Computer and Information Systems

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Lecture 2

Dr. Hui Xiong
Rutgers University

THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS

Learning Objectives (1)

- Know the eight principles of competitive advantage.
- Understand how information systems create competitive advantage.
- Define *problem*.

Learning Objectives (2)

- Recognize that different information systems are needed to solve different problem definitions.
- Know the characteristics of decision making.
- Understand how information systems facilitate decision making.

Information Systems for Competitive Advantage

- Businesses continually seek to establish competitive advantage in the marketplace.
- There are eight principles:
  - The first three principles concern products.
  - The second three principles concern the creation of barriers.
  - The last two principles concern establishing alliances and reducing costs.

Figure 2-1 Principles of Competitive Advantage

1. Create a new product or service
2. Enhance products or services
3. Differentiate products or services
4. Lock in customers and buyers
5. Lock in suppliers
6. Raise barriers to market entry
7. Establish alliances
8. Reduce costs

Figure 2-2 Two Roles for Information Systems Regarding Products

a. Information System as Part of a Car Rental Product

Daily Service Schedule -- November 17, 2005

StudentID	22
StudentName	Lubrication

ServiceDate	ServiceTime	VehicleID	Make	Model	Mileage	ServiceDescription
11/17/2005	12:00 AM	15890	Ford	Explorer	2244	Oil, Lube
11/17/2005	11:00 AM	12440	Toyota	Tacoma	7358	Oil, Lube

StudentID	26
StudentName	Alignment

ServiceDate	ServiceTime	VehicleID	Make	Model	Mileage	ServiceDescription
11/17/2005	9:00 AM	12440	Toyota	Tacoma	7358	Front end alignment inspect

StudentID	27
StudentName	Transmission

ServiceDate	ServiceTime	VehicleID	Make	Model	Mileage	ServiceDescription
11/17/2005	11:00 AM	15890	Ford	Explorer	2244	Transmission oil change

b. Information System that Supports a Car Rental Product

Information System that Creates a Competitive Advantage

- ABC invested heavily in information technology.
- ABC led the shipping industry in the application of information systems for competitive advantage.

Figure 2-3 ABC, Inc. Web page to select a Recipient from the Customer's Records

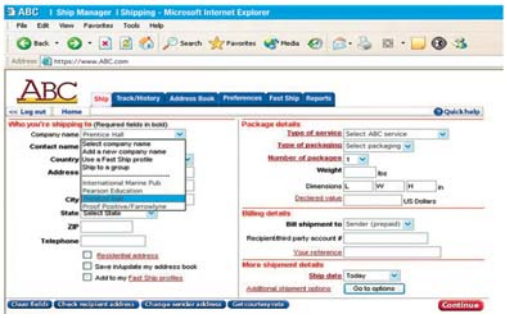


Figure 2-4 ABC, Inc. Web Page to Select a Contact from the Customer's Records

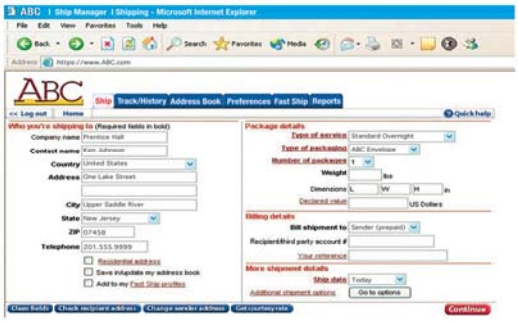


Figure 2-5 Using the ABC, Inc. System to Specify Email Notification

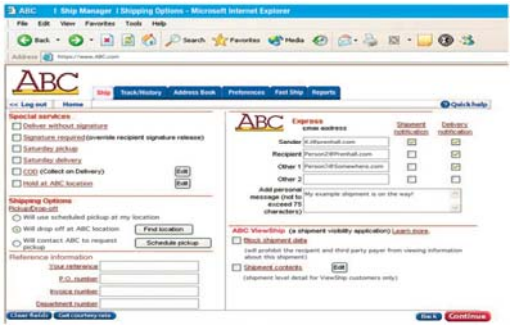
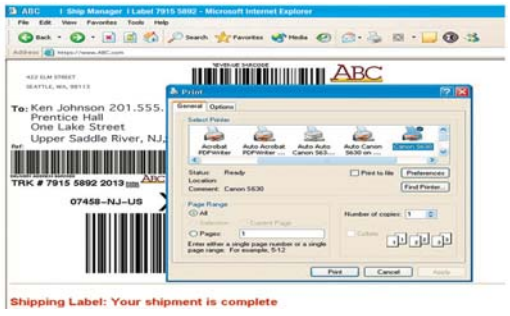


Figure 2-6 Using the ABC, Inc. System to Print a Shipping Label



How this System Creates a ABC, Inc Competitive Advantage

- ABC information system provides the following:
  - Enhances an existing product
  - Differentiates the ABC package delivery product from competitors
  - Lock's customers into the ABC system
  - Raises the barrier to market entry
  - Reduces costs

Information Systems for Problem Solving

- Information systems can be used to solve problems.
- Problem definition
  - A problem is a perceived difference between what is and what is not.
  - A problem is a perception.
  - A good problem definition defines the differences between what is and what ought to be by describing both the current and desired situations.

Information Systems for Problem Solving

- Problem definition
  - Different problem definitions require the development of different information systems.
  - All personnel in the organization must have a clear understanding of which definition of the problem the information system will address.

A Customer Relationship Management System

- A Customer Relationship Management (CRM) system is an information system that maintains data about customers and all of their interactions with the system.
- CRM systems vary in their size and complexity.

Knowledge Management System

- A knowledge management system (KMS) is an information system for storing and retrieving organizational knowledge.
- This knowledge can be in the form of data, documents, or employee know-how.
- KMS goal is to make the organization knowledge available to
  - Employees
  - Vendors
  - Customers
  - Investors
  - Press and who else who needs the knowledge

Figure 2-8 Example Customer Relationship Management (CRM) System

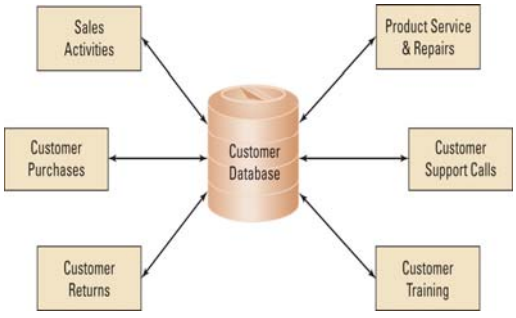
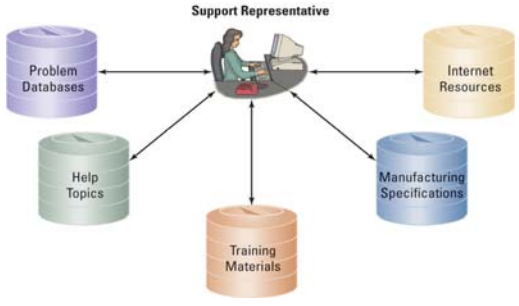


Figure 2-9 Customer Support Knowledge Management System



A Manufacturing Quality-Control Information System

- Many organizations believe that the optimal way to provide customer service is to eliminate the need for it.
- One way to improve customer service is to improve manufacturing quality.
- The type of system to develop depends on the way the organization defines the problem.
- Before developing the system, the organization must have a complete, accurate, and agreed-upon problem definition.

Information Systems for Decision Making

- Developing an information system is to facilitate decision making.
- Decision making in organizations is varied and complex.

Decision Level (1)

- Decisions occur at three levels in organizations.
- Operational decisions concern day-to-day activities.
  - Information systems that support operational decision making are called transaction processing systems (TPS).

Decision Level (2)

- Managerial decisions concern the allocation and utilization of resources.
  - Information systems that support managerial decision making are called management information systems (MIS).
- Strategic decision making concern broader-scope organizational issues.
  - Information systems that support strategic decision making are called executive information systems (EIS).

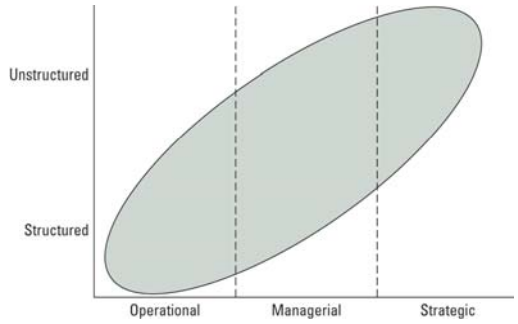
Figure 2-10 Decision-Making Dimensions

- Decision Level
  - Operational
  - Managerial
  - Strategic
- Decision Process
  - Structured
  - Unstructured

The Decision Process

- Two decision processes (method by which a decision is to be made) are structured and unstructured.
  - Structured decision process is one for which there is an understood and accepted method for making the decision.
  - Unstructured process is one for which there is no agreed on decision making process.
- The terms structured and unstructured refers to the decision process-not the underlying subject.

Figure 2-11 Relationship of Decision Level and Decision Type Figure



Different Types of Information Systems for Different Types of Decisions

- Automated information systems are those by which the computer hardware and program components do most of the work.
  - Humans start the programs and use the results.
- Augmentation information systems are those in which humans do the bulk of the work.
  - These systems augment, support, or supplement the work done by People (email, instant messaging, video-conferencing, etc) to aid in decision making.

Figure 2-12 Automated vs. Augmentation IS

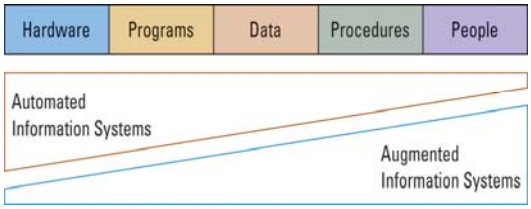
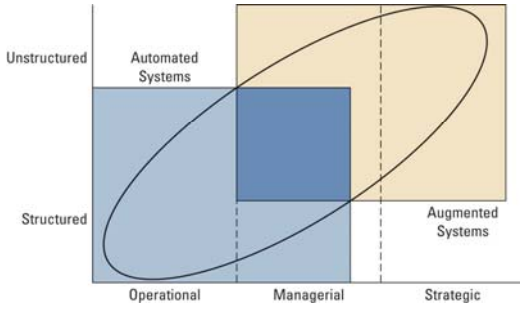


Figure 2-13 How Decision Level, Decision Type and IS Type Are Related



Information Systems and Decision Steps

- A way to examine the relationship between information systems and decision making is to consider how an information system is used during the steps of the decision making process.
- There are five steps
  - Intelligence gathering
  - Alternative formulation
  - Choice
  - Implementation
  - Review

Figure 2-14 Decision-Making Steps

Decision Step	Description	Examples of Possible Information Systems
Intelligence gathering	• What is to be decided? • What are the decision criteria? • Obtain relevant data	• Communications applications (email, video conferencing, word processing, presentation) • Query and reporting systems • Data analysis applications
Alternative formulation	• What are the choices?	• Communications applications
Choice	• Analyze choices against criteria using data • Select alternative	• Spreadsheets • Financial modeling • Other modeling
Implementation	• Make it so!	• Communications applications
Review	• Evaluate results of decision. If necessary, repeat process to correct and adapt.	• Communications • Query and reporting • Spreadsheets and other analysis

Security Guide–Security as Competitive Advantage

- Example–Two different security problems
  - Slammer worm
    - The Slammer worm infected computers that used a Microsoft program called SQL Server by consuming so many resources on a computer that serious traffic jams occurred over the Internet.
    - Microsoft issued a patch for customers to install via it's Web site to plug the hole used by the Slammer worm.

Security Guide–Security as Competitive Advantage

- Example–Two different security problems
  PeopleSoft (Hacker access)
    - Allowed hackers to exploit PeopleSoft software to install unauthorized programs on the computers of PeopleSoft's customers
- No software is known to be completely secure.
- There is always a chance that a hole will be found in any company's software.

Ethics Guide–Limiting Access to Those Who Have Access (1)

- It's easier for those with considerable knowledge and expertise to gain more knowledge and expertise.
- The person with greater knowledge pulls farther and farther ahead.
- Searching the Internet is also a matter of choice

Ethics Guide–Limiting Access to Those Who Have Access (2)

- The increasing reliance on the Web for information and commerce has created a divide of the haves and the have-nots.
- Various groups have addressed this problem by making Internet access available in public places.
- It's much cheaper to provide support information over the Internet than on printed documents.

Opposing Forces Guide–G. Robinson Old Prints and Maps

- George Robinson buys and sells old prints and maps.
- George feels that he does not need a computer in his business.
- George keeps a manual list of customers to whom he sends a newsletter 2-4 times per year (keeping the newsletter to 1K or so for the best customers)
- Georges sells 90–95% of the items in his catalog.

Opposing Forces Guide–G. Robinson Old Prints and Maps

- Biggest challenge is finding new inventory.
- Inventory control does not account for gross margin.
- Can George use a CRM system?

Problem Solving Guide–Egocentric versus Empathetic Thinking (1)

- When developing Information Systems, it is critical for the development team to have a common definition and understanding of the problem.
- Egocentric thinking centers on the self.
- Empathetic thinkers consider their view as one possible interpretation of the problem and actively work to learn what others are thinking.

Problem Solving Guide–Egocentric versus Empathetic Thinking (2)

- In business, empathetic thinking is recommended.
- Those who understand others' point of view are always more effective.
- Empathetic thinking is an important skill in all business activities.
- Skilled negotiators always know what the other side wants.

Hardware and Software Chapter 3

Learning Objectives

- Learn the terminology necessary to be an intelligent consumer of hardware products.
- Know the functions and basic features of common hardware devices.
- Understand the essentials of the representation of computer instructions and data.
- Know the purpose of the CPU and main memory, and understand their interaction.

Learning Objectives (2)

- Learn about viruses, Trojan horses, and worms and how to prevent them.
- Understand the key factors that affect computer performance.
- Learn basic characteristics of the four most popular operating systems.
- Know the sources and types of application software.

Essential Hardware Terminology

- Computing devices consists of computer *hardware* and *software*.
- Hardware is electronic components and related gadgetry that input, process, output, and store data according to instructions encoded in computer programs or software.
- Your personal computer and other computers like it are **general-purpose computers.**
  - They can run different programs to perform different functions.

Essential Hardware Terminology (2)

- Some computers are **special-purpose computers.**
  - The programs they run are fixed permanently in memory.
  - The computer in your cell phone is a special-purpose computer, and so is the computer in your car that meters fuel to your car's engine.

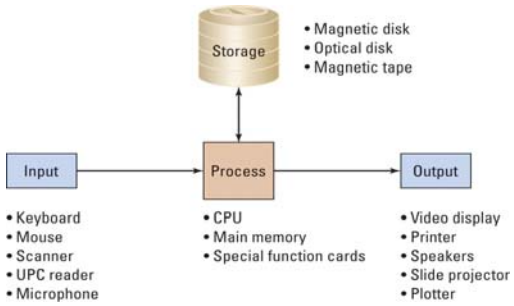
Essential Hardware Terminology (3)

- The principles and fundamental components of general-purpose and special-purpose computers are the same;
  - The sole difference is the computer can process a variety of different programs

Input, Processing, Output, and Storage Hardware

- One easy way to categorize hardware is by its primary function:
  - Input hardware
  - Processing hardware
  - Output hardware
  - Storage hardware
  - Communication hardware

Figure 3-1 Input, Process, Output, and Storage Hardware



Input, Processing, Output, and Storage Hardware

- **Input hardware** devices are the keyboard, mouse, document scanners, and bar-code (Universal Product Code) scanners.
- Microphones also are input devices; with tablet PCs, human handwriting can be input as well.
- *Processing devices* include the **central processing unit (CPU)**, which is sometimes called "the brain" of the computer.

Figure 3-2 Scantron Scanner

Input, Processing, Output, and Storage Hardware (2)

- The CPU selects instructions, processes them, performs arithmetic and logical comparisons, and stores results of operations in memory.
- CPU's vary in speed, function, and cost.
- Whether you or your department needs the latest, greatest CPU depends on the nature of your work.
- The CPU works in conjunction with **main memory.**

Input, Processing, Output, and Storage Hardware (3)

- The CPU reads data and instructions from memory, and it stores results of computations in main memory.
- Computers also can have **special function cards** that can be added to the computer to augment the computer's basic capabilities.
  - A common example is a card that provides enhanced clarity and refresh speed for the computer's video display.

Figure 3-3 Special Function Cards

Input, Processing, Output, and Storage Hardware (4)

- **Output hardware** consists of video displays, printers, audio speakers, overhead projectors, and other special-purpose devices, such as large flatbed plotters.
- **Storage hardware** saves data and programs.
- Magnetic disk is by far the most common storage device, although optical disks, such as CDs and DVDs are popular.
- In large corporate data centers, data are sometimes stored on magnetic tape.

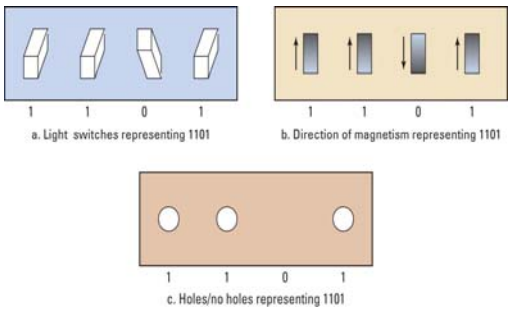
Binary Digits

- Computers represent data using **binary digits**, called **bits.**
- A bit is either a zero or a one.
- Bits are used for computer data because they are easy to represent physically.
- A switch can either be closed or open.

Binary Digits (2)

- A computer can be designed so an open switch represents zero and a closed switch represents a one.
- Or, the orientation of a magnetic field can represent a bit;
  - Magnetism in one direction represents a zero
  - Magnetism in the opposite direction represents a one
- Or, for optical media, small pits are burned onto the surface of the disk so that they will reflect light
  - In a given spot, a reflection means a one
  - No reflection means a zero

Figure 3-4 Bits Are Easy to Represent Physically



Computer Instructions (1)

- Computers use bits for two purposes: instructions and data.
- A given instruction, say to add two numbers together, is represented by a string of digits (0111100010001110).
- When the CPU reads such an instruction from main memory, it adds the numbers or takes whatever action the instruction specifies.
- The collection of instructions that a computer can process is called the **computer's instruction set.**

Computer Instructions (2)

- All of the personal computers that run Microsoft Windows are based on an instruction set developed by Intel Corporation that is called **Intel instruction set.**
- Until 2006, all Macintosh computers used a different instruction set, the **PowerPC instruction set**, designed for Powerful PC processors.
- In 2006, Apple began offering Macintosh computers with a choice of either Intel or PowerPC processors.

Computer Instructions (3)

- Currently, you cannot run a program designed for one instruction set on a computer having a different instruction set.
- In the future, you may be able to run Windows on a Macintosh that uses the Intel instruction set, although the particulars of that are uncertain.
- When you pick a family of computers, such as Windows or the Macintosh, you pick not only the hardware, but also the sets of programs that can run on one family of computers.

Computer Data

- All computer data are represented by bits.
- The data can be numbers, characters, currency amounts, photos, recordings, or whatever.
- Bits are grouped into 8-bit chunks called **bytes.**
- For character data, such as letters in a person's name, one character will fit into one byte.
  - Thus, when you read a specification that a computing device has 100 million bytes of memory, you know that the device can hold 100 million characters.

Figure 3-5 Important Storage-Capacity Terminology

Term	Definition	Abbreviation
Byte	Number of bits to represent one character	
Kilobyte	1,024 bytes	K
Megabyte	1,024 K = 1,048,576 bytes	MB
Gigabyte	1,024 MB = 1,073,741,824 bytes	GB
Terabyte	1,024 GB = 1,099,511,627,776 bytes	TB

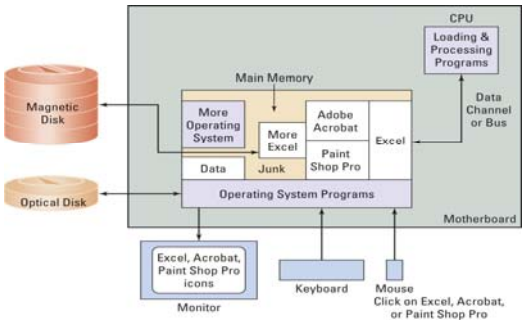
Knowledge for the Informed Professional

- Suppose that your IS department states that you can buy three different computer configurations for three different prices.
- The computers are described by expressions like the following:
  - Intel Pentium 4 Processor at 2.8 GHz with 533MHz Data Bus and 512K cache, 256MB RAM
  - Intel Pentium 4 Processor at 2.8 GHz with 533MHz Data Bus and 512K cache, 512 MB RAM
  - Intel Pentium 4 Processor at 3.6 GHz with 533MHz Data Bus and 1MB cache, 256 MB RAM

Knowledge for the Informed Professional (2)

- Now, you, have two choices:
  - You can tell the people in the IS department to specify what they think is best;
  - Or, with a little bit of knowledge on your part, you can work with the IS department to ask intelligent questions about the relationship of these computers to the kind of work your department does

Figure 3-6 Computer with Applications Loaded



CPU and Memory Usage

- The **motherboard** is a circuit board upon which the processing components are mounted and/or connected.
- The *central processing unit (CPU)* reads instructions and data from main memory, and it writes data to main memory via a **data channel,** or **bus.**
- Main memory consists of a set of cells, each of which holds a byte of data or instruction.

CPU and Memory Usage (2)

- Each cell has an address, and the CPU uses the addresses to identify particular data items.
- Main memory is also called **RAM memory**, or just **RAM.**
- RAM stands for *random access memory.*
- The term *random* is used to indicate that the computer does not need to access memory cells in sequence; rather, they can be referenced in any order.

CPU and Memory Usage (3)

- To store data or instructions, main memory or RAM must have electrical power.
- When power is shut off, the contents of main memory are lost.
- The term **volatile** is used to indicate that data will be lost when the computer is not powered.
  - Main memory is **volatile.**

CPU and Memory Usage (4)

- Magnetic and optical disks maintain their contents without power and serves as storage devices.
- You can turn the computer off and back on, and the contents of both magnetic and optical disks will be unchanged.
  - Magnetic and optical disk are **nonvolatile.**

The Contents of Memory

- Memory is used for three purposes:
  - It holds instructions of the operating system
  - It holds instructions for application programs such as Excel or Acrobat.
  - It holds data.
- The operating system (OS) is a computer program that controls all of the computer's resources
  - It manages main memory.
  - It processes key strokes and mouse movements.
  - It sends signals to the display monitor.
  - It reads and writes disk files.
  - It controls the processing of other programs.

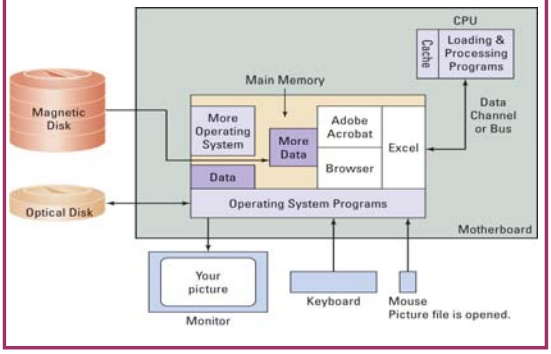
Memory Swapping

- Memory swapping occurs when there is a request to the operating system to store data in memory and the data will not fit because there is not enough free memory to store the requested data.
- In this case, the operating system will have to remove something to make space.
- Little swapping occurs when:
  - Your computer has a very large main memory.
  - You use only one or a few programs at a time.
  - You use small files.

Memory Swapping (2)

- You may have a serious problem if:
  - Your computer has a small memory capacity.
  - You need to use many programs or process many large data files.
  - Your computer has a small memory capacity.
- In this latter case, adding more main memory will substantially improve your computer's performance.

Figure 3-7 Picture File Overlays Memory Previously Used by Excel



Work at the CPU

- The CPU reads instructions and data from memory via the data bus.
- The maximum speed at which it transfers data is determined by the speed of main memory and the speed and width of the data bus.
- A bus that is 16 bits wide can carry 16 bits at a time; one that is 64 bits wide can carry 64 bits at a time.
- The wider the bus, the more data it can carry in a given interval of time.

Work at the CPU (2)

- Because the data transfer rate depends on both the width of the data bus and the speed of main memory, another way to speed up the computer is to obtain faster memory.
- Some data are accessed more frequently than other data.
  - Because of this, computer engineers found they could speed up the overall throughput of the CPU by creating a small amount of very fast memory, called **cache memory.**
  - The most frequently used data are placed in the cache.
  - Typically, the CPU stores intermediate results and the most frequently used computer instructions in the cache.

Work at the CPU (3)

- Each CPU has a clock speed that is measured in cycles per second, or hertz.
- A fast modern computer has a clock speed of 3.0 gigahertz (abbreviated GHz), or 3 billion cycles per second.
  - By the time you read this, CPU speeds will be greater.
- In general, the faster the clock speed, the faster work will get done.

Figure 3-8 Hardware Components and Computer Performance

Component	Performance Factors	Beneficial for:	Example Application
CPU and data bus	• CPU speed • Cache memory • Data bus speed • Data bus width	• Fast processing of data once the data reside in main memory	• Repetitive calculations of formulas in a complicated spreadsheet • Manipulation of large picture images
Main memory	• Size • Speed	• Holding multiple programs at one time • Processing very large amounts of data	• Running Excel, Word, Paint Shop Pro, Adobe Acrobat, several Web sites, and email while processing large files in memory and viewing video clips • 3D games
Magnetic disk	• Size • Channel type and speed • Rotational speed • Seek time	• Storing many large programs • Storing many large files • Swapping files in and out of memory	• Store detailed maps of counties in the United States • Large data downloads from organizational servers • Fix computer with too little memory
Optical disk—CD	• Up to 700 MB • CD-ROM • CD-R (recordable) • CD-RW (rewritable)	• Reading CDs • Writable media can be used to back up files	• Install new programs • Play and record music • CD being replaced by DVD • Backup data
Optical disk—DVD	• Up to 4.7 GB • DVD-ROM • DVD-R (recordable) • DVD-RW (rewritable)	• Process both DVDs and CDs • Writable media can be used to back up files	• Install new programs • Play and record music • Play and record movies • Backup data
Monitor—CRT	• Viewing size • Dot pitch • Optimal resolution • Special memory?	• Small budgets	• Nongraphic applications, such as word processing • Less used computers
Monitor—LCD	• Viewing size • Pixel pitch • Optimal resolution • Special memory?	• Crowded workspaces • When brighter, sharper images are needed	• More than one monitor in use • Lots of graphics to be processed • Continual use