised data mining*: model developed before analysis; statistical techniques used to estimate parameters; (3) examples

-(1) **regression analysis**: measures impact of a set of variables on another variable

-(2) **neural networks**: predicts values, and make classifications (good prospect customer's, poor prospect customer's)

-(3) **market-basket analysis**: technique for determining sales patterns; creates probabilities that 2 items will be purchased together (computes correlations based on past performances)

-*confidence*: probability of purchasing 2 items

-*lift*: ratio of confidence to the base probability of buying an item

-may need to consider multiple item purchases

-*competitive advantage*: improves decisions by discovering patterns and relationships in data to predict future outcomes

-(3) **Knowledge-management systems**: *a process* = creates values from intellectual capital, and collecting and sharing human knowledge; *supported by* = IS technology, and 5 components of an IS (emphasis on people [knowledge and sharing])

-*competitive advantage*: improves decisions by publishing employee and others knowledge, creates value from existing intellectual capital, fosters innovation, improves customer service, increases organizational responsiveness, and reduces costs

-(4) **Expert systems**: encodes human knowledge (gathered from human experts in the domain), has rule-based systems (**IF/Then**), and improves diagnosis and decision making in non-experts

-*expert system shells*: program that process the rules, process IF side of rules until no value returned, and report values of all variables
-(3) *disadvantages of expert systems*: (1) difficult and expensive to develop (labour intensive, ties up domain experts), (2) difficult to maintain (changes cause unpredictable outcomes), (3) didn't live up to expectations (can't duplicate diagnostic abilities of humans, and constantly needs expensive changes to programs to reflect new knowledge)
-*competitive advantage*: improves decision making by non-experts by encoding, saving, and processing expert knowledge

BI And Competitive Advantage: data mining techniques should be incorporated into complete ISs (competitive advantages of each BI system listed under each above)
-Important to understand difference between the tool and the complete system: *data mining tool* creates equation to compute the probability that a customer will default on a loan; *the system* uses the equation for bankers to approve or reject a loan

RFM (Recency, Frequency, Monetary) Analysis: a way of analyzing and ranking customer's according to their purchasing patterns
-It's a simple technique that considers (3) things: (1) how recently (**R**) a customer has ordered, (2) how frequently (**F**) the customer orders, (3) how much money (**M**) the customer spends per order

Data Warehouse: extracts and cleans data from operational systems, prepares data for BI processing; many components to the data warehouse
-*Data-warehouse database management system* (data-warehouse DBMS): stores data, may also include data from external sources
-metadata concerning data is stored in data-warehouse meta database
-also extracts and provides data to BI tools

Data Mart: data collection, and was created to address particular needs (business function, problem, opportunity)
-It's the smaller than the data warehouse
-Users may not have data management expertise (knowledgeable analysts for specific functions)

Chapter 9: E-Commerce, Social Networking, And Web 2.0

Pages: Lecture Slides

E-Commerce

E-Commerce: buying and selling of goods and services over public and private computer networks (only buying and selling transactions [checking weather on application isn't *e-commerce*, buy buying the application is *e-commerce*]; (2) *e-commerce* categories

-(1) **Merchant companies**: take title to the goods they sell, buy goods and resell them, and sell services that they provide; (3) relationships/types of companies

-(1) **business-to-consumer** (*B2C*): sales between a supplier and the (retail) consumer

-(2) **business-to-business** (*B2B*): sales between companies

-(3) **business-to-government** (*B2G*): sales between companies and governmental organizations

-(2) **Non-merchant companies**: arrange for the purchase and sale of goods without ever owning or taking title to those goods, and sell services provided by others; 3 types of nonmerchant companies (*auctions*, *clearinghouses*, *exchanges*)

(3) *Benefits* Of E-Commerce: (1) lower cost to consumer, (2) higher per unit profit for manufacturer, (3) (maybe) increased sales

Issues With E-Commerce: (6) different issues with e-commerce

-(1) **Channel conflict**: manufacturer sells through 2 methods (*traditional*, *B2B*), retailer discovers they are being *cut out of the loop* (*B2B* = no sales for them), so the retailer retaliates by discontinuing sales of their product to the general public

-*result*: manufacturer loses more sales in the end

-(2) **Price conflict**: manufacturer lowers price by *B2B*, but the retailer doesn't want consumer to know reduced price

-*result*: competition for sales reduces the retailer's ability to compete

-(3) **Logistics expense**: cost of sale per unit may increase if sold one at a time (as opposed to shipping multiple units to a retailer all at once)

-*result*: per unit profit may actually decrease due to increased logistical costs

-(4) **Customer service expense**: *traditional sales* = manufacturer demonstrated how a product works to 1 regional manager, who instructs their sales people, who instruct the consumer; with e-commerce, must do *B2C* = manufacturer must instruct each buyer

-*result*: increase training and/or support costs

-(5) **Showrooming**: consumer goes to physical store to examine the product in person, then the consumer buys the item online

-*result*: store pays sales people, but no direct sale results; so physical store incurs cost without realizing a profit

-(6) **Taxation**: *traditional sales* are taxes on location of sale (purchase in Ontario = pay provincial and federal tax); but different with *B2C sales* (how much to tax, physical goods could be subject to duties, what about software or services)

-*result*: reduced revenue for the government

Social Networking

Social Networking: *process* by which individuals use relationships to communicate with other in a social network

-**Social network**: a structure of individuals and organizations that are related to each other in some way

-There are (3) types of capital

-(1) *physical*: the investment of resources for future profit

-(2) *human*: the investment in human knowledge and skills for future profit

-(3) **social capital**: investment in social relations with the expectation of returns in the marketplace; *social capital* add value in 4 ways (information, influence, social credentials, personal reinforcement)

-How social networks **add value** to business: organizations have *social capital* just as humans do; social capital is measured using (3) = (1) number of relationships, (2) strength of relationships, (3) resources controlled by *friends*

-endorsements by high profile people are a traditional way of increasing social capital

-**progressive** organizations maintain a presence on *facebook*, *linkedin, twitter*, and possible other sites

Web 2.0

Web 2.0: describe applications and platforms on the web

-*Tim Reilly* is noted for helping to establish the concept of *Web 2.0*

-*Examples*: smartphones, user created content, social networking, location and context-based services, and dynamic marketplaces (*google*, *amazon.com*, and *ebay* exemplify *Web 2.0*)

Software As A Service (SAAS): *Web 2.0* companies do not sell software licenses because software is not their product; instead, they provide a software as a service (SAAS)

-Several software items are obtained from a thin-client browser, with the bulk of the processing occurring in the cloud, somewhere on the Internet

-The *Web 2.0* business model relies on advertising or other revenue that results as users employ the SAAS

-Traditional software vendors depend on software licence fees

How Businesses Benefit From *Web 2.0*: *amazon.com, google, ebay,* and other *Web 2.0* companies pioneered *Web 2.0* technology and techniques to their benefit
-Businesses use *Web 2.0* as follows: *advertising*, *mashups*
-Not for all applications: not all business information systems benefit from flexibility and organic growth; there is need for some level of control

No *Web 3.0* Yet: *Web 2.0* is thought to be preceded by *Web 1.0*, and that it will be followed by *Web 3.0*
-It is hard to predict the future as some changes are discontinuous and the invention and use of technology are hard to predict as well
-*Web 2.0* is a broad overarching term
-We can't predict what *Web 3.0* will look like (or even if it will be called *Web 3.0*)
-Nobody knows what the next generation of inventors and entrepreneurs will invent

Management Information System (MIS) In Use: **computing your social capital**; social capital is not an abstract concept that applied only to organizations, it applied to you/us/people as well
-Me and classmates are accumulating social capital right now

Hiding The Truth: nobody is going to publish their ugliest picture on their *facebook* page
-Questions are: how far should people go to create a positive impression, what is your digital footprint, and what does it say about you

---

Chapter 10: IT Projects And Acquiring Information Systems

Pages: Lecture Slides

Acquiring Information Systems (ISs)

-There are (4) basic methods for acquiring software applications: (1) buy it and use it, (2) buy it and customize it (*most common*), (3) rent it or lease it, (4) build it yourself
-Acquiring new software is **not** the same as acquiring new ISs because there is a lot more to think about in *systems* than just *software* (new software must be integrated into existing IS)

Information Technology (IT) Projects

IT Project: a project that consists of a temporary endeavor undertaken to create a unique product, service, or results
-IT projects have a large IT component (in terms of budget or personnel): scope/objective, start and end date, temporary use of resources, unique, accomplish something new
    -hard to estimate time, budget, and scope

Project Management = PMBOK: developed the project management institute; first published in 1996, and most recent publish in 2008
-Defines **project** as: consisting of a temporary endeavour undertaken to create a unique product, service, or result
-Project management institute (PMI) compiled best practices, processes, and techniques
-Has (5) process groups (stages in life of project): (1) initiating, (2) planning, (3) executing, (4) monitoring and controlling, (5) closing
-Has (9) knowledge areas (factors managed throughout life of project): (1) project integration, (2) scope/requirements, (3) time, (4) cost, (5) quality, (6) human resources, (7) communications, (8) risk, (9) procurement

Information Technology Project Management (ITPM): collection of techniques and methods used to plan, coordinate, and complete IT projects; including **planning tools**, budgeting methods, graphical scheduling methods, risk management techniques, communication planning, high-tech team development
-**Planning tools**: **work breakdown structure**, graphical methods (*program evaluation review technique [PERT],* gantt charts [shows tasks, dates, dependencies]), and other planning tools (budgeting methods, risk management, communication planning)
-**work breakdown structure** (**WBS**): hierarchy of tasks required to complete project; each task is broken into smaller tasks that can be managed and estimated
-defines task dependencies, estimates task durations
-may be used with project management software
-**baseline WBS**: final WBS plan
-*Project management professionals*: due to increase important of projects, individuals seek certification in project management; need relevant skills and certifications
-**Information technology project risks**: not easy to graphically represent, lack of a good model; good estimates are difficult to develop because technology continually changes, and so it is difficult to monitor progress
-difficult to: estimate time, budget, scope
-risks to consider: lack of experience, lack of support, lack of participation, unclear project requirements, technical complexity
-*evaluation risks*: process performance (project on time and on budget), product performance (are benefits realized)
-*pathways through model*: forces of evil and forces of good

Systems Development: systems analysis and design; consists of 5 components (hardware, software, data [software and data = computer programming concerned with programs, some data], procedures, and people

-Creation and maintenance of ISs: development of all 5 components; requires more than programming or technical expertise (need = human relation skills, business knowledge, and understanding of group dynamics)
-**Methodologies**: (4) different methodologies; no single process works in all situations = different requirements, some systems wholly automated, others use *augmented system* for gaps
-(1) **systems development life cycle** (**SDLC**): whether systems changes are major or minor, most companies go through a SDLC; (5) phases
-(1) *business-planning process*: determining a system need and planning
-(2) *system definition*: define system goals and scope, assess feasibility, form project team, plan projects
-(3) **requirements analysis** (most important phase): *conduct user interviews* (user must be able to describe what they want and need, and specify requirements for procedures and personnel), evaluate existing systems, determine new forms/reports/queries, identify new application features and functions, consider security, create data model, consider all 5 components
-(4) *component design*: determine hardware specifications, determine software specifications (depends on **source** [off-the-shelf, off-the-shelf with alterations, custom-developed programs]), design the database, design procedures, create job specifications
-4 ways to acquire ISs = buy, buy and customize, rent, build it yourself; first 3 require organizations to match its requirements with the capabilities of the available software application
-(5) *implementation*: build system components, conduct unit test, integrate components, conduct integrates test, convert to new system
-(3) important concepts regarding **systems testing**
-(1) **test plan**: sequences of all actions taken when employing system, include all normal and error conditions; testing, retesting, and retesting = labour intensive
-(2) *product quality assurance (PQA)*: testing specialists
-(3) *beta testing*: future systems users try out new system
-(4) important concepts regarding **systems conversion**
-(1) *pilot*: entire system implemented on a limited portion of the business; if fails, only affects limited boundary (reduced exposure)
-(2) *phased*: new system installed in phases, tested after each phase; continue until installed at entire organization (can't be used thought in tightly integrated systems)
-(3) *parallel*: new system runs in parallel with old system during testing (expensive and time consuming [data must be entered twice]); benefit is the easy fallback system

-(4) *plunge*: direct installation, install new system and discontinue old; there is no backup position, so this should be avoided

-(6) *system maintenance* (problem or need for change): record request for change, prioritize requests (based on *severity* or *business decision)*, fix failures

-**problems** with SDLC: SDLC waterfall (phases aren't supposed to be repeated [often need to though]), difficulty in documenting requirements (spend too much time on it due to all the requirements), scheduling and budget difficulties (multi year projects are difficult to schedule and estimate cost)

-(2) **rapid** (**application**) **development** (**RAD**): characteristics = design/implement/fix development process, iterative development process, continuous user involvement throughout, extensive use of prototypes, joint application design

-(5) phases: (1) requirements (less detailed because users actively involved), (2) design, (3) implementation, (4) conversion, (5) maintenance

-(3) **object-oriented** (**systems**) **development**: technique = *object-oriented programming*

-*object-oriented programming* (*OOP*): designing and writing computer programs, easier and cheaper to fix and adapt, business applications (slower to use this)

-**unified process**: designed for use with *unified modeling language* (*UML*); has (5) phases = (1) inception, (2) elaboration, (3) construction, (4) transition, (5) maintenance

-*UML*: diagramming technique for OOP development

-(4) **extreme programming** (**XP**): extreme iterative development (short development cycle); characteristics = customer centric, just-in-time (JIT) design, paired programming (2 programmers work side-by-side continuously communication [less errors])

Outsourcing: process of hiring another organization to perform services

-Outsource any business activity in value chain

-Vendors can be domestic or international: offshoring = vendor is overseas (tends to be less expensive), gives ability to take advantage of time differences

-*Reasons for outsourcing*: easy way to gain expertise, cost reductions, reduces development risk

-*Risk of outsourcing*: (3) main risks associated with outsourcing

-(1) **loss of control**: vendor is in control, so potential loss of intellectual capital, and vendors priorities may change over time (difficult and expensive to change vendor); company's CIO may be ineffective due to loss of control

-(2) **benefits outweighed by long-term costs**: fixed costs (unit cost forever, removes benefits of economies of scale), vendor's change in pricing strategy (once becomes sole provider), vendor's organizational problems (unfilled goals, poor service)

-(3) **no easy exit**: inflexibility (long contract), locked-in (organization may lack knowledge to bring service back in-house), vendor may be too tightly integrated (may need to invest considerable work and money to change)

-*Outsourcing alternatives*: acquisition and operation of hardware, acquisition of licensed software, outsource entire system, business function outsourcing, or application outsourcing
-**Application service providers** (**APS**): special form of outsourcing; APS agreement (contract with vendor to *rent* applications); vendor maintains the system at its own web location and the client organization accesses the application on the vendor's website, payments (monthly or yearly, based on number of employees or users)

Chapter 11: Structure, Governance, And Ethics

Pages: Lecture Slides

How Information Technology (IT) Department Is Structured/Organized
-Most organizations rely on IT services
-All these services (email systems, accounting applications, desktop computers, and mobile devices) used in an organization require some form of technical support
-The department of people who support this is often referred to as *IT services* or *ISs services*

IT Department Organization: (includes) chief information officer (CIO), technology office, operations, development, outsourcing relations, and data administration
-IT services jobs: IT industries have a wide range of interesting and well-paying jobs; some think industry consists only of programmers and computer technicians who have great technical skills, but the reality is that most jobs that are in the highest demand in the IT industry require a mix of interpersonal and technical skills
    -the industry needs people who can bridge the knowledge gap between computer technicians and business system users
    -for most technical positions, knowledge of business speciality increases marketability
    -high-paying jobs require communication, leadership, and business skills
    -for students, a dual major can be an excellent choice to open up opportunities
-IT architecture: is the basic framework for all the computers, systems, and information management that support organizational services
-Enterprise architect: creates a blueprint of an organization's ISs and the management of these systems (organizational objectives, business processes, databases, information flows, operating systems, applications and software, and supporting technology)
    -no standards yet, typically a complicated document, first step to understanding how IS support business objectives
    -can divide system into (2) dimensions: (1) 6 reasons for communication (what-data, how-function, where-network, who-people, when-time, why-motivation), (2)

stakeholders (planner, owner, designer, builder, implementer, worker); intersection provides view of the **enterprise**

Organizational Strategy And ISs (And IT Planning): industry structure → competitive strategy → value chains → business processes → ISs
-Use *porter's five forces model* to consider the **industry structure** and then develop a **competitive strategy** for the organization; the competitive strategy is supported through activities in **value chain**, which consists of a collection of **business processes** supported by **ISs**
-ISs: support the competitive strategy and help organizations achieve their goals and objectives
-effectively managing ISs is a difficult process: requires a significant amount of IT planning; developing these plans requires an understanding of both organizational and the technology
-misalignment can occur since this is a challenging process

Alignment: process of matching organizational objectives with IT architecture; measured as the degree to which the IT department's missions, objectives, and plans overlapped with the overall business missions, objectives, and plans (**not** a straightforward process)
-Ongoing continuous challenge: fitting IT architecture to business objectives
-Most important indicator of alignment is the successful communication between the business and IT executives

<u>ISs Governance</u>
ISs Governance: ensures organization product *good* results and avoid *bad* results
-Development of consistent management policies and verifiable internal processes
-Establishment of rules applying to sourcing, privacy, security, and internal investments
-Goal: to improve the benefits of an organization's IT investment over time (which in turn increases stakeholder value); reporting structures, review processes, improve quality, reduce service costs and delivery time, reduce IT risks, better support business processes
-Organizational governance associated with *information technology architecture*
-Law: force companies to comply with standards (collecting, reporting, disclosing information); 2 important laws
-(1) *Sarbanes-Oxley Act (SOX) (2002*): revision of *Exchange Act (1934*), governs reporting of publicly held companies; enacted to prevent corporate fraud
-(2) *Budget Measures Act (Bill 198*): similar legislation introduced in Canada, increased level of responsibility and accountability of executive management of publicly held Canadian companies
-both laws: require management to create internal controls (produce reliable financial statements, protect organization's assets) and a issue statement indicating this has been done, also require an organization's external auditor (to issue an opinion on the quality of

controls and management's statements), and expose management and external auditor to **financial and potential criminal liability** if events show internal controls were defective

-computer-based accounting systems used for the production of financial statements (appropriate controls in place to ensure reliability)
-IS production of assets that are subject to liability

Information Systems Audit: examination and verification of a company's information resources that are used to collect, store, process, and retrieve information (including organization's IS policies and procedures)
-Many firms offer IS audit services: *information systems audit and control association* (*ISACA*), *certified information systems auditor* (CISA)
-Control objectives for information and related technology (**COBIT**): framework for best practices designed for IT management; provides board members, managers, auditors, and IT users a set of accepted measures, indicators, processes, and best practices to assist them in getting the best from their organizational IT investments (COBIT 4 = latest edition)

-developed by the ISACA
-cobit framework does (2) things
-(1) allows: management to benchmark the security and control practices for IT control, users of IT services to be assured security and controls exist, and auditors to substantiate their opinions on internal control and advise on IT security and control matters
-(2) addresses issues of control from (3) dimensions
-(1) *business objectives*: conform to criteria in 7 categories (effectiveness, efficiency, confidentiality, integrity, availability, compliance, reliability)
-(2) *IT resources*: people, application systems, technology, facilities, data
-(3) *IT processes*: in 4 domains (planning and organization, acquisition and implementation, delivery and support, monitoring)

Importance Of IS Governance: increased need to report and disclose IS operational information will require employees at all levels of an organization to become more familiar with the issues facing IT management
-Senior business managers are required to make assertions about the controls on IS that will expose them to both financial and criminal penalties

<u>IS Ethics</u>
-IS ethics: concerned with people involved with the system, not hardware or software
-IS ethics is about understanding our own behaviour (thinking and acting that affects others)

Green IT: *green computing* using IT resources to better support the **triple bottom line** for organizations
-**Triple bottom line**: expands traditional financial reports (based solely on financial performance); takes into account ecological and social performance
-(3) *Primary goals*: (1) improve energy efficiency, (2) promote recyclability, (3) reduce the use of materials that are hazardous to the environment
-Green IT considers the effects of choices on: people and environment
-**Energy star program**: international government/industry partnership to produce equipment that meets high-energy efficiency specifications or promotes the use of such equipment
-**E-cycling**: recycling of electronic computing devices

Chapter 12: Managing Information Security and Privacy

Pages: Lecture Slides

Criminal Code Of Canada

Unauthorized Use Of computer 342.1: (1) Every one who, fraudulently and without colour of right, (a) obtains, directly or indirectly, any computer service, (b) by means of an electro-magnetic, acoustic, mechanical or other device, intercepts or causes to be intercepted, directly or indirectly, any function of a computer system, (c) uses or causes to be used, directly or indirectly, a computer system with intent to commit an offence under paragraph (a) or (b) or an offence under section 430 in relation to data or a computer system, or (d) uses, possesses, traffics in or permits another person to have access to a computer password that would enable a person to commit an offence under paragraph (a), (b) or (c) is guilty of an indictable offence and liable to imprisonment for a term not exceeding ten years, or is guilty of an offence punishable on summary conviction
-(2) In this section, there are definitions for each of the words

- **computer password**: any data by which a computer service or computer system is capable of being obtained or used
- **computer program**: data representing instructions or statements that, when executed in a computer system, causes the computer system to perform a function
- **computer service**: data processing and the storage or retrieval of data
- **computer system**: a device that, or a group of interconnected or related devices one or more of which, (a) contains computer programs or other data, and (b) pursuant to computer programs, (i) performs logic and control, and (ii) may perform any other function
- **data**: representations of information or of concepts that are being prepared or have been prepared in a form suitable for use in a computer system

-**electro-magnetic, acoustic, mechanical or other device**: any device or apparatus that is used or is capable of being used to intercept any function of a computer system, but does not include a hearing aid used to correct subnormal hearing of the user to not better than normal hearing
-**function**: logic, control, arithmetic, deletion, storage and retrieval and communication or telecommunication to, from or within a computer system
-**intercept**: listen to or record a function of a computer system, or acquire the substance, meaning or purport thereof
-**traffic**: in respect of a computer password, to sell, export from or import into Canada, distribute or deal with in any other way

Security

Identity Theft: (fastest growing crime) stealing, misrepresenting, or hijacking the identity of another person; usually vital information (name, address) is acquired to complete impersonation
-With this information, identity thief takes over a victim's financial accounts, opens new bank accounts, transfer bank balances, applies for loans, credit cards, and other services
-Understanding threats to your own privacy helps make you more sensitive to the importance of security and privacy for the organization

Security Threats: many important terms to know
-**Malware**: software used to disrupt computer operation, gather sensitive information, or gain access to private computer systems; includes computer viruses, ransomware, worms, trojan horses, keyloggers, *spyware*, *adware*
-**Spyware**: software that aids in gathering information about a person or organization without their knowledge and that may send such information to another entity without the consumer's consent, or that asserts control over a computer without the consumer's knowledge
-most classified into 4 types: system monitors, trojans, *adware*, tracking cookies
-**Adware** (*advertising-supported software*): any software package which automatically renders advertisements in order to generate revenue for its author
-advertisements may be in user interface of software or on a screen presented to the user during the installation process
-functions may be designed to analyze the Internet sites the user visits and to present advertising pertinent to the types of good/services featured there

Sources Of Security Threats: (3) different sources of security threats
-(1) **Human errors and mistakes**: accidental problems, poorly written programs, poorly designed procedures, physical accidents
-(2) **Malicious human activity**: intentional destruction of data, destroying system components, hackers, virus and worm writers, criminal, terrorists

-(3) **Natural events and disasters**: fires, floods, hurricanes, earthquakes, tsunamis, avalanches, tornadoes = initial losses of capability, losses from recovery actions

Unauthorized Data Disclosure: **personal information protection and electronic documents act** (**PIPEDA**) = *personal information* is information about an identifiable individual (not including name, title, business address, telephone number of an employee of an organization)
-Act gives individuals the right to know why an organization collects, uses, or discloses their personal information
-Act requires organizations to identify anyone who is responsible for keeping personal information private and secure

Problems: (4) categories of problems that can occur
-(1) **Unauthorized data disclosure**: (2) types of problems that occur
    -(1) **human error**: posting private information in public place, placing restricted information on searchable web sites, inadvertent disclosure
    -(2) **malicious release**: (4) different types of malicious release
        -(1) *pretexting*: someone pretending to call someone else
        -(2) **phishing**: obtaining unauthorized data using pretexting via email; usually initiated by email request (designed to cause you to click, asks for personal data, may install something), defences = know purchases and deal directly with vendors, implausibility of email, don't be misled by legitimate looking stuff
            -(3) *spoofing*: links connect to a website that is an imitation of the spoofed company's actual website
        -(4) *sniffing*: interception of computer communications; packet sniffers = programs capturing data from information packets as they travel over the internet or company networks (confidential information taken from captured data)
-(2) I**ncorrect data modification**: (2) types of problems that occur
    -(1) **human errors**: incorrect entries and information, procedural problems, system errors, *hacking* (unauthorized access to and use of computer systems [usually by means of a personal computer and a telecommunications network], intent differs [curiosity])
    -(2) **faulty service**: incorrect system operation, usurpation
-(3) **Denial of service** (**DOS**): (2) types of problems that can occur
    -(1) **human errors**: *human errors can occur in the denial of service*
    -(2) **attacks**: force victim's computer to rest or consume its resources such that it can no longer provide its intended service; obstructs the communication media between the intended users and the victim so that they can't communicate adequately anymore

Elements Of A Security Program: (3) elements of a security program
-(1) **Senior management involvement**: must establish a security policy and manage risk (balance costs and benefits)
-(2) **Safeguards**: protections against security threats; need all (3) types of safeguards (effective security required balanced attention to all 5 components [hardware, software, data, procedures, people])

-(1) **technical safeguards**: *identification and authorization* (usernames, passwords, smart cards, biometric authentication, single sign-on), encryption, firewalls, *malware protection*, application design

-*passwords*: effective password satisfies 5 requirements (length, multiple character types, randomness, changed frequently, secret)
-*smart card*: magnetic strip or microchip that contains identification information; can be used with PIN to be more effective (usually size of credit card)
-*biometric authentication*: authenticates with physical characteristics (fingerprints, facial scans, retina scans); early stages of development still
-*single sign-on*: usually multiple levels of authentication (personal computer, LAN, database); systems can provide single authentication
-**malware** (*mal*icious soft*ware*): (5) types of malware

-(1) virus: computer program that replicates itself
-(2) worm: virus that propagates using internet or other computer
-(3) trojan horse: viruses that masquerade as useful programs or files
-(4) spyware: discussed above
-(5) adware: discussed above

-*antivirus and antispyware*: scan your systems frequently automatically, update software definitions (install as they are available)
-*malware safeguards*: never open email attachments from unknown source, install software updates, browse reputable sites

-*application design*: ensure any system developed for your organization includes security as one of its requirements (design for secure applications)

-(2) **data safeguards**: define data policies, data rights and responsibilities, rights enforced by user accounts authenticated by passwords, data encryption, backup and recovery procedures, physical security

-*data administration*: develop organization-wide data policies; specific database function, procedures for multi-user processing, control of changes to database structure, protection of database, establish user data (rights and responsibilities), enforce rights (user accounts and passwords)
-*encryption*: protection for sensitive data, key escrow (safety procedure = trusted party holds encryption key)
-*backup copies*: stored off-premise, check validity, effective recovery procedure

-*physical security*: lock and control access to facility, maintain entry log
-*third party contracts*: safeguards must be part of contract; periodically inspect premises and interview personnel

-(3) **human safeguards**: involves **people** and **procedural** components of IS; user access restriction requires authentication and account management, design appropriate security procedures (security considerations for *employees* and *non-employee personnel*)

-*account administration*: account management procedures (new/modify/remove accounts), password management (change frequently), help-desk policies (don't email password, authentication of users who lost password)

-**system procedures**: normal operation, backup, recovery; procedures of each type should exist for each IS (reduced likelihood of computer crime)

-*non-employee personnel*: temporary personnel and vendors (screen personnel, training and compliance), public users (**harden** web site and facility), partners and public that receive benefits from the IS (protect them from internal company security problems)

-**hardening**: take extraordinary measures to reduce system's vulnerability

-(3) **Incident response**: must plan prior to incidents

Security Monitoring: activity log analysis = *firewall logs* (dropped packets, infiltration attempts, unauthorized access attempts)
-DBMS log-in records: successful and failed access attempts
-Web server logs: documents web activities
-Analysis of logs: threat patterns, successful and unsuccessful attacks, evidence of security vulnerabilities
-Security testing: in-house and external security professionals
-Overall: security system reside in a dynamic environment, new technology = new threats, must monitor situation, and ensure safeguards are in place

Disaster Preparedness: **disaster** = substantial loss of infrastructure caused by acts of nature, crime, or terrorism; best safeguard = location of infrastructure (not prone to natural disasters)
-*Disaster preparedness guidelines*: locate infrastructure in safe location, identify all mission critical systems (applications if lost can cause organization to fail), identify all resources necessary to run those systems (computers, OS, applications, databases…)
-Should create backups for critical resources at remote processing center
-There are (2) types of sites

-(1) **hot site**: remote site run by disaster recovery service
-(2) **cold site**: only space is provided, customer provides everything else that is needed

-Backup facility can be expensive (costs like *insurance* involved); senior management makes decision by balance the risk, benefits, and costs

Incident Response: organization must have a plan = detail reporting and response, centralized reporting of incidents (allows for applications of specialized expertise)
-Speed is of the essence (so preparation pays off): identify critical employees and contact numbers, training is vital; practice incidence response

Computer Crime: there are (3) different types of computer crime
-(1) Crimes committed using computer (ID theft, phishing)
-(2) crimes committed against a computer (viruses)
-(3) Crimes where computer was used to store data that can be used as evidence (emails)
-**Prevention of computer crime**: develop security plan, manage security risk (list assets, determine threats against assets, develop safeguards [may be uneconomic to create safeguards])
-management may accept risk of loss

Laws For Computers: *fourth amendment* (US) and *section 8 of charter of rights and freedoms* (Canada) both provide protection against illegal search and seizure
-Right to free speech: material on web sites protected

Computer Forensics: identification, collection, examination, and preservation of digitally recorded data; aids investigators in determining = what happened, learn how to prevent similar incidents, catch perpetrator and gather evidence for trial
-*Forensics*: use of science to obtain data for use by legal system
-Complicate procedure: easy to damage data during process of computer forensics
-Deleted data not really gone: system de-allocated space on disk, data still resides until over-written, software tools can read de-allocated space
-Data may be hidden in many locations on network (files can be disguised by name and type)
-**Steganography**: messages hidden by encoding them in files, hide in inessential overhead data; programs for finding *steganography* aren't effective

Responded To A Suspected Computer Crime: treat like any other security incident
-Develop incident response plan: address all types of security incidents, developed prior to any attack
-Balance liability against need to know full nature of attack
-Action depends on nature of crime
