Module 1, Chapter 1:

Information system (IS) is a group of components that interact to produce information

- Five fundamental components of computer-based information systems are:
    1. Computer hardware (electronic components and associated gadgetry that constitute a computer system)
    2. Software (programs or applications that run or operate on computer systems)
    3. Data (basic building blocks of information such as facts and observations)
    4. Procedures (instructions or processes that you follow to achieve your desired objective)
    5. People (actors who want to achieve a particular outcome by interacting with the system)

Example: Moodle

Hardware: person computers, tablet, smartphone (physical device used to access the system)

Software: includes the stored set of instructions that run on your access device as well as the specific program that your university has licensed to provide the service

Data: may be stored on specialized computers called servers which can be located almost anywhere in the world (includes student id number, enrollment dates, answers to test questions)

Procedure: steps you follow to achieve your goal (how you log on or access the system, how you submit or save your work

People: Me, IS professionals who built and maintain the site.

Management Information Systems comprise the **development and use** of **information systems** that help organizations achieve their **goals and objectives**

Difference between IT and IS: IS includes people and procedures in the equation. Information technology only includes hardware, software, and data.

Information and Communications Technology (ICT) sector: provides products and services that other industries rely on to get their work done.

- software and computer services
- cable and other program distributors
- telecommunications services
- ICT manufacturing
- ICT wholesaling

Moore's Law: the density of circuits on an integrated chip was doubling approximately every two years or so. (cost of computers has significantly declined over the past 55 years, same amount of money, computer capacity has significantly increased)

Second major characteristic of IT: network effects and lock in

Network effect: the value that is received increases significantly as the number of users increases. (selling the first fax machine, first people on facebook)

Once established, network effects and lock in make it harder to switch.

Example: QWERTY keyboard → used by almost all computers

Module 3, Chapter 3

Productivity, or, labour productivity, is the ratio of the Canadian gross domestic product (GDP) over the total paid hours worked by Canadians

It measures the value that Canadian workers generate per hour

The increasing labour productivity is the best measure of Canada's future growth

Revisiting the Productivity Paradox

In 1989, economist Stephen Roach found no evidence of an increase in worker productivity associated with the massive increase in investment in information technology. This result led the Nobel Prize winning economist, Robert Solow, to make the now famous quote **"We see computers everywhere except in the productivity statistics."** The Productivity Paradox remains with us today

The difficulty in measuring productivity in an increasingly service-based economy has made it challenging to find productivity increases arising from IT. This mismeasurements is, in part due to the often invisible or intangible benefits associate with IT. (ex. You can use a typewriter instead of a computer to complete an essay, no typing time is saved since you are still typing the words)

<u>3 ways to which the value of IT can be realized:</u>

1: Through productivity:

IT allows a company to create more and/or better output from the same inputs and create them faster than before the technology was in place. Ex: small accounting firm→IT might allow you to add more customers, automate basic tasks and provide more up to date information for clients. This investment makes the firm more efficient and potentially more effective.

2. Through the structure of competition:

When one accounting firm invests in IT, it is often the case that other rival firms will follow suit to keep up with competition. Accounting firms now compete on the software they offer and the technical support they can provide. The competitive structure changes because of IT.

3. Through benefits to the end customer:

IT helps make processes more efficient and changes the nature of competition. With increased competition, the reduction of costs associated with new processes is often passed on to the final consumer. The consumer may therefore see cheaper and better goods and services as a result of IT. Ex: competing accounting firms might offer their clients more services and perhaps even lower prices on services after investing in IT. Thus, the consumer, rather than the provider often reaps the benefits of higher investment in IT.

Increasing efficiency means that business processes can be accomplished either more quickly or with fewer resources and facilities (or both).

“doing things right”

Increased effectiveness means that the company considers offering either new or improved goods or services that the customer values

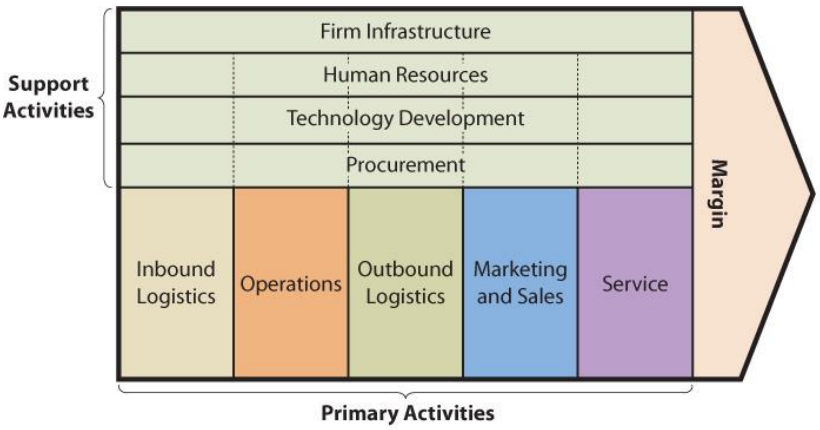
“doing the right things”

Value chain is a network of value-creating activities

Primary activities→ activities in which value is added directly to the product. Ex: shipping raw materials, designing the tires, manufacturing the tires, shipping the finished tires and installing the tires.

Support activities → Support the primary activities. Ex: paying the workers in the factory, maintaining the machines inside the factory, keeping the heat and lights on, scheduling the shipping of the finished tires. Contribute indirectly to production, sale, and service

Add value and costs, Produce margin that is difficult to calculate, Made up of at least one and often many business processes



Margin: Difference between the price the customer is willing to pay and the cost the company incurs in moving the goods or services through the value chain.

Inbound logistics: receiving, storing, and disseminating inputs to the product.

Operations: Transforming inputs into the final product

Outbound logistics: Collecting, storing, and physically distributing the product to buyers

Marketing and Sales: Inducing buyers to purchase the product and providing a means for them to do so.

Service: Assisting a customer's use of the product and thus maintaining and enhancing the product's value.

Porter's five competitive forces (used to assess an industry structure)**:**

- Bargaining power of customers
- Threat of substitution
- Bargaining power of suppliers
- Threat of new entrants
- Rivalry among existing firms

The intensity of each of the five forces determines the characteristics of the industry, how profitable it is, and how sustainable that profitability is.

Example→The soft drink industry

Bargaining power of customer: Customers can switch pretty easily between competing soft drinks

Threat of substitution: customers may turn to substitute such as bottled water or juice, companies must constantly respond to it, partly by expanding their product offerings to include these choices

Bargaining power of suppliers: companies get highly competitive prices for their ingredients.

New entrants to the soft drink industry have a hard time because they are unable to obtain the same kinds of terms from their suppliers and so their costs are higher placing them at a disadvantage.

Competition within the industry: firms very rarely compete on price, instead they spend massive amounts of money on marketing their brand.

Porter's four competitive strategy:

An organization can focus on being the cost leader, or it can focus on differentiating its products from those of the competition. Further the organization can employ the cost or differentiation strategy across an industry or it can focus its strategy on a particular industry segment.

	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

Bower and Christensen suggested:

Sustaining technologies: Changes in technology that maintain the rate of improvement in customer value. Vulcanization of rubber allowed tire manufacturers to produce tires that facilitated the faster and more comfortable rides.

Disruptive technologies: introduce a very new package of attributes to the accepted mainstream products, MP3 replaced CDS.

This theory was defined by Everett Rogers

The process by which an innovation is communicated through certain channels over time among the members of a social system

Stages of diffusion of an innovation are:

- Knowledge (when you first hear about an innovation but lack specific information)
- Persuasion (interested and find out more about it)
- Decision (consider pros and cons and make a decision to adopt it or reject it)
- Implementation (if pursued, use the innovation and figure out if you want to continue using it)

- Confirmation (If happy, then peaceful state of confirmation where you use the innovation to its full potential)

Switching costs: Organizations can retain customers by making it difficult or expensive for them to switch to another product.

Competitive advantage via products:

Organizations gain a competitive advantage by:

- Creating new products or services
- Enhancing existing products or services
- Differentiating their products and services from those of their competitors

Competitive advantage via business process:

Organizations can gain a competitive advantage by implementing business systems

- Locking in customers
  - High switching costs
- Locking in suppliers
  - Making it easy to connect to and work with organization
- Create entry barriers
  - Making it expensive for new competition to enter market
- Establish alliances
  - Establish standards
  - Promote product awareness

- Reducing costs
    - Increased profitability

The Digital Divide

- Someone who knows how to search the Internet can learn more readily than someone who does not
- And every year, the person with greater knowledge pulls farther and farther ahead
- The increasing reliance on the web for information and commerce has created a digital divide between those who have Internet access and those who do not
- This divide continues to deepen as those who are connected pull farther ahead of those who are not

Module 2, Chapter 4

Early Computers: 1939–1952

ENIAC (Electronic Numerical Integrator and Computer) 1946

- large, complex and expensive
- single user
- one program run at a time
- housed at universities
- computer in mobile phone is 1000 times smaller and 1 000 000 times faster

Mainframes: 1952–Present

- First digital computers - large, room-sized devices
- Mainly used by business and government
- 1st generation
    - vacuum tube technology
- 2nd generation
    - transistors
- 3rd generation
    - operating systems
    - multiprocessing

Microcomputers: 1975–Present

- integrated circuits
- small microprocessors
- monitors
- keyboards
- portable floppy disks
- software

Networking Personal Computers: 1985–Present

- Local Area Networks (LANs)
  - linking many personal computers together
  - shared access to data, printers, and other peripheral devices
  - Served relatively small groups of people within small areas
- Wide Area Networks (WANs)
  - the Internet
  - email
  - web browsing
  - access to a worldwide network of computers

Ethernet: Set of rules or protocols that connected devices to communicate and share information. Simple and popular. Gave each device a specific address

Information Technology Principles:

- **Price and performance advances** (Moore's Law)
- **Small is powerful**
- **The Network is the thing** (The value of IT can be measured not only in the power of the processor but also in the power of the network that can be accessed through the machine)

Hardware consists of electronic components and related gadgetry that input, process, output, and store data according to instructions encoded in computer programs or software

Basic hardware categories:

- Input (keyboard, mouse, scanner, upc reader, microphone)
- Processing (CPU, main memory, special function cards)

- Output (video display, printer, speakers, slide projector, plotter)
- Storage (magnetic disk, optical disk, magnetic tape, SSD)

Central Processing Unit (CPU): selects instructions, processes them, performs arithmetic and logical comparisons, and stores results of operations in memory.

Measured in Hertz

Works in conjection with the computer's main memory: **Random Access Memory (RAM)**

The CPU reads data and instructions from the RAM and then stores the results of its computations in the main memory which is often a hard drive.

- Transfers program or data from disk to *main memory*
- Moves instruction from main memory via *data channel* or *bus*
- Has small amount of very fast memory called *cache*
  - Keeps frequently used instructions
  - Large cache makes computer fast, but is expensive

Main Memory

- Contains program instructions
- Contains *operating system (OS)* instructions

Memory Swapping

- Main memory is too small to hold all data
- CPU loads programs into memory in chunks
  - Places new program into unused memory
  - If none available, the operating system will remove chunk being used and replace with requested data

Main memory

- Too little means constant memory swapping
  - Slows processing
  - Needs more memory if processing many programs

Cache and main memory are **volatile**

- Contents lost when power is off

Magnetic and optical disks are **nonvolatile**

- Saved contents survive after power is turned off

Special Function cards: Can be added to the computer to augment each of its compenents. Ex: video cards can be used to support an additional monitor for two or three screens.

Binary digits (bits): either 0 or 1

A **Switch** can be either closed or open

A computer can be designed so that an open switch represents a 0 and closed switched represents 1.

Sizing Computer Data

- Computer data are represented in bits
- Bits grouped in 8-bit chunks
- Specifications for size of memory

K	kilobyte	1024 bytes
MB	megabyte	1024 K
GB	gigabyte	1024 MB
TB	terabyte	1024 GB

Operating system (OS): Program that controls the computer's resources as well as a block of data.

Client computers used for word processing, spreadsheets, database access

- Connect to servers for Web, e-mail, database

Servers provide service (ex: Facebook, Google, Amazon, YouTube)

Used to publish websites, sell goods, host databases, support printing and provide other functions.

Faster, larger, more powerful than client computers

- May or may not have video display
- Cloud computing
- Similar to the concept of servers that supply applications and data

Server Farm: For large commercial sites such as Amazon or Google, the server is actually a large collection of computers that coordinate all activities

Cloud computing (Hotmail or google doc):

- Customers do not own the computers
- Hardware, software, and applications are provided as a service, through a web browser

- The cloud is a metaphor for the Internet, which makes software and data services available from any location at any time
- It builds upon the concept of grid computing

Grid Computing - several computers are used to address a single problem at the same time

Cloud computing is still relatively new- What happens if a cloud provider becomes bankrupt? Where are the data actually stored and who is responsible for ensuring that the information is secure and protected? Companies can choose private or public cloud services.

Computer software can be categorized into of one two varieties: (1) operating systems (large and complicated programs that control the computer's resources and (2) application software (programs that perform specific user task)

Example:

Operating system: Windows, Mac OS, Unix, Linux

Application: Microsoft Word and Oracle Customer Relationship Management

Windows

- Used by 85% of the world's desktops
- 95% of business users
- Microsoft developed
- Many different versions
- Current version is Windows Vista

Mac OS

- Apple Computer, Inc. developed for Macintosh computers
- Easy-to-use interfaces
- Used primarily by graphic artists and art community
- Current version is Mac OS X

Unix

- Developed by Bell Labs
- Workhorse of scientific and engineering community
- Sun Microsystems is a major vendor of computers employing this operating system

Linux

- A version of Unix
- Developed by open-source community (This community is a loosely coupled group of programmers)
- Volunteers - contribute code to develop and maintain Linux
- IBM is a primary proponent

Users buy **license** to use program

- Ownership remains with development company
- Linux owned by open-source community
- No license fee
- Companies make money by offering support

Horizontal-market application software

- Provides capabilities common across all organizations and industries
    - Examples: Word, Excel, PowerPoint, Acrobat, Photoshop, Paint Shop Pro

Vertical-market application software

- Serves the need of a specific industry
- Usually altered or customized
    - Examples: appointment scheduling software, tracking system for mechanics

One-of-a-kind application software

- Designed for a specific, unique need
    - Example: IRS software

Other (dual-category) application software

- Example: CRM software

Acquiring Application software

- Buy off-the-shelf
    - may be a great fit
    - may be a disaster
- Buy off-the-shelf with alterations
- Tailor-made - **custom-developed software**

Firmware: Computer software that is installed into such devices as printers, print servers and various typed of communication devices. Installed into special, read only memory of the printer or other device.

Basic Input/Output System (BIOS): Important piece of firmware.

Used when a computer is initially started or "booted" up. BIOS is required because all volatile memory is lost when the computer is shut down. The first thing the computer does when starting up is to load BIOS from ROM and run through the commands provided by the firmware.

Thin client: An application that requires nothing more than a browser

Thick client: An application such as Microsoft Outlook that requires programs other than a browser on the user's computer.

The terms thin and thick refer to the amount of code that must run on the client computer.

Virus: A computer program that replicates itself. Like computer cancer. Ultimately the virus consumes the computer's resources.

Payload: Program code that causes unwanted activity. Can delete programs or data, or even modify data in undetectable ways.

Macro-viruses: Attach themselves to Word, Excel, and other types of documents. When the infected document is opened, the virus places itself in the start-up files of the application. After that, the virus infects every file that the application creates or processes.

Worm: Virus that propagates using the Internet or other computer network. Spread faster than other virus types because they are specifically programmed to spread.

Zombie computers: Computers that are infected with the worm or virus. Have been used to extensively to send an email. This allows spammers to avoid detection.

Botnet: Set of computers and applications that are coordinated through a network and used to perform malicious tasks.

Measures to prevent viruses:

Viruses take advantage of security holes in computer programs. As vendors find these holes they create program modifications called **patches** to fix the problem.

Use an antivirus program.

Module 6, Chapter 5

Intellectual property: form of creative endeavour that can be protected through a trademark, patent, copyright, industrial design or integrated circuit topography.

Data management: focuses on how to efficiently and effectively store and process these bytes (data).

Database Management Systems (DBMS): The management of many types of data has traditionally been handled through organizational dbms.

Web **Content management systems (CMS):** developed to help companies organize the presentation of content on their website.

Content management challenge: processing and storing the right content and getting the right content to the right person in the right format at the right time

Many professionals use spreadsheets

Spreadsheets: Keep lists of single concepts

Databases: Keep lists that involve multiple themes. Self-describing collection of integrated records.

Byte: character of data

Bytes are grouped into **columns** (also called **fields)**

Columns or fields, in turn, are grouped into **rows** (also called **records**)

A group of similar rows or records is called a **table** (also called a **file**)

A database is a collection of tables **plus** relationships among the rows in those tables **plus** special data called **metadata** (describe the structure of the database)

Metadata: data that describe data, the presence of data much more useful than spreadsheets or data in other lists.

Hierarchy of Data Elements: table/file, records/rows, fields/columns, bytes/characters

Key: a column or group of columns that identifies a unique row in a table. Every table must have a key.

Foreign Key: Such columns are keys but they are keys of a different (foreign) table from the one in which they reside.

Example, student number may be a key in the Student Table, but in the email table, a student number does not identify a unique row since a student can email a teacher more than once. Therefore, it is a foreign key.

Relational databases: Databases that carry their data in the form of tables and that represent s relationships using foreign key

Relation: Formal name for a table

Database Application System: make database data more accessible and useful.

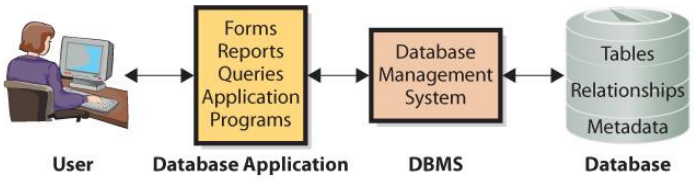


Figure 5-8
Components of a Database Application System

Database management system (DBMS): program used to create, process, and administer a database.

Popular DBMS products are:

DB2 from IBM

Access and SQL Server from Microsoft

Oracle from Oracle Corporation

MySQL an open source DBMS product that is free for most applications.

Difference between database and DBMS:

A DBMS is a software program,

Database: is a collection of tables, relationships, and metadata

Processing the Database

The second function of DBMS is to process the database. Applications use the DBMS for four operations

Read

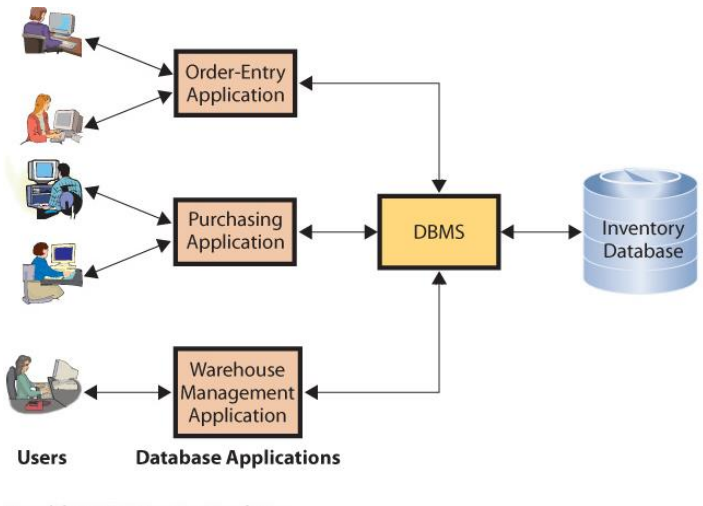
Insert

Modify

Delete

Structured Query Language (SQL): international standard language for processing a database

Database Application: collection of forms, reports, queries, and application programs that process a database.



Forms: Used to read, insert, modify, and delete data

Reports: Show data in structured context, May compute values

Queries: Means of getting answers from database data

Multi-user processing is common

Unique problems

- Lost-update problem
- Locking used to coordinate activities of multiple users
  - creates new set of problems
- Data conflicts produce inaccurate results

Personal DBMS: products are designed for smaller, simpler database applications. Such products are used for personal or small workgroup applications, Supports fewer than 100 users.

Examples: Access, dBase, FoxPro, Paradox, R:Base

Enterprise DBMS: Process large organizational and workgroup databases, Support many users and many database applications,

Examples: DB2, Microsoft's SQL Server, Oracle

Chapter 5A

Data model: logical representation of the structure of the data. Contains a description of both the data and the relationships among the data. Similar to a blueprint.

Most popular technique for creating a data model is the **entity-relationship data model.** Developers describe the content of a database by defining the things (entities) that will be stored in the database and the relationships among those entities.

Less popular tool for data modelling → **Unified Modeling language (UML)**

Entity: Something that users want to track. Examples: Order, Customer, Salesperson, Item.

Some entities represent a physical object such as item or salesperson; others represent a logical construct or transaction such as order or contract.

Entities have **attributes** that describe the characteristics of the entity. Examples: SalespersonName, Email, Phone, and so forth.

Entities have an **identifier** which is an attribute (or group of attributes) whose value is associated with one and only one entity instance. For example, OrderNumber is an identifier of Order because only one order instance has a given value of OrderNumber. For the same reason CustomerNumber is an identifier of Customer.

Entities have relationships to each other. An order for example has a relationship to a Customer entity and to a Salesperson entity.

Entity-relationship diagrams (ERD) all of the entities of one type are represented by a single-rectangle. Additionally, a line is used to represent a relationship between the entities.

Entities have relationships to each other

Maximum cardinalities: maximum number of entities that can be involved in a relationship

1:1 relationship: Single entity to single entity

1:N relationship: One-to-many, Single entity to many entities

N:M: Many-to-many

Rectangles represent entities

Relationships shown by lines

Crow's foot

- Forks at end of lines
- Indicate more than one relationship
- Read "many"

Vertical line means at least one entity of that type is required

Small oval means entity is optional, the relationship need not have an entity of that type.

Minimum cardinalities: minimum number of entities required in the relationship.

Database design is the process of converting a data model into tables, relationships, and data constraints

- Transforms entities into tables
- Expresses relationships
  - defines foreign keys
- Shows data constraints

Normalization is the process of converting poorly structured tables into two or more well-structured tables

Data integrity problem: Different names for the same entity, Produces incorrect and inconsistent information, Resolve by eliminating duplicated data

Normalizing for Data Integrity

- Eliminate data duplication
- Slower to process
- Construct tables such that every table has single topic

Normalizing the table: Transforming a table into a normal form to remove duplicated data and other problems.

Relational Database Design:

- Designer creates table for every entity
- Entity identifier becomes primary key of table
- Attributes of entity become columns
- Tables normalized to single theme
- Represent relationships between tables
- Add foreign key to one or more tables

Module 7, Chapter 6

Networks: allow you to send and receive email, browse web pages stored across the globe, download audio and video files, and even talk to friends using the telephone

Collaboration: occurs when two or more people work together to achieve a common goal, result or product. When collaboration is effective, the results of the group are greater than those that could be produced by any of the individuals working alone.

Effectiveness of a collaborative effort is driven by:

1. Communication skills and culture
2. Communication systems
3. Content management
4. Workflow control

Communication skills and culture: The ability to be a part of a group and to give and receive critical feedback is particularly important for employers.

Communication systems: few collaborative meetings are conducted exclusively face to face. Availability of email, virtual private networks, instant messaging and more sophisticated communications systems is crucial.

Content Management: multiple users are contributing and changing documents, schedules, tasks lists, assignments etc…

One user's work might interfere with another's and keeping track of and integrating the various versions is critically important. Users need to manage content so that conflicts do not occur. Important to know who made what changes, when and why. Content management systems track and report these data.

Workflow control: workflow is a process or procedure by which content is created, edited, used and disposed of.

Workflow delivers a good or service internally to other employees in the organization where a **business process focuses on delivering a good or service externally** to a customer.

Specifies a particular order of tasks and includes processes for handling rejected changes.

Network effect: The larger the number of people using a network, the more vulnerable that network becomes. Example flickr. The first person that joins gets almost no benefit. The second user gets a little more benefit and so on.

Critical mass: the point at which the value of being part of the network is larger than the cost of being on it.

Natural monopoly: A type of network where one can support all users and switching is hard (ex Facebook)

Network: A computer network is a collection of computers that transmit and/or receive electronic signals through transmission media.

Transmission media: might be physical media such as copper cable or optical fiber (glass fiber) cable, or wireless media transmitting light or radio frequencies (including cellular and satellite systems)

3 major types of networks:

Local Area Network (LAN) connects computers within a relatively small, single geographical location. The number of connected computers can range from 2 to several hundred. But ONE SINGLE LOCATION

Wide Area Network (WAN) connects computers at different geographical locations. Uses communication networks from vendors, Licensed by government

The Internet and internets: networks of networks. Internets connects LANs, WANs and other internets. The most famous internet is the Internet, the collection of networks that you use when you send email or access a website. In addition to the Internet, private networks of networks called internets, also exist.

Protocol: Set of rules that two communicating devices follow.

Switch: Special purpose computer that receives and transmits messages on the LAN.

Each device on a LAN (computer, printer) has a hardware component called a **Network Interface Card (NIC)** that connects the device's circuitry to the network cable. The NIC works with programs in each device to implement the protocols necessary for communication. Newer machines have an **onboard NIC** which is a NIC that is built into the computer

Each NIC has a unique identifier, which is called the **MAC (media access control) address.** The computers, printers, switches, and other devices on a LAN are connected using one of two media.

Most connections are made using **unshielded twisted pair (UTP) cable.**

RJ-45 connector is used to connect the UTP cable into NIC devices on the LAN

UTP cable may be replaced by **optical fibre cables**: The signals on such cables are light rays carried inside the glass core of the cable. Uses ST and SC connectors.

The core is surrounded by a **cladding** to contain the light signals and the cladding in turn is wrapped with an outer layer to protect it.

For a LAN to work, all devices must use the same protocol. The **Institute for Electrical and Electronics Engineers (IEEE)** sponsors committees that create and publish protocols and other standards.

The committee that addresses LAN standards is called the IEEE 802 Committee. Thus IEEE LAN protocols always start with the numbers 802.

Ethernet: most popular protocol for LANs is based on **IEEE 802.3 protocol** which is also called **Ethernet**. Specifies hardware characteristics such as which wire carries which signals. Also describes how messages are to be packaged and processed for transmission over the LAN.

10/100/1000 Ethernet: these products conform to the 802.3 specification and allow for transmission at a rate of 10, 100, 1000 Mbps (megabits per second)

For communication equipment, k stands for **1000**, not 1024 as it does for memory

Communication speeds are expressed in **bits** whereas memory sizes are expressed in **bytes**.

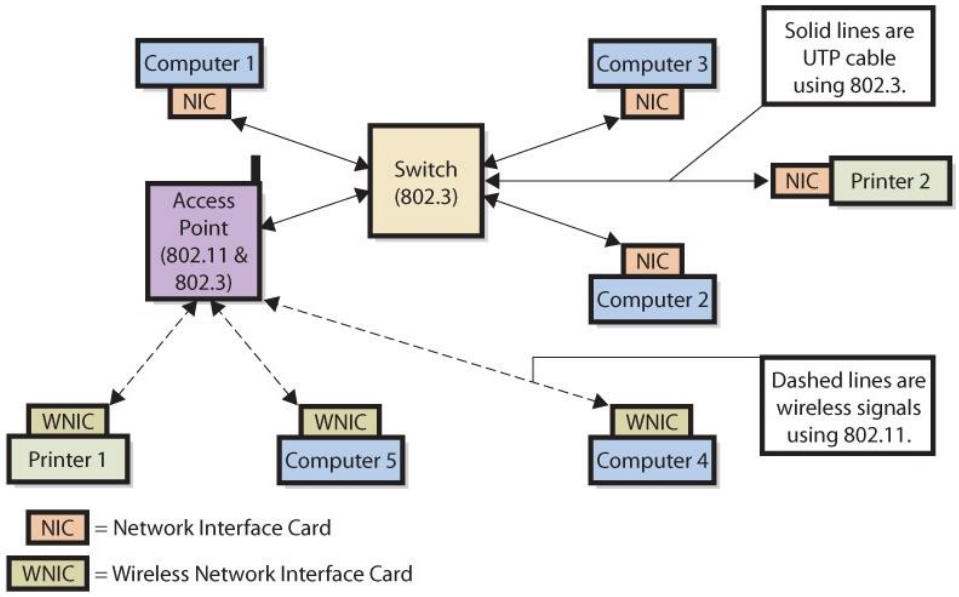
Wireless LAN (802.11 or Wi-Fi): allows users to connect to a network without using a network cable.

Wireless LANs require one or more **access points (APs)** that wireless devices connect to. The AP then connects users to the wired network. The coverage of a wireless access point can range from 4 to 100 meters. Outdoors has a longer range than indoors.

LAN operation

- NICs operate on 802.3 protocol
- WNICs operate on 802.11 protocol (Wi-Fi)
- WNICS connect to Access Point (AP)
    - AP processes both standards

Figure 6-7
Wireless Local Area Network



Devices called **repeaters** and **reflectors** are sometimes used to amplify and reflect signals to extend the range.

M commerce: mobile commerce, allows users to conduct new kinds of transactions. (ex, mobile banking)

3G is a group of standards for wireless communications

The difference between 2G and 3G is that 3G provides higher data transfer rates and allows for simultaneous use of voice and data transfer

Tablets:

Thought as hybrid-type devices that fill a gap between small handheld smartphones and notebook computers

Issues in these devices include support, security (risks when such devices are lost or stolen, **synchronization complexity** (ex: email sent from one device appearing on another) and **ownership** (Bring your own device (BYOD) employees are encouraged to simply use their own devices for work rather than be provided with additional company issued devices. Personal and professional use is further blurred.

The Internet is a WAN.

An important component in any WAN is a **router**.

Router: Special purpose computers that implement the protocol for WANs. The router normally connects your connects your computer to computers owned and operated by your **internet service provider (ISP)**

The ISP has three important functions:

1. Provides your computer with a legit Internet address
2. Serves as a gateway to the Internet, the ISP receives the communications from your router and passes them on to the Internet. The ISP also receives communications from the Internet and passes them back to your router and then on to you.
3. ISPs help pay for the Internet. They collect money from their customers and pay access fees and other charges on your behalf.

The **Web** is a subset of the Internet, consists of sites and users that process the **hypertext transfer protocol (HTTP)**.

Browsers: Programs that implement the HTTP protocol. (Mozilla, Explorer)

The Internet is the communications infrastructure that supports all application-layer protocols, including the HTTP, the **simple mail transfer protocol (SMTP)** and the **file transfer protocol (FTP).** When you send an email you use SMTP. When you **use webpages, you use HTTP**, and when you transfer files between computers on the Internet you use FTP

Top-level domain (TLD) last letters in any domain name (.ca, .com, .org)

Uniform Resource Locator (URL): an address on the Internet that is stated in a way humans can remember. Not the actual address on the internet→ numbered

IP address: Address on the Internet given by four numbers each separated by a period. Logical address

Public IP addresses are used on the Internet

Private IP addresses are used within private networks and internets, they are controlled only by the private company that operates them

DHCP Server: Dynamic Host Configuration Protocol server is a computer or router that host a program called DHCP

- DHCP assigns a temporary IP address to your computer
- When you disconnect, the IP address is available again
- The DHCP server re-assigns it when it is needed

Domain Name System (DNS) converts human-friendly URLs into computer-friendly IP addresses

- Domain name resolution
- Conversion of domain name into a public IP address
- Done by domain name resolvers

Three ways of connecting Home and small-business computers to an ISP:

- through a regular telephone line
- through a special telephone line called a *DSL line*
- through a cable TV line

Those three connections require that the digital data in the computer be converted to an **analog**, or wavy, signal before being sent

When receiving data, the analog signal must be converted to a digital signal before the computer can read it

A device called a modulator/demodulator, or **modem**, performs these conversions

Different modems use different protocols and speeds

Types of Modems

- Dial-up modems
- Digital Subscriber lines (DSLs)
- Cable modems
- All require digital data in the computer to be converted to analog
    - Modem (modulator/demodulator) device performs conversion

Dial-Up Modems: Operate over regular telephone lines, Interfere with voice telephone service, Perform conversion between analog and digital, Connection made by dialing ISP's phone number, Maximum transmission speed of 56 kbps

Digital subscriber line (DSL) modem: operate on the same lines as voice telephones and dial-up modems, Do not interfere with voice telephone service, Faster data transmission than dial-up, connection always maintained

- Download and upload speeds vary
    - Asymmetric Digital Subscriber Lines (ADSL)→different upload and download speeds
    - Symmetrical Digital Subscriber Lines (SDSL)→ same fast speed in both directions

Cable modem: provides high speed data transmission using cable television line.

The cable company installs a fast, high capacity optical fibre cable to a distribution centre in each neighborhood it serves. At the distribution centre, the optical fibre cable connects to regular cable-television cables that run to subscribers' home or businesses.

Narrowband: transmission speeds less than 56kbps.

Broadband: speeds in excess of 256 kbps

Dial up modem provides narrowband access

DSL and Cable provide broadband access.

Wireless WAN: covers a larger area than wireless LANs. WWANS use cellular networks to transfer data.

Since WWANs use existing cellular phone networks, it is possible to make voice calls over a WWAN.

EMAIL:

Network Layers

Transmission Control Program/Internet Protocol (TCP/IP) four-layer scheme

- Layer 1 (Network Access Layer) is used to transmit data within a single network
- Layers 2 (Internet Layer) & 3(Transport Layer) are used for data transmission across an internet
- Layer 4 (Application layer) provides protocols that help different applications interact with each other and the person using the computer

Transmission Control Program (TCP): operates at layer 3. Examine the email you are sending and break apart large messages into pieces called segments.

TCP interacts with protocols that operate at later 2. The layer 2 protocol is the Internet protocol (IP)

IP: Route messages across an internet.

EMAILING STEPS

1. Getting Internet Access and Pressing "Send/Receive"
   - Layer 4, Simple Mail Transfer Protocol (SMTP)
2. Break Apart Message and Get Ready for Transport
   - Layer 3, Transmission Control Program (TCP)
3. Send and Receive Packets
   - Layer 2, Internet Protocol (IP)
4. Reassemble Packets and Display Message

Firewall: Computing device that prevents unauthorized network access

May be special-purpose computer or program

Access Control List (ACL) encodes rules stating what packets are allowed or prohibited

Organizations may have multiple firewalls

- Perimeter firewalls sit outside organizational network (simplest type of firewall)
- Internal firewalls are inside network

- Packet-filtering firewalls examine source address, destination address, and other data before allowing message to pass
- May filter both incoming and outgoing messages

Port: a number used to uniquely identify a transaction over a network. Specifies a service provided. Ports can be used to create firewalls.

Access Control List (ACL): keep track of which IP addresses are to be allowed and which are to be prohibited.

Encryption: the process of transforming clear text into coded, unintelligible text for secure storage or communication.

Key: number used to encrypt data. The encryption algorithm applies the key to the original message to produce the message.

Symmetric encryption: the same key is used to encode and decode, simple, fast, preferred

Asymmetric Encryption: different keys are used. One key to encode the message and one to decode.

Flow of Symmetric Encryption:

1. Your computer obtains the public key of the website to which it will connect
2. Your computer generates a key for symmetric encryption
3. Your computer encodes that key using the website's public key. It sends the encrypted symmetric key to the website
4. The website then decodes the symmetric key using its private key
5. From that point forward, your computer and the website communicate using symmetric encryption

Virtual Private Network (VPN): Uses the Internet or private internet to create appearance of private point-to-point connections

- Uses public Internet to create appearance of private connection
- Client and server have point-to-point connection called a **tunnel**
  - private pathway over shared network
- Secure, encrypted communications

Search engines are a tool used to search for information on the Internet

Web search engines require two things:

- a way to collect URLs
- a method for storing/accessing the URLs so that they can be searched

Web crawlers browse the web to find URLs

Search engine indexing: creates indexes for the results from the web crawling

Search engine needs understanding of breadth of coverage and the ordering of the results from a search

Module 8, Chapter 9

E-commerce: The buying and selling of goods and services over public and private computer networks.

Restricts e-commerce to buying and selling transactions.

Merchant companies: Take title to the goods they sell. They buy and resale goods. Sell services they provide

Nonmerchant companies: arrange for the purchase and sale of goods without every owning or taking title to those goods. Sell services provided by others

E-Commerce Merchant Companies:

Three types of merchant companies:

1. sell directly to consumers
2. sell to companies
3. sell to government

Business to Consumer (B2C): sales between supplier and retail customer

Might use a web based application or **web storefront** by which customers enter and manage their orders.

Business to business (B2B): sales between companies. Raw materials suppliers uses B2B systems to sell to manufacturers. Manufacturers use B2B systems to sell to distributors, and distributors use B2B systems to sell to retailers.

Business to government (B2G): sales between companies and government organization. Suppliers, distributors, and retailers can sell to government.

Nonmerchant E-commerce

Most common are auctions (eBay) and clearinghouses.

E-commerce auctions match buyers and sellers by using an e-commerce version of a standard auction.

Clearinghouses: provide goods and services at a stated price and arrange for the delivery of the goods but they never take the title. (Amazon.ca→sells books owned by others)

Other examples of clearinghouse businesses are **electronic exchange** that match buyers and sellers; the business process is similar to that of a stock exchange. Sellers offer goods at a given price through the electronic exchange, and buyers make offers to purchase over the same exchange. Price matches results

in transactions from which the exchange takes a commission. **Priceline.com** is an example of an electronic exchange used by consumers.

Benefits of E-commerce

Disintermediation: the removal of intermediaries between parties. Higher revenues for manufacturers and lower prices for consumers.

Improves the flow of price information: can go to any number of sites that offer product price comparisons. Enables you to pay the lowest possible price and serves ultimately to remove inefficient vendors. The market as a whole becomes more efficient.

From the seller's side: e-commerce produces **information about price elasticity that has not been available before.**

Price elasticity measures how much demand rises or falls with changes in the price. Company can understand more about various customers' willingness to pay a particular price or what is often called the **shape of the price elasticity curve.**

Issues with E-commerce

- Channel conflict
- Price conflict
- Logistics expense
- Customer service expense
- Showrooming
- Taxation

Showrooming: when a customer learns about or tries a product or service in the high cost bricks and mortar retail store while completing the sales transaction at the low-cost Internet sales channel of another retailer.

A **social network** is a structure of individuals and organizations that are related to each other in some way

Social networking is the process by which individuals use relationships to communicate with others in a social network

Three types of capital:

1. Physical capital → investment of resources for future profit
2. Human capital → investment in human knowledge and skills for future profit.
3. Social capital → investment in social relations with the expectations of returns in the market place. (Linkedin, Facebook, attending a business function)

Social Capital adds value in 4 ways

1. Information
2. Influence
3. Social credentials
4. Personal reinforcement

The importance of weak relationships:

Strong relationships create the most social capital in a social network

Weak relationships contribute the most to the growth of social networks

Weak tie: the people you know the least but they contribute the most to your network

Weak links add the greatest number of new connections to your social network

How do Social Networks add Value to a Business

Organizations have social capital just as humans do

Social capital is measured using: number of relationships, strength of relationships, and 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 possibly other sites

How social networking has been enabled by technology

1. **Improved search capabilities** →enables us to quickly sort through large amounts of data and find the specific people or relationships that we are interested in.
2. **Reduction in the trade-off of richness and reach** → ability to keep track of many more people and enhance personalization
3. **Network effects**→ as a network grows the benefit or utility that each person adds tends to increase.

Web 2.0: first popularized in 2005 by Tim O'Reilly to refer to the integration and interaction of products and services such as smartphones, user created content, social networking, location and context-based services, and dynamic marketplaces.

Web 2.0

- Describe applications and platforms on the web
- Google, Amazon.com, and eBay exemplify Web 2.0
- Web 2.0 applications are thin clients, do not require an installation on users' computers

Software as a service (SAAS):

- Web 2.0 companies do not sell software licenses because software is not their product

- Instead, they provide 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 license fees
- Example: Google, Google Docs, Google Earth

The value of the site increases with users and use

Example: Amazon.com gains more value as more users write more reviews

User-generated content (UGC) refers to website content that is contributed by users

On some sites, users provide customer support to one another in the creation of product specifications, designs, and complete products in a process called ***crowdsourcing***

Businesses use Web 2.0 as follows:

- Advertising
- Mashups

Not for all applications

- Note that not all business information systems benefit from flexibility and organic growth
- There is need for some level of control

Module 9, Chapter 10

Five basic ways to acquire a software application:

1. Buy it and use it as is
2. Buy it and customize it →most common
3. Rent or lease it
4. Build it yourself
5. Outsource it

Projects: begin with a set of goals or objectives. Project managers are given resources, such as people, money, and working space to complete the project. Usually have a start and end date. Projects often represent change in an organization.

IT Projects: have a large IT component. Includes installation a new email application, a CRM system or an enterprise resource planning (ERP) system. IT Projects are never exclusively about technology: They affect data, people, and processes.

Information Technology Project Manager (ITPM): The collection of techniques and methods that project managers use to plan, coordinate, and complete IT projects.

Tools used in ITPM: work breakdown structures, budgeting methods, graphical scheduling methods, grantt charts, risk management techniques.

Project management body of knowledge (PMBOK): suggests there are five process groups in any project:

1. Initiating
2. Planning
3. Executing
4. Controlling and monitoring
5. Closing

IT Operations: The delivery of service, maintenance, protection, and management of IT infrastructure

IT projects: The renewal and adaptation of IT infrastructure is normally accomplished through projects

The distinction between operations and projects is important for several reasons

Operational work and project work tend to attract two different types of IT professionals

IT people who want to work in operations often want to specialize in particular technologies.

Examples: Networking specialists, operating systems specialists, database administrators.

These workers continually seek ways to improve the efficiency and security of the entire set of systems that support operations. These active systems are **production systems.**

Other people in the IT department are responsible for changing the production systems rather than maintaining them. These professionals work on IT projects. Because projects are temporary and often change existing infrastructure, they generally require broad skills and they challenge project team members to learn new technologies.

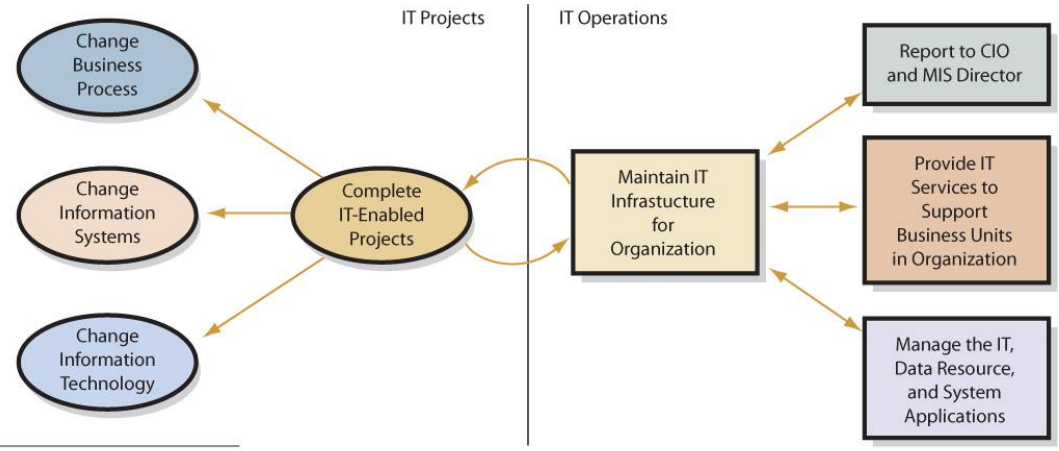


Figure 10-2
What the IT Department Does

Information Technology Infrastructure Library (ITIL): well recognized collection of books that provide a framework of best practice approaches to IT operations. Offers a large set of management procedures that are designed to help businesses achieve value from IT operations.

IT projects are risky because:

- Most IT project definitions are not easy to graphically represent
- Lack of a good model is an important risk to recognize in IT projects
- Good estimates are difficult to develop because the technology is continually changing
- Being able to monitor progress is another challenge for IT projects

Risks not emerged from technology:

- Lack of experience in the team
- Lack of support from top management
- Lack of participation from system users
- Unclear and uncertain project requirements
- A high level of technical complexity, and changes in the project environments

Systems development life cycle (SDLC): classic process used to acquire information systems.

To successfully acquire and maintain information systems, there are basic tasks that need to be performed

These basic tasks are combined into phases of **systems development**

Five phases in the SDLC:

1. **System definition** → management's statement defines new system
2. **Requirement analysis** → identify features and functions
3. **Component design** → based on approved user requirements
4. **Implementation** → implement, test, and install new system
5. **System maintenance** → repair, add new features, maintain.

Phase 1: Defining systems:

Define goals and purpose for new system

- Must facilitate organization's competitive strategy
- Supports business processes
- Improves decision making

Defining project's scope

- Simplifies requirements determination and other subsequent development work

Assess feasibility of project

- Cost, Schedule, Technical, Organizational

Phase 2: Requirement Analysis

- Management of scope in an IT project
- Determine and document specific features and functions of the new system
- Approve requirements
- Less expensive to change system in this phase

Business analysts: tend to focus on the analysis of the current system and procedures and they interact with the stakeholders of the system.

System analysts: tend to be more technically focuses IT professionals, who understand both business and technology.

Phase 3: Component design

Develop and evaluate alternatives

- Accurate requirements critical

Hardware design determined by project team

Software design depends on source

- Off-the-shelf

- Off-the-shelf with alterations
- Custom-developed programs

Data model converted to database design

Procedures designed for BI system

Job descriptions created for users and operations personnel

Phase 4: Implementation:

Tasks: building, testing, converting the users to the new system.

Test plan: consists of sequences of actions that users take when using the new system

Beta Testing: process of allowing future system users to try out the new system on their own. Last stage of testing.

System conversion: process of organization installing the system once it has passed the test.

Organizations can implement a system conversion in one of four ways:

1. Pilot
2. Phased
3. Parallel
4. Plunge

Pilot installation: implements the entire system in a limited portion of the business. The advantage: if the system fails, the failure is contained within a limited boundary. This reduces the business' exposure and also protects the new system from developing a negative reputation throughout the organization.

Phased installation: installed in phases across the organization. Once a given piece is installed, the organization then installs and tests another piece of the system until the entire system has been installed.

Parallel installation: the new system runs in parallel with the old one until the new system is tested and fully operational. Expensive, running 2 programs. Some companies consider the cost of parallel installation to be a form of insurance. Slowest and most expensive type of installation.

Plunge installation: Shuts the old system down and starts the new system. If the new system fails, the organization is in trouble. Nothing can be done until either the new system is fixed or the old system is reinstalled.

Phase 5: Maintenance:

The work done during this phase is either to fix the system so that it works correctly or to adapt it to changes in requirements.

There needs to be a way to track both failures, and requests for enhancements to meet new requirements.

IS personnel prioritize system problems according to their severity.

Software developers group fixes for high priority failures into a patch that can be applied to all copies of a given product.

Group fixes for high priority failures into a **patch** that can be applied to all copies of a given product.

They usually bundle fixes of low priority problems into larger groups called **service packs**.

Problems with SDLC:

Waterfall method: the process is often described as a sequence of nonrepetititve phases.

Difficulty of documenting requirement in a useable wa

Outsourcing: process of hiring another organization to perform a service.

Offshoring: when a vendor is overseas

Benefits of Outsourcing

Outsourcing can be an easy way to gain expertise.

Cost reduction

Reduce development risk

Outsourcing risks

Ensuing loss of control over the project

Outsource vendor may change its pricing strategy over time.

Ending the agreement

Application service providers (ASPs): particular form of outsourcing. In an ASP agreement

ASP agreement: Organization contracts with a vendor to “rent” applications from the vendor company on a fee-for-service basis

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”

Module 10, Chapter 11

Chief Information officer: common title of the principle manager of the IT department. Heads the technology group. Sorts through new ideas and products to identify those that are most relevant to the organization.

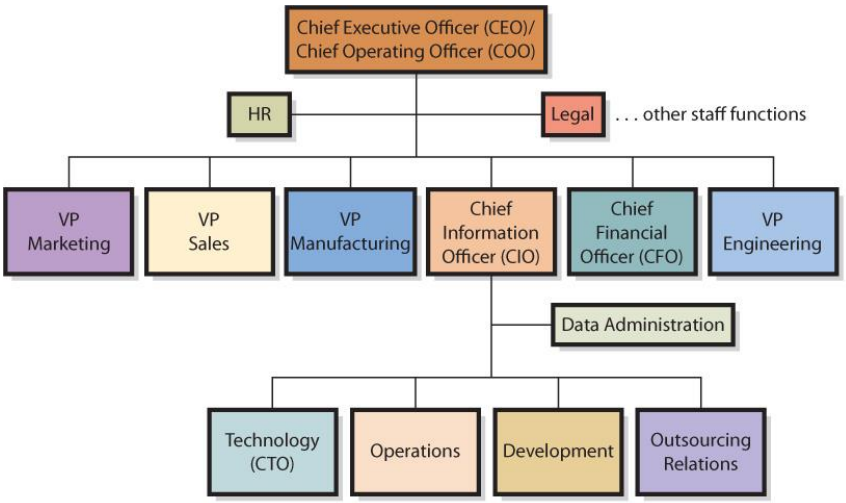


Figure 11-1
Typical Senior-Level Reporting Relationships

This task now belongs to marketing department to keep up with branding and control of content while IT provides technical support for the website

Creating well-designed company web pages requires knowledge of **branding and marketing**

Examples of IT jobs:

Computer technician: install software, repair computer equipment and networks

Programmer/developer: design and write computer programs

Network administrator: Monitor, maintain, fix and tune computer networks.

Salesperson: Sell software, consulting services

Project manager: initiate, plan, manage, monitor and close down projects.

IT architecture is the basic framework for all the computers, systems, and information management that support organizational services (like a city plan) complex

Enterprise architect creates a blueprint of an organization's information systems and the management of these systems

Organizational objectives, business processes, databases, information flows, operating systems, applications and software, and supporting technology

Alignment: The process of matching organizational objectives with IT architecture. Ongoing process

Alignment depends on business goals, the organizational context, and the state of IT architecture in an organization.

Low price retailer competitive strategy (Walmart) maintaining a competitive strategy based on being a low-price retailer meaning maintaining costs that are lower than industry average.

Alignment can help provide competitive advantage for those who are willing to make the investment in developing communication and sharing knowledge.

Alignment is measured as the degree to which the IT department's missions, objectives, and plans overlapped with the overall business missions, objectives, and plans

Communication between business and IT executives is the most important indicator of alignment

Governance: in publicly traded organizations: ensure that an organization is working on behalf of its shareholders to produce good results and avoid bad one.

For business organizations: governance is the development of consistent, cohesive management policies and verifiable internal processes for information technology and related services.

Goal of IS governance is to improve the benefits of an organization's IT investment over time

- Reporting structures
- Review processes
- Improve quality
- Reduce service costs and delivery time
- Reduce IT risks
- Better support business processes

Information systems audit: comparable to a financial audit. Focus is placed on information resources that are used to collect, store, process and retrieve information.

Control Objectives for Information and Related Technology (COBIT) is a framework of best practices designed for IT management

Information systems ethics is about people involved with the system, not hardware or software

IS ethics is about understanding our own behaviour—the way we think and act in situations where our choices affect others

Green IT, or green computing - using IT resources to better support the **triple bottom line** for organizations

The triple bottom line - a concept that expands the notion of traditional financial reports, which are based solely on financial performance, to take into account ecological and social performance

Primary goals to improve energy efficiency, promote recyclability, and reduce the use of materials that are hazardous to the environment

Green IT considers the effects of choices on people and the environment

E-cycling or the recycling of electronic computing devices

Module 11, Chapter 12

Identity theft: vital information such as name, address, date of birth, sin, and mother's maiden name are often all that is needed to facilitate impersonation.

One of the fastest growing crimes in Canada because it is relatively easy to do.

Personal Information Protection and Electronic Documents Act (PIPEDA): intended to balance an individual's right to the privacy of his or her personal information, which organizations need to collect, use and share personal information for business purposes.

PIPEDA suggests that organizations should not be able to use the information collected for any purpose other than what the organization agreed to use it for

PIPEDA suggests that it is the duty of an organization to protect the information they collect

PIPEDA **does not** facilitate individuals suing organizations

The **commission** reviews case and produces a report stating its conclusions

Three sources of security threats are:

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
    - Criminals
    - Terrorists

3. **Natural events and disasters**
    - Fires, floods, hurricanes, earthquakes, tsunamis, avalanches, tornados, and other acts of nature
    - Initial losses of capability and service
    - Plus losses from recovery actions

Five types of security problems are:

1. Unauthorized data disclosure
2. Incorrect data modification
3. Faulty service
4. Denial of service
5. Loss of infrastructure

Unauthorized data disclosure: can occur by human error when someone inadvertently releases data in violation of policy.

Pretexting occurs when someone deceives by pretending to be someone else. A common scam involves a telephone caller who pretends to be from a credit card company and claims to be checking the validity of credit card numbers.

Phishing obtains unauthorized data. Uses pretexting via email. The phisher pretends to be a legit company and sends an email requesting confidential data, such as account numbers, sin , account passwords and so on.

Spoofing another term for someone pretending to be someone else. If you pretend to be your professor you are spoofing your professor. IP spoofing occurs when an intruder uses another site's IP address as if it were that other site.

Email spoofing is a synonym for phishing.

Sniffing: technique for intercepting computer communications. Required a physical connection to the network. With wireless networks no such connection is required.

Drive by sniffers simple take computers with wireless connections through an area and search for unprotected wireless networks. They can monitor and intercept wireless traffic at will. Even protected wireless networks are vulnerable. Spyware and Adware are two other sniffing techniques.

Incorrect data modification

Examples: incorrectly increasing customer's discount or incorrectly modifying an employee salary.

Can occur through human error when employees follow procedures incorrectly or when procedures have been incorrectly designed.

Hacking: occurs when a person gains unauthorized access to a computer system. Purpose of stealing or modifying data.

Faulty Service

Incorrect system operation. Could include incorrect data modification. Could also include systems that work incorrectly by sending the wrong goods to the customer or ordered goods the wrong customer.

Denial of Service

Human error in following procedures or lack of procedures can results in dos. For example: employees can inadvertently shut down a web server or corporate gateway router by starting a computationally intensive application.

Usually launched maliciously.

Loss of Infrastructure

Human accidents can cause loss of infrastructure. Examples: bull dozer cutting fibre-optic cables or the floor polisher crashing into a rack of web servers.

Theft, terrorism.

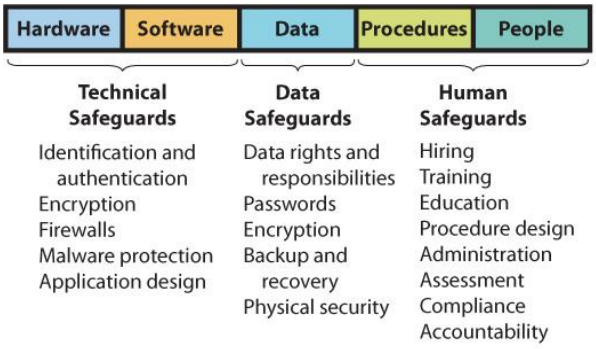
Natural disasters present a large risk for infrastructure loss.

A **security program** has three components: senior management involvement, safeguards of various kinds, incident response.

Senior management involvement must establish a security policy, Manage risk, balancing costs and benefits

Safeguards: Protections against security threats

Incident response: Must plan for prior to incidents



Effective security requires balanced attention to all five components!

Figure 12-2
Security Safeguards as They Relate to the Five Components

Username **identifies** the user

The password **authenticates** that user.

Authentication falls into three methods:

1. What you know (password)
2. What you have (smart card)
3. What you are (biometric)

Smart card: plastic card that is similar to a credit card. Have a microchip rather than a magnetic strip. Microchip holds far more data than a magnetic strip. Loaded with identifying data or algorithms.

Users of smart cards are required to enter a person identification number (pin) to be authenticated.

Biometric authentication: uses personal physical characteristics such as finger prints, facial features, and retinal scans. Provides strong authentication but the required equipment is more expensive.

Technical safeguards: encryption, firewalls, malware.

Malware: includes viruses, worms, Trojan horses, spyware and adware.

Spyware programs are installed on the user's computer without the user's knowledge or permission. Observes the user's actions and keystrokes, monitors the computer activity and reports that activity to sponsoring organizations.

Adware installed without the user's permission. Does not perform malicious acts or steal data. It does watch user activity and produce pop-ups. Simply annoying.

Malware safeguards:

1. Install antivirus and antispyware on your computer.
2. Set up your anti-malware programs to scan your computer frequently.
3. Update malware definitions (patters that exist in malware code)
4. Open email attachments only from known sources
5. Promptly install software updates from legit sources
6. Browse only in reputable Internet neighborhoods

Data Safeguards: protect databases and other organization data.

Two organizational units are responsible for data safeguards:

Data administration and database administration

Data administration: refers to an organization-wide function that is in charge of developing data policies and enforcing data standards.

Database administration: Refers to a function that pertains to a particular database. Ensures that procedures exist to facilitate orderly multiuser processing of the database, to control changes to the database structure and to protect the database.

Data and database administration work together to specify user data rights and responsibilities.

Human Safeguards: involve the people and procedures components of information systems. Result when authorized users following appropriate procedures for system use and recovery.

Human safeguards for employees:

Effective human safeguards begin with creating definitions of job tasks and responsibilities. Job descriptions should provide a separation of duties and authorities.

Example: No single individual should be allowed both to approve expenses and to write cheques. Instead, one person should approve them, another should pay them, and a third should account for the payment.

Hiring and screening: Security considerations should be part of the hiring process. When hiring for high-sensitivity positions, extensive interviews. References, background investigations are appropriate.

Dissemination and enforcement:

Enforcement consists of 3 interdependent factors:

1. Responsibility
2. Accountability
3. Compliance

Termination

Companies must establish security policies and procedures for the termination of employees.

Human Safeguards for non-employees

Temporary personnel and vendors

- Screen personnel
- Training and compliance
- Contract should include specific security provisions
- Provide accounts and passwords with the least privileges

Public users

- Harden Web site and facility

Hardening: Take extraordinary measures to reduce system's vulnerability

Partners and public that receive benefits from the information system

- Protect these users from internal company security problems

The third human safeguard is **account administration.** The administration of user accounts, passwords, and help-desk policies and procedures is an important component of the security system.

- The IT department should create standard procedures for this. The existence of accounts that are no longer required or in use is a serious security threat.

Account management procedures

- Creation of new user accounts
- Modification of existing account permissions
- Removal of unneeded accounts

Password management

- Acknowledgment forms
- Change passwords frequently

Help-desk policies

- Authentication of users who have lost their password
- Password should not be e-mailed (just a notification of password change)

System procedures:

- Normal operation
- Backup
- Recovery

Procedures of each type should exist for each information system

Definition and use of standardized procedures reduces the likelihood of computer crime

Each procedure type should be defined for both, system users and operations personnel

Security Monitoring

Important monitoring functions are activity log analyses, security testing and investigating and learning from security incidents.

The best safeguard against a disaster is **appropriate location.**

If possible, place computing centres, web farms, and other computer facilities in locations not prone to floods, earthquakes, tornados.

Some businesses prepare backup processing centres in locations geographically removed from the primary processing site.

Organization creates backups for the critical resources at the remote processing centre. So-called **hot sites** are remote processing centres run by commercial disaster recovery services. For a monthly fee they provide all the equipment needed to continue operations following a disaster.

Cold sites: provide office space but the customers themselves provide and install the equipment needed to continue operations.

Incident Response

Every organization should have an incident response plan as part of the security program. The plan should include how employees respond to security problems, whom they should contact, the reports they should make, and steps they can take to reduce further loss.

Second Part
Module 4, Chapter 5

Business Process: Sequence of activities for accomplishing a function

Activities: Tasks within a business process

Resources: Items necessary to accomplish an activity

Actors: Resources who are either human or computers

Role: Subset of activities in a business process performed by a particular actor

IS can be used to improve processes

Example: Using Facebook to invite people to an event

Operational processes: commonplace, routine, everyday business processes.

Examples: ordering supplies, paying bills, ringing up customers. The procedures or instructions for these processes are changed very infrequently. Many actors contribute to this process so changing them is difficult. IS that facilitate operational processes are sometimes called **transaction processing systems (TPS)**

Managerial processes: concern resource use. These processes include planning, assessing, and analyzing the resources used by the company in pursuit of its objectives. Occur much less frequently. Fewer computerized actors than operational processes.

Examples: planning and scheduling cashiers, determining which personnel to promote.

IS that facilitate managerial processes are sometimes called **management information systems (MIS)**

Strategic processes: seek to resolve issues that have long-range impact on the organization. These processes have broad scope and impact most of the firm. More human actors

Examples: determining where to locate new restaurant. Setting a business's budget and introducing a new products

IS that support strategic processes are sometimes called **executive support systems (ESS)**

Objectives of Processes

An **objective** is a desired goal an organization has decided to pursue. These can be classified as **effective** or **efficient.**

Effective objective: helps achieve organizational strategy.

Efficient objective: seeks more output with the same inputs or the same output with fewer inputs.

Both objectives can occur at any of the three levels of processes.

Most common combinations:

Effective→Strategic

Efficient→ operational

Common Business Processes:

Inbound logistics: receives, stores, disseminates product input. Include, procurement, manage inventory, evaluate potential suppliers.

Procurement→ an operational process that acquires goods and services.

Example: at the pizza shop, ordering ingredients and boxes as well as receiving and paying for those items.

A strategic inbound logistics process is the evaluation of potential suppliers.

Operational processes: Operations transform inputs into outputs. Schedule the equipment, people, and facilities necessary to build or assemble a product or provide a service. Assembling and baking pizzas are 2 operational operations processes. An example of management operations process is scheduling maintenance on the ovens. Strategic processes evaluate if the pizza company should open another restaurant or menu.

Outbound logistics processes: collect, store, and distribute products to buyers. Concern the management of finished-goods inventory and the movement of goods from that inventory to the customer. Operational outbound process is the **sales process** that records the sale order, ships the product and bills the customer. Managerial outbound logistics process is award a refund. Strategic is determine payment policy such as deciding if the shop will accept personal checks.

Sales and Marketing Processes: provide the means and incentives for customers to purchase a product or service. Primary objective is to find prospects and transform them into customers by selling them something.

Service processes: providing after-sales support to enhance or maintain the value of a product

Human resource processes: assess the motivations and skills of employees, create job positions, investigate employee complaints and staff, train, and evaluate personnel.

Technology development process: including designing, testing, and developing technology in support of the primary activities.

Value Chain Activity	Operational Process	Managerial Process	Strategic Processes
Primary Activities			
Inbound logistics	Procurement (*Chapter 7*)	Manage inventory	Evaluate potential suppliers
Operations	Assemble product	Schedule maintenance	Open new restaurant
Outbound logistics	Sales (*Chapter 8*)	Award refund	Determine payment policy
Sales & marketing	Mail promotion	Evaluate promotional discounts	Launch new product
Service	Track orders	Evaluate complaint patterns	Evaluate outsourcing options
Support Activities			
Human resources	Recruit employees	Plan future needs	Determine pay scales
Technology development	Test software	Estimate milestones	Evaluate acquisition options

OMIS Model: Objectives; Measures; and Information Systems

To improve a process:

- **O**bjectives: Specify and improve
- **M**easures: Specify and improve
- **IS**: Implement IS improvements

Measures also called metrics: quantities assigned to attributes

Measure of a delivery process is the elapsed time from leaving the store until arrival at the customer's location.

Three way to improve IS

1. Improve efficiency or effectiveness or activities
2. Provide linkages across activities
3. Improve control of the process

The impact of one activity on another activity is called a **linkage**

Control→keep pizza the same size, oven the same temperature. Etc…

Non-IS improvements:

Add more resources (add more drivers)

Change the structure of the process (specialize the jobs in the kitchen)

Six Sigma: seeks to improve process outputs by removing causes of defects and minimizing variability in the process. Six Sigma gets its name from its goal that 99.99966 percent of process outputs will be free from defects.

As is diagrams: current process

Ought to be diagrams: diagrams of suggested improvements

Information Silos: Data exists in isolated functional IS

Why Information Silos Exist: Data stored in separate databases

Information silos can make processes inefficient. Anytime data is transcribed from one place to another or entered in two places errors can occur. With errors, the measures calculated for some new suppliers and promotions will be incorrect, making these processes less effective than if the data were in one place.

Organizations store data in separate databases for several reasons.

1. Organizational departments prefer to control the systems they use. One department may have very different objectives than other departments in the firm. These objectives might be to minimize inventory or serve customers.
2. They analyse the costs and benefits of the system using their own, fairly narrow measures.

Service oriented architecture (SOA): Design philosophy. Design in which every activity is modeled as an **encapsulated service** and exchanges among those services are governed by **standards.**

Middleware facilitates communication and data sharing

Design approach for activities bases on:

- Service, Encapsulation, Standards

Service: repeatable task that a business needs to perform. Similar to an activity in a process. Needs access to data to be efficient.

Encapsulation: hides details inside a container. SOA hides data within containers so that services can communicate.

Because of encapsulation, service implementations can be readily adapted to new requirements, technologies and methodologies.

Standards: Data and more generically, messages, are exchanged among services using standardized formats and techniques, which are referred to as **SOA standards.**

Module 5, Chapter 6

Problems an ERP system solve?

-Information Silo Problem

- Data isolated in separate information systems

-Solutions

- Enterprise Application Integration (EAI)
- Enterprise Resource Planning (ERP)

Enterprise Application Integration (EAI) system: tackles the silo problem by providing layers of software that connect information systems together. EAI is software that enables information silos to communicate with each other and share data.

EAI software keeps files of metadata that describe where all the ogranization's data are located and how the data must be transformed to work at each location. These details are hidden from users. The EAI system appears to be an integrated database to the user.

EAI does the following:

- Connects information silos via a new layer of software
- Enables existing applications to communicate and share data
- Provides integrated data
- Leverages existing systems, leaving departmental information systems as is, but providing an integration layer over the top
- Enables a gradual move to ERP

Less expensive to convert to an EAI than to ERP.

Enterprise Resource Planning (ERP): product is a suite of software, a database, procedures and a set of processes for supporting business operations with a single consistent, information system.

Elements of an ERP system:

Material requirements planning (MRP): software that efficiently manages inventory, production, production, and labor.

Manufacturing resource planning (MRPII): financial tracking capabilities as well as the opportunity to schedule equipment and facilities.

Just in Time (JIT) delivery: synchronizes manufacturing and supply. Manufacturing occurs just as raw materials arrive.

ERP includes applications that integrate the processes for the following functions:

- SCM (supply chain management)→ procurement, sales order processing, inventory management
- Manufacturing → manufacturing scheduling, capacity planning, quality control, bill of materials
- CRM (customer relationship management) → sales prospecting, customer management, marketing, customer support, call center support
- Human Resources → payroll, time and attendance, HR management, commission calculations, benefits administration.
- Accounting → general ledger, accounts receivable, accounts payable, cash management, fixed asset accounting.

ERP software: accomplishes interprocess data integration. Resides on servers and on client machines in the company. Customization is called **configuration**.

Custom software is expensive

Avoiding customization by choosing an ERP product that has applications that function close to the organization's requirements is critically important to success.

ERP databases: An ERP solution includes a gigantic but largely unpopulated, database; a database design; and initial configuration data.

Operation data are entered during development and use.

One key characteristic of relational databases are that they are modular.

Modular: tables can be added or removed without significant impact on the overall structure.

Procedures: instructions and methods for users to interact with the application. Training the employees of a business on how to interact with an ERP system can be a time-consuming and costly operation.

Hardware: each ERP implementation requires a wide variety of hardware including disk storage, servers, clients, printers, scanners, network devices and cables.

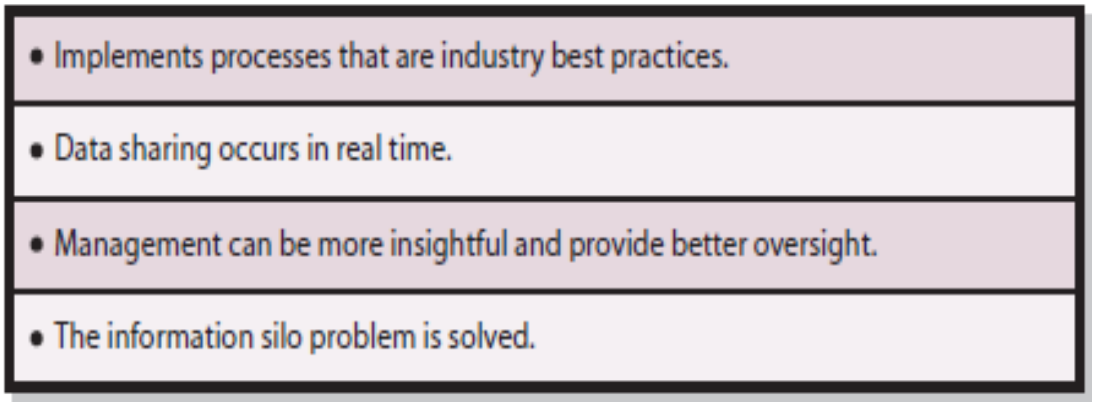
To determine the necessary levels of each of these hardware devices, an org. first estimated the number of **users.**

People: fall into three roles

1. Users→ employees of the firm implementing the system
2. Analysts →employees. Specialized training or education that enables them to support, maintain, and adapt the system after it has been implemented.
3. Consultant → works for the ERP vendor or a difference company called a **third party** and helps budget, plan, train, configure and implement the system.

Inherent Business Processes in ERP: System specified business processes. Process blueprints

Benefits using an ERP system:



Challenges of implementing an ERP system:

Daunting and expensive

If not done well, the losses are often very significant.

Users must be trained on the new processes, procedures and use of the ERP system's features and function.

Implementation decisions:

Devil is in the details, and there are a lot of details.

Order size? Structure of the **bill of material (BOM)** like a recipe, it specifies the raw materials quantities and subassemblies needed to create a final product. Deciding on the BOM standard can be challenging, particularly when the organization makes different types of products in different divisions.

People issues:

The actions and attitudes of the people in the implementing organization can make the situation even more challenging. People tend to resist change even when the benefits of the change are well known.

ERP by industry type: first major ERP customers were large manufacturers in the aerospace, automotive, industrial equipment and other industries. Over time ERP use spread to companies and organizations in other industries. ERP systems are used by governments and utilities, in the retail industry and in education.

ERP by organization size: Today ERP is used in organizations with yearly revenues as low as 5$ million.

International ERP: most billion dollar companies operate in many countries and the ERP application programs must be available in many languages and currencies. Some companies can declare a single

"company language" and force all company transactions to use that language. Other companies must accommodate multiple languages in their ERP solution.

ERP vendor market share: SAP, Oracle, Infor, Microsoft Dynamics, Epicor.

Epicor: known primarily for its retail-oriented ERP software. Low in cost

Infor: pursued an acquisition strategy to consolidate many product offerings under one sales and marketing organization. Products vary in purpose scope and quality.

Microsoft Dynamics: composed of four ERP products, all obtained via acquisition. None of these products is well integrated with Microsoft Office.

Oracle: intensely competitive company with a deep base of technology and high quality technical staff. Designed according to SOA principles. Easy to use products, fully featured products with superior performance. They are also expensive.

SAP gold standard of ERP products. Used by midsize and large companies and offers the most expensive of the ERP products.

Why is SAP different?

- product of SAP AG (a German firm)

Offers consulting, training, and other services for its software solutions.

SAP stands for Systems, Applications, Products

- SAP Modules
- SAP Inputs and Outputs
- SAP Software
    - SAP Business Suite

SAP's ERP product is made up of a collection of interconnected and interdependent modules. The **modules** can be further described as a distinct and logical set of processes.

SAP inputs and outputs provide usability features. Data is stored in a single centralized database and when running various transactions in the system, users enter information which calls up additional information from the database making transactions smooth.

Finally, in recent years, SAP has repackaged its application offerings by grouping them into what they call the **"SAP Business Suite".**

SAP Business Suite

- SAP ERP
- SAP CRM (customer relationship management)
- SAP SRM (Supplier relationship management)
- SAP SCM (Supply chain management)
- SAP NetWeaver

SAP NetWeaver is the application platform on which these mentioned applications run.

SAP NetWeaver offers several **advantages** to SAP customers:

-includes services oriented architecture capabilities which allow for these SAP applications to integrate with non-SAP applications.

Chapter 7

Three main procurement activities:

1. Order
2. Receive
3. Pay

Procurement objectives → save time and money

Purchase order (PO): a written document requesting delivery of a specified quantity of a product or service in return for a payment.

Key term in the procurement process is Inventory

Procurement process acquires **raw materials** whereas the production process converts the raw materials into finished goods.

Raw materials inventory: stores components like bicycle tires and other goods procured from suppliers.

Finished goods inventory: completed products awaiting delivery to customers

Invoice or itemized bill: data on the invoice: the amount due and the purchase order number for that invoice.

CBI's Procurement process

- Involved several roles
- Resulted in information silos
- Inefficiencies

Problems with procurement before SAP

- Warehouse Problems
- Accounting Problems
- Purchasing Problems

Warehouse problems:

- Growth in finished goods inventory
- Limited space for raw materials
- Lack of visibility into price discounts in the Sales Database

As a results of not knowing if the bike was selling due to discounts or popularity, the person in charge would frequently order too many or few bike components

Accounting problems:

- Three-way match for payment was a challenge
- Correcting discrepancies were labor intensive
- Time delays in updating accounting data

Three way match: data on the invoice matches the data in the purchase order and the goods receipt.

Roll up: compile and summarize the account transactions into balance sheets and income statements.

Purchasing problems:

- Purchasing wasn't centralized (agents scattered throughout the firm, diverse training, experience and motivation→ produced a variety of mistakes on the purchase orders)
- Inexperienced users
- Errors in data entry
- Pressure for greater financial controls

ERP: Provides solutions to CBI's problems. CBI selects SAP to provide ERP solutions

CBI had to reexamine and refocus their strategy

Involved three activities

- Determine industry structure
- Commit to a specific competitive strategy
- Develop objectives and measures for processes

Determining industry structure:

Porter's five force model

- Bargaining power of customers
- Threat of substitutes
- Bargaining power of suppliers
- Threat one new entrants
- rivalry

Competitive strategy:

Focus on high end bikes and a differentiation strategy of responsiveness to retailers.

Objectives and measures for processes to support the competitive strategy

SAP

Hired an IS consulting firm that specialized in SAP implementation

Efficiency objectives: smaller finished goods inventory and fewer errors

Need to keep track of inventory turnover

Inventory turnover: number of times inventory is sold over a given period.

Need to record three way match errors.

Effectiveness objectives: two measures for better financial controls, and three for responsiveness to customers.

Financial controls → better if the roll up time at the end of the month is shorter and if more managers make requests for financial reports.

More responsive to customers → order fulfillment time, number of products to sell and stockouts of hot selling products.

After installing SAP

Maintained same three major activities

- Order; Receive; and Pay

Single shared database

Solutions to prior problems

- Purchasing, Warehouse, Accounting

Purchase requisition (PR): internal company document that issues a request for a purchase. Automated by a computer

Purchasing:

The purchasing manager approves the purchase, converts the PR into a PO.

- New purchasing department centralized purchasing activities
- Data entered in a single, shared database
- Automated internal company document
    - Purchase Requisition (PR)
- Easy conversion of PR's to Purchase Orders
    - Reduces errors

Warehouse:

- Goods receipts entered into same database as PO's
- SAP verifies the goods received against the PO
- Immediate update to inventory
- Accounting impacts automatically updated in the same database
- SAP documents this in the database

Accounting:

- Three-way match completed by SAP
    - Less labor intensive
    - Incoming invoices are compared to PO and Goods Receipt for verification
- Payment simplified
- Accounting updated automatically in SAP
- SAP documents these steps in the database

Benefits of SAP for CBI's procurement process

- Single database
- Shared information in real time
- Reduction of errors
- Improved financial controls
- Increased responsiveness

SAP can also benefit Supply chain.

Supplier Relationship Management (SRM) process: automates, simplifies and accelerates a variety of supply chain processes.

SRM is a management process that helps companies reduce procurement costs, build collaborative supplier relationships, better manage supplier options and improve time to market.

Returns Management Process: manages returns of faulty products for businesses.

Supplier Evaluation process: determines the criteria for supplier selection and adds and removes suppliers from the list of approved suppliers.

Supply chain process integration:

Supply chain management (SCM): the integration of supply chain processes

SCM is the design, planning, execution and integration of all supply chain processes.

Integration of processes is improved by sharing data between processes and increasing process synergy.

Integration of processes is the same idea as linkages among activities.

Process integration is improved when processes share data.

Example: Data from the returns management process about defective bicycle parts should be shared with the supplier evaluation process to ensure that suppliers with high defect rates are removed from the list of approved suppliers.

Bullwhip effect: occurs when companies order me supplies than are needed due to sudden change in demand.

Improving Supply Chain Process Integration by Increasing Process Synergy

Process synergy: occurs when processes are mutually supportive; that is, when one process is done well, the objectives of another process are supported.

You synergize you dating and studying processes when you study with your significant other.

bottleneck : occurs when a limited resource greatly reduces the output of an integrated series of activities or processes.

SAP Integration Problems with Emerging Technologies

Other IS That Improve Supply Chain Processes

- Augmented reality
- RFID
- Sensors
- Robotics
- 3D printing

Augmented Reality (AR): computer data or graphics are overlaid onto the physical environment.

Radio frequency identification (RFID) technology: used identify and track items in the supply chain.

RFID chips are as small and cheap as a grain of rice. They broadcast data to receivers that can display and record the data.

3-D printing will also impact Procurement process.

3-D printing is also additive manufacturing. Objects are manufactured through the deposition of successive layers of materials. 3-D printers deposit material in three dimensions, layering material in the third dimension as it dries.

How does the use of SAP change CBI?

- New skills are needed
- Process focus
- More data sharing
- Outsourcing