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**University of Technology
Computer Science Department**

**1st Class
Principles of Information Technology**

استاذ المادة: اخلاص خلف

**UNIVERSITY OF TECHNOLOGY
COMPUTER SCIENCE DEPARTMENT
Chapter 1
Introduction to Information Technology**

Lecture: MSc.Ikhlaf Khalaf

References

- 1-introduction to information technology by Turban&Rainer&Potter 1997
- 2-Introduction to information systems by James.O'Brien
- 3-Raymond McLeod, Jr. and George P. Schell-© 2004, Prentice Hall, Inc.

Learning Objectives:

- 1. Discuss business pressures and responses in today's information age.**
- 2. Differentiate between data and information, and describe the characteristics of high-quality data.**
- 3. Name and describe the components of an information system.**
- 4. Describe the capabilities expected of information systems in modern organization.**
- 5. Describe opportunities for strategic use of information systems.**

Introduction

Information technology plays a major role in reengineering business processes, the speed, information processing power, and ease-of-use of modern computer hardware, software, and networks can dramatically increase the efficiency of business processes, and communications among its people.

Information technologies and business systems that use IT allow us to work more intelligently, they also often change how we structure and manage our organization and processes-that is, how we work and how interact. IT is a facilitator of organization activities and processes.therefor it is very important for every manager and professional staff member to learn about IT from the stand point of his or her specialized field.

Every manager and staff member should know how to build, use, and manage successful systems based on IT.

In sales and Marketing, managers use IT to:

- 1-develop new goods and services (product analysis)
- determine the best location for production and distribution facilities (site 2analysis).
- 3-determine the best advertising and sales total revenues promotion analysis
- 4-set product prices to get the highest total revenues (price analysis).

Marketing managers also use IT to manage customer relationship.

IT: are the individuals components that are typically organized into computer –based information systems (IS)

The two terms IT & IS are not precisely synonymous, but are used interchangeably in common practice.

HISTORY OF INFORMATION SYSTEMS

The earliest “mainframe” computers could only process a single task by a single user

1946: ENIAC (Electronic Numerical Integrator and Calculator) was developed

1951: first computer installed by the U.S. Census Bureau

1954: first computer used by G.E

Over the last half century, hardware has seen many-fold increases in speed and capacity and dramatic size reductions

Applications have also evolved from relatively simple accounting programs to systems designed to solve a wide variety of problems

Figure 1.1 Computer Scientists Harold Sweeney (left) and J. Presper Eckert (center) Demonstrate the UNIVAC Computer to Walter Cronkite as It Predicts the Winner of the 1952 Presidential Election



What Is An Information System?

Information systems(IS)collects,processes,stores,analyzes,and disseminates information for a specific purposes ,like any other system ,an information system include inputs(data, instructions)and outputs(reports, calculations).

It processes the inputs and produces outputs that are sent to the user or other system. Feedback mechanism that controls the operation may be

included. like any other system, an information system operates within an environment.

It is important to note the differences between data, information, and knowledge.

Data: are raw facts or elementary descriptions of things, events, activities, and transactions that are captured, recorded, stored, and classified but not organized to convey any specific meaning.

Examples of data would include grade point averages, bank balances, or the number of hours employees worked in a pay period.

Information: is collection of facts (data) organized in some manner so that they are meaningful to recipient, for example, if we include student name with grade point averages, customer names with bank balances, and employees' wages with hours worked, we would have useful information.

Knowledge: consists of information that has been organized and processed to convey understanding experiences, accumulated learning, and expertise as it applies to a current business problem or process.

To be useful to managers and the organization, information should exhibit a variety of characters, it should be accurate, complete, flexible, reliable, information that is not of high quality can lead to poor decision, costing the organization a great deal of money.

Computer –Based Information System

Computer –based information system (SBIS) is an information system that uses computer and often telecommunications technology to perform some or all of its intended tasks.

An information technology is a particular component of a system, like a personal computer, printer, or network.

The basic components of information systems are the following:

1-**hardware:** a set of devices such as processor, monitor, keyboard, and printer that accept data and information processes them and displays them.

2-**software:** a set of computer programs that enables the hardware to process data.

3-**database:** an organized collections of related files, records, etc, that stores data and the associations among them

4-**network:** a connecting system that permits the sharing of resources among different computers.

5-**procedures:** the strategies, policies, methods, and rules for using the information systems.

6-**people:** the most important element in IS: include those persons who work with the information system or use its output.

End of Chapter

**UNIVERSITY OF TECHNOLOGY
COMPUTER SCIENCE DEPARTMENT
Chapter 2
Introduction to Computer Architecture**

Lecture: MSc. Ikhlas Khalaf

References

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Learning Objectives:

- 1) Identify the major hardware components of computers.
- 2) Describe the design and functioning of the central processing unit
- 3) Discuss the relationship between microprocessor component designs and performance.
- 4)Describe the mai types of primary and secondary storage
- 5)Distinguish between primary and secondary storage along the dimensions of speed, cost and capacity.
- 6)Describe the hierarchy of computers according to power and trier respectiv roles.
- 7)Differentiate the different types of input and output technologies and their uses.

Figure 1.2 A Personal Computer



Source: Dell Computer Corporation.

Introduction to Computer Architecture

- Most computers have similar architectures that combine software and hardware.
- Software includes the operating system which controls the computer hardware and application software, such as word processing, spreadsheets, etc.
- Hardware includes processors, memory and peripheral devices.

Computer hardware

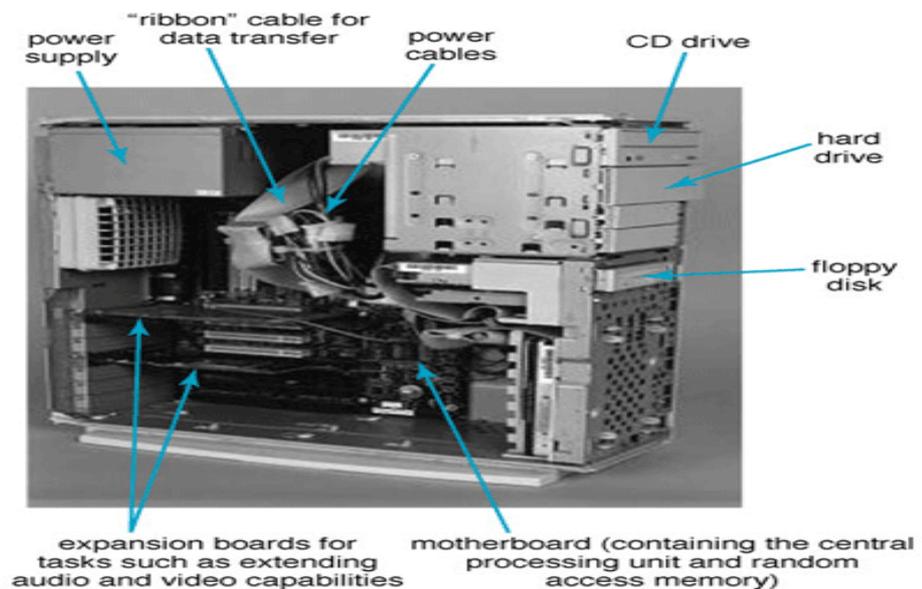
Computer based information system (CBIS) are composed of hardware, software, databases, people, telecommunications, and procedures. The components are organized to input, processing, output data and information.

Physical equipment used for the input, processing, output and storage activities of computer system.

It consists of the following:

- Central processing unit(CPU)
- Memory(primary and secondary storage)
- Input technology
- Output technology
- Communication technology

Figure 1.5 Computer Hardware Components



Source: James A. Folts Photography.

1-The central processing unit

The central processing unit(CPU) perform the actual computation inside any computer, the CPU is a microprocessor(for example, Pentium III) made up of millions of microscopic transistors embedded in a circuit on a silicon wafer or chip. Examples of specific microprocessor are listed in table (1.1)

The microprocessor has different portions which perform different functions:

1-**control unit**: this controls the flow of information.

2-**Arithmetic logic unit (ALU)** performs arithmetic calculations.

3-**Registers**: which store very small amount of data and instructions for short period of time

Figure 5.1 Intel Pentium 4 Processor



Source: Intel Corporation.

2-Computer Memory

There are two basic categories of memory:

A-**Primary storage (main memory)**:so name because small amounts of data and information that will be immediately used by the CPU are stored there.

B-**secondary storage**: where much larger amount of data and information (an entire software program, for example) are stored for extended period of time.

Memory capacity

CPU process only 0s and 1s, all data are translated through computer languages into series of these binary digits, or bits.

Eight bits are needed to represent a character.this 8-bit string is known as a byte. the storage capacity of a computer is measured in bytes. The hierarchy of byte memory capacity is as follows:

1-**Kilobyte**: a kilobyte is 1024 byte

2-**Megabyte** (1024*1024)byte or 1,048,576 byte)

3-**Gigabyte** (1024*1024*1024)byte)or(1,073,741,824 byte)

4-**Terabyte**: are trillion byte (1,078,036,791,296 byte)

There are four main types primary(main)memory:

1-Registers: are part of CPU, they have the least capacity, storing limited amounts of instructions and data only immediately before and after processing.

2-Random Access Memory (RAM): it stores more information than registers and is farther away from the CPU, but it stores less than secondary storage and is much closer to the CPU than is the secondary storage.

When you start most software programs on your computer, the entire program is brought from secondary storage into RAM. As you use the program, small parts of the programs instructions and data are sent into the registers and then to the CPU.

Again, getting the data and instructions as close to the CPU as possible is key to the computer's speed, as is the fact that the RAM is a type of microprocessor chip. As we shall discuss later, the chip is much faster (and more costly) than are secondary storage devices.

3-Cache Memory: many modern computer applications (Microsoft office 98, for example) are very complex and have huge numbers of instructions. It takes considerable RAM capacity (usually a minimum of 16MB) to store the entire instruction set. Or you may be using an application that exceeds your RAM. In that case, your computer has to go into secondary storage to retrieve the instruction. To alleviate this problem, software is often written in smaller blocks of instruction. As need, these blocks can be brought from secondary storage into RAM; this is still slow however, cache memory is the place closer to the CPU where the computer can temporarily store those blocks used most often. Those used less often remain in RAM until they are transferred to cache; those used infrequently stay stored in secondary storage. Cache memory is faster than RAM. Because, the instructions travel a shorter distance to the CPU.

4-Read Only Memory (ROM)

Most people who use computers have lost precious data at one time due to a "computer crash" or power failure. What is usually lost is what ever is in RAM, cache, or the registers, this loss occurs because these types of memory is volatile.

Read-only-memory (ROM) is the place (a type of chip) where certain critical instruction are safeguarded. ROM is nonvolatile and retains these instructions when the power to the computer is turned off. The (read-only) means that these instructions can be read only by the computer and cannot be changed by the user.

B) Secondary Storage (Backing storage)

Secondary storage is designed to store very large amounts of data for extended periods of time. Secondary storage can have memory capacity of gigabyte or more; only small portions of the data are placed in primary storage at any one time. Secondary storage has the following characteristics:

- 1-it is nonvolatile
- 2-it takes much more time to retrieve data from secondary storage than it does from RAM
- 3-it is much more cost effective than primary storage.
- 4-it can take place on a variety of media each with its own technology, as discussed below:

- a) **Magnetic tape**
- b) **Magnetic disc**
- c) **Magnetic diskette (floppy disc)**
- d) **Optical discs**

A-features of the magnetic tapes

- 1-it is 1/4 inch wide and 300, 1200, 2400, or 3600 feet long
- 2-it has a plastic base, coated with magnetic material on one side.
- 3-data is stored in tracks, there are 7 or 9 tracks (depending on the tape unit) which run the length of the tape. The data is recorded so that one character is recorded across the 7 or 9 tracks.
- 4-the density of recording can vary between 200-6250 characters per inch.
- 5-it is a serial access device.
- 6-the tape is reusable i.e. it can be overwritten.
- 7-the same tape can be used for input and output. The tape can be write-protected.

B-Features of magnetic disks (hard disks)

- 1-disks are randomly accessed
- 2-disks are of size and shape similar to a long-playing record.
- 3-the surfaces of each disk are of magnetic material.
- 4-each disk surface is divided into a number of concentric tracks (typically 200)
- 5-disks are placed on a pack and each pack may have 6 or 11 disks and is used as a single unit.
- 6-the latest models of disk packs can store many hundreds of megabytes of data (i.e. hundreds of millions of characters)

C-features of floppy disks

- 1-appliable disk permanently sealed with a rigid, protective plastic envelope.
- 2- they have random access facility.
- 3- data are stored in concentric tracks.
- 4-the floppy disk sizes are 8 1/4, 3 1/2 inch.
- 5-storing capacity of 3 1/2 inch disks is 1.44 megabytes i.e. one million four hundred thousand characters.

D-features of optical disks

1-this is a random access device.

2-data is written into the disk by burning a permanent pattern into the surface of the disk by means of high precision laser beam.

3-data is read by using the laser at lower intensity and detecting the pattern reflected from its beam by the surface of the disk

there are four types of optical disks:

1-compact disk read-only memory (CD-ROM)storing devices feature high capacity, low cost.

It has become popular for recorded music as well as information(such as books)a variant is the digital video disk(DVD),used for movies.

2- Write once, read many (WORM) disk can be written

3-rewritable CD is a less common technology that allow the disk to be written upon and written up to 1.000 times.

PRIMARY STORAGE

Primary storage has much less capacity than secondary storage, and is faster and more expensive per byte stored, primary storage is located much closer to the CPU than is secondary storage. Sequential _access secondary storage media such as magnetic tape is much slower and less expensive than direct access media(e.g hard drives, optical media)

Computer hierarchy

The traditional way of comparing classes of computers is by their processing power. This section presents each class of computers beginning with most powerful and ending with least powerful. We describe the computers and their respective roles in modern organizations

1-Super computers

- Are the computer with the most processing power
- The primary application of its has been in scientific and military work
- Are used for image creation and processing
- Are used to model the weather for better weather prediction
- To test weapons nondestructively
- To design aircraft (e.g. the Boeing 777) for more efficient and less costly production.
- to make many sequences in motion pictures(e.g. star wars and Jurassic park)
- Super computes generally operate 4 to 10 times faster than the next most powerful computer class.

2-Mainframe computers

- Are less powerful and generally less expensive than super computers
- Are used for centralized data processing and maintain large databases
- Examples of mainframe applications include airline reservations systems, students grade calculations and reporting
- A mainframe system may have anywhere from 50MB to several gigabytes of primary storage, secondary storage may use high capacity magnetic and optical storage media with capacities in the gigabyte rang.

3-Minicomputers

- Are called midrange computers
- Are relatively small, inexpensive that perform the same functions as mainframe computers but to a limited extent.
- Are used to accomplish specific tasks, such as process control, scientific research, and engineering applications.

4-Workstations

- Are also called desktop engineering workstations
- Are developed to provide the high levels of performance demanded by engineers
- Provide very high-speed calculations and high-resolution graphic.
- These computers have found a widespread acceptance within the scientific community and with the business community.

5-Microcomputers

- Also called micros or personal computers(PCs)
- Are smallest and least expensive category of general purpose computers
- They can be subdivided into three classifications based on their size
a)desktops b)laptops and notebooks c)palmtops

Figure 1.4 IBM NetVista Microcomputer



Source: IBM Corporation. Photo courtesy of International Business Machines Corporation.

3-Input Technologies

a) keyboards

are the most common input device the keyboard is designed like a typewriter but with additional function keys.

b) Mice and trackballs:

a mouse is a hand-held device used to point a cursor at a desired place on screen, such as an icon, cell in a table.

A variant of the mouse is the trackball, which is often used in graphic design, the user holds an object much like a mouse but rather than moving the entire device to move the cursor.

c) Touch screen

Are a technology that divides the computer screen into different areas. Users simply touch the desired area (often buttons or squares) to trigger an action.

d) a stylus

is a pen-style device that allows the user either to touch parts of a predetermined menu of options.

e) a joystick

is used primarily at workstations that can display dynamic graphics, they can also be used to play video games.

f) a microphone

is becoming a popular data input device as voice recognition software improves and people can use a microphone to dictate to a computer.

Figure 5.4 Computer Keyboard



Source: Getty Images, Inc.

Figure 5.5 Computer Mouse



Source: Microsoft Corporation. Reprinted with permission from Microsoft Corporation.

4/Output Technologies

a) Monitors

are the video screens used with most computers that display input as well as output like television sets, monitors come in a variety of sizes and color/resolution quality .and like television sets, the common desktop monitor uses cathode ray tube(CRT)technology to shoot beams of electrons to the screen. the points on the screen known as pixels, the more pixels on the screen, the better resolution.

Here are some other useful facts about monitors:

1-portable computers use a flat screen that uses liquid crystal display(LCD) technology not (CRT)

2-LCDs use less power than CRT monitors but cost six to eight times what an equivalent CRT

Figure 5.6 Touch Screen Monitor



Source: Stock Boston, © Bob Daemrich.

Figure 5.8 Flat Panel Computer Monitor



Source: Getty Images, Inc.

b) Printers

There are three types of printers:

A-impact printers:

Work like typewriters, using some kind of striking action, raised metal character strikes an inked ribbon that makes a printed impression of the character on the paper, these devices cannot produce high-resolution graphics, and they are relatively slow, noisy, and subject to mechanical failure, although inexpensive, they are becoming less popular

b) Non-impact printers

come in two styles **laser printers**. Are higher speed, high-quality devices that use laser beams to write information on photosensitive drums, laser printers produce very high quality resolution text and graphics.

Inject printers: work differently, by shooting fine streams of colored ink onto the paper. These are less expensive than laser printers, but offer less resolution quality.

c) Plotters: are printing devices that use computer-directed pens for creating maps and architectural drawings.

c) Voice output

a voice output system construct the sonic equivalent to textual words, which can then be played through speakers.

Figure 5.7 Standard Computer Monitor



Source: ViewSonic Corporation.

Computer Software

There are two major types of software: **system software** & **application software**

System software:

Is a set of instructions that serves primarily as an intermediary between computer hardware and application programs. System software provides important self regulatory functions for computer system, such as loading itself when the computer is first turned on, managing hardware resources such as secondary storage for all applications, and providing commonly used sets of instructions for all applications to use.

Application software

Is a set of computer instructions that provide more functionality to a user such as word processing and payroll programs.

System software can be grouped into two major functional categories: system control programs and system support programs.

System control programs

System control programs control the use of the hardware, software, and data resources of a computer system. The main system control program is the **operating system**

Operating system

Supervise the overall operation of the computer, including monitoring the computer's status and scheduling operations, which include input and output processes. In addition, the operating system allocates CPU time and main memory to programs running on the computer, and it also provides an interface between the user and the hardware.

The operating system provides services that include process management, virtual memory, file management, security, fault tolerance, and the user interface.

Process management

Means managing the program or programs (also called jobs) running on the processor at a given time, in the simplest case (a desktop operating system), the operating system loads a program into main memory and executes it. Some operating systems offer more other forms of process management such as multitasking, multithreading, and multiprocessing.

Multitasking:

Multitasking or multiprogramming is the management of two or more tasks, or programs running on the computer system at the same time. The first program is executed until an interruption occurs, such as a request for input, while the input request is handled, the execution of the second program begins because switching among these programs occurs so rapidly, they appear to be executing at the same time, however, because there is only one processor, only one program is actually in execution mode at any one time.

Multithreading:

Is a form of multitasking that focuses on running multiple tasks within a single application simultaneously. For example, a word processing application may edit one document while another document is being spell-checked.

Time-sharing:

is an extension of multiprogramming in this mode, a number of users operate online with the same CPU, but each uses a different input/output terminal. The programs of these users are placed into partitions in primary storage, execution of these programs rotates among all users, occurring so rapidly that it appears to each user as though he or she were the only one using the computer.

Multiprocessing

Occurs when a computer system with two or more processors can run more than one program, or thread, at a given time by assigning them to different processors, multiprocessing uses simultaneous processing with multiple CPUs.

Virtual memory

Simulates more main memory than actually exists in the computer system. it allows a program to behave as if it had access to the full storage capacity of a computer, rather than just access to the amount of primary storage installed in the computer. Virtual memory divides an application program or module into fixed-length portions called pages. the system executes some pages of instructions while pulling others from secondary storage. in effect, primary storage is extended into a secondary storage device, allowing users to write programs as if primary storage were larger than it actually is. this enlarged capability boosts the speed of the computer and allows it to efficiently run programs with very large numbers of instructions.

File management and security

The operating system is responsible for file management and security, managing the arrangement of, and access of, files held in secondary storage. the operating system creates and manages a directory structure that allows files to be created and retrieved by name. and it also may control access to those files based on permission and access controls. The operating system provides other forms of security as well, for example, it must typically provide protected memory and maintain access control on files in the file system, the operating system also must keep track of users and their authority level, as well as audit changes to security permissions.

Fault tolerance

Is the ability as a system to produce correct results and to continue to operate even in the presence of faults or errors. fault tolerance can involve error correcting memory, redundant computer components. And related software that protects the system from hardware, operating system, or user errors.

Common operating system tasks

- 1-monitoring performance
- 2-correcting errors
- 3-providing and maintaining the user interface
- 4-starting'booting' the computer
- 5-reading the program into memory
- 6-managing memory allocation to those programs
- 7-placing files and programs in secondary storage
- 8-creating and maintaining directories.
- 9-formatting diskettes
- 10-controlling the computer monitor

- 11-sending jobs to printers
- 12-maintaining security and limiting access
- 13-locating files
- 14-detecting viruses
- 15-compressing data

System support programs

the second major category as a system software, system support program, that support the operations, management and users of a computer system by providing a variety of support services, system utility programs, performance monitors, and security monitors are examples of system support programs.

System utilities are programs that have been written to accomplish common tasks such as sorting records, checking the integrity of diskettes (i.e. amount of storage available and existence of any damage) and creating directories and subdirectories. they also restore accidentally erased files, locate files within the directory structure, manage memory usage, and redirect output.

System performance monitors

Are programs that monitor the processing of jobs on a computer system performance and produce reports containing detailed statistics relating to the use of system resources, such as processor time, memory space, input/output devices, and system and application programs, these reports are used to plan and control the efficient use of the computer system resources and to help trouble-shoot the system in case of problems.

System security monitors

Are programs that monitor the use of a computer system to protect it and its resources from the unauthorized use, fraud, or destruction such programs provide the computer security needs to allow only authorized users access to the system. Security monitors also control use of the hardware, software, and data resources of a computer system.

Application software

Application software consists of instructions that direct a computer system to perform specific information processing activities and that provide functionality for users. this type of software consists of many widely used packages:

1) **Spreadsheets**: computer spreadsheets software transforms a computer screen into a ledger sheet, or a grid, of coded rows and columns. Users can enter numeric or textual data into each grid location, called a cell.

Computer spreadsheets packages can be used for financial information, such as statements or cash flow analysis.

Microsoft excels, and lotus is examples of spreadsheet packages.

2) **Data management**: data management software supports the storage, retrieval, and manipulation of related data.

Microsoft's access is an example of popular database management software.

3) **Word processing**: word processing software allows the user to manipulate text rather than just numbers. a typical word processing software package consists of an integrated set of programs including an editor program, a formatting program, a print program, a dictionary program, charting.

4) **Multimedia**: multimedia software combines at least two media for input or output of data. These media include audio (sound), voice, animation, video, graphics, and images.

Programming languages

Programming languages provide the basic building blocks for all systems and application software. Programming languages allow people to tell computers what to do and are the means by which software systems are developed, we will describe the five generations-levels-of programming languages:

1) Machine language

Is the lowest-level computer language, consisting of the internal representation of the instructions and data. These machine code-theactual instructions understood and directly executable by the CPU is composed of binary digits. machine language is the only programming language that the machine actually understands,therefore,machine language is considered the first-generation language .all other languages must be translated into machine language before the computer can run the instructions because computer's CPU is capable of executing only machine language programs. Machine language is extremely difficult to understand and use by programmers. as a result, increasingly more user-friendly languages have been developed.

These user oriented languages make it much easier for people to program. But they are impossible for the computer to execute without first translating the program into machine language.

The set of instructions written in a user _oriented language is called a source program.

The set of instructions produced after translation into machine language is called the object program.

Programming in a higher _level language (i.e., a user oriented language)is easier and less time consuming but additional processor time is required to translate the program before it can be executed.

2) Assembly language

Assembly languages are considered second-generation languages, it is more user-friendly because it represent machine language instructions and data locations in primary storage by using mnemonics, which people can more easily use.

Compared to machine language, assembly language eases the job of the programmers.

Translating an assembly language program into machine language is accomplished by system software program called an assembler.

3) Procedural language

- Called third-generation language
- Procedural language are much closer to natural language (the way we talk) and therefore, are easier to write, read.
- Procedural language use common words rather than abbreviated mnemonics.
- There are three examples of procedural languages FORTRAN, COBOL, and C.

4) **Nonprocedural languages**

- Called fourth-generation language.
- They can be used by non technical users to carry out specific functional tasks.
- These languages simplify the programming process as well as reduce the number of coding errors.
- They are common in database applications as query languages, report generators.

5) **Natural languages**

- Are called fifth –generation languages or" intelligent language"
- They are use mnemonics and tables.
- Most of these languages are still experimental because the programs that are translate natural language into machine – readable form are extremely complex and require a large amount of computer resources.

There are a handful of newer programming languages:

1) **Visual programming languages**

- Are used within graphical environment
- Are using a mouse, icons, and symbols on screen.
- Visual basic and visual C++ are examples of visual programming languages.

2) **Hypertext markup language(HTML)**

- Is an approach to data management in which data are stored in a network of nodes connected by links(called hyperlinks)
- Users can access data through an interactive browsing system.
- The combination of nodes ,links, and supporting indexes for any particular topic is a hypertext document
- A hypertext document may contain text, images, and other types of information such as data files, audio, and video.
- World Wide Web (www) uses HTML for creating and recognizing hypertext document.

3) **object-oriented programming languages**

- object-oriented programming (OOP)languages are based on the idea of taking a small amount of data and instructions about what to do with that data and putting both of them together into what is called an **object**
- C++ and JAVA are examples of OOP languages.

D OF
CHAPTER
TWO

UNIVERSITY OF TECHNOLOGY
COMPUTER SCIENCE DEPARTMENT
CHAPTER 3
Managing Organizational Data and information

Lecture: MSc. Ikhlas Khalaf

References

- 1-introduction to information technology by Turban&Rainer&Potter 2001
- 2-Introduction to information systems by James.O'Brien 1997
- Raymond McLeod, Jr. and George P. Schell-© 2004, Prentice Hall, Inc.
- 3

Learning Objectives

- 1) Discuss traditional data file organization and its problems**
- 2) Explain how a database approach overcomes the problems associated with traditional file environment, and discuss disadvantages to the database approach.**
- 3) Describe the three most common data models organize data and the advantages and disadvantages of each model.**

Introduction

Our previous chapters gave us an introduction to information system and organizational topics, as well as insights into how IT hardware and software function. These technologies and systems support organizations through their ability to handle-acquire, store, access, analyze, and transmit-electronic data. Properly managed these data become information.

The data hierarchy

A computer system organizes data in a hierarchy that begins with bits, and proceeds to bytes, fields, records, files, and databases, a bit represents the smallest unit of data a computer can process (a 0 or 1). and a group of eight bits, a byte, represent a single character, which can be a letter, number, or a symbol. a logical grouping of characters into a word, small group of words or a complete number is called a field. A logical grouping of related fields, comprise a record, logical grouping of records is called a file, and logical grouping of related files would constitute a database.

Example

A student's name in a university's computer files would appear in the "name" field.

While grouping student's name, the course taken, the date comprise a record

A student record in a single course would constitute a data file for that course; the student course file could be grouped with files on student's personal historic and financial backgrounds to create a student database

A record describes an entity; an entity is a person, place, thing or event about which information is maintained

Every record in a file should contain at least one field that uniquely identifies that record so that the record can be retrieved, updated, and stored. This identifier field is called the primary key.

For example, a student record in a college would probably use the social security number as its primary key .an addition, locating a particular record may require the use of secondary keys.

Secondary keys are other fields that have some information, but typically don't identify the file with complete accuracy, for example, the student's last name might be a secondary key. it should not be the primary key, as more than one student can have the same last name.

Table 6.1

The COURSE Table	
CODE	DESCRIPTION
MIS105	Information Systems Literacy
MIS315	Database Management Systems
POM250	Introduction to Operations Management
MGT300	Introduction to Management
MKT300	Introduction to Marketing
MKT444	Marketing Research
STA230	Descriptive Statistics
ACG201	Financial Accounting
ACG301	Cost Accounting
FIN305	Personal Finance
ECN375	Global Markets
ECN460	Banking Regulations
INT100	Cultural Diversity
INT201	Spanish for Business
INT202	French for Business

Storing and accessing records

records are stored in different ways on secondary storage media, and the arrangement determines the manner in which they can be accessed ,as we learned in previous lectures with sequential access ,data records must be retrieved in the same physical sequence in which they are stored.

In direct, or random, access, users can retrieve records in any sequence, without regards to the actual physical order on the storage medium.

Magnetic tape utilizes sequential file organization, where as magnetic disks use direct file organization.

The traditional file environment

From the time of the first computer application in business (mid 1950)until the early 1970s,organizations managed their data in file environment. This environment began because organizations typically began automating one application at a time.

These systems grew independently. Without overall planning. each application required its own data, which were organized in a data file. A data file is a collection of logically related records.therefore,in a file management environment, each application has a specific data file related to it, containing all the data records needs by the application, over time, organizations developed numerous applications, each with an associated, application-special data file .for example a university has many computer-based applications for students. These applications include course registration, fee payment, and grades among others. in a file management environment, each of these applications would have its own data file .this approach to data management, where the organization has multiple application with related data files, is considered the traditional approach.

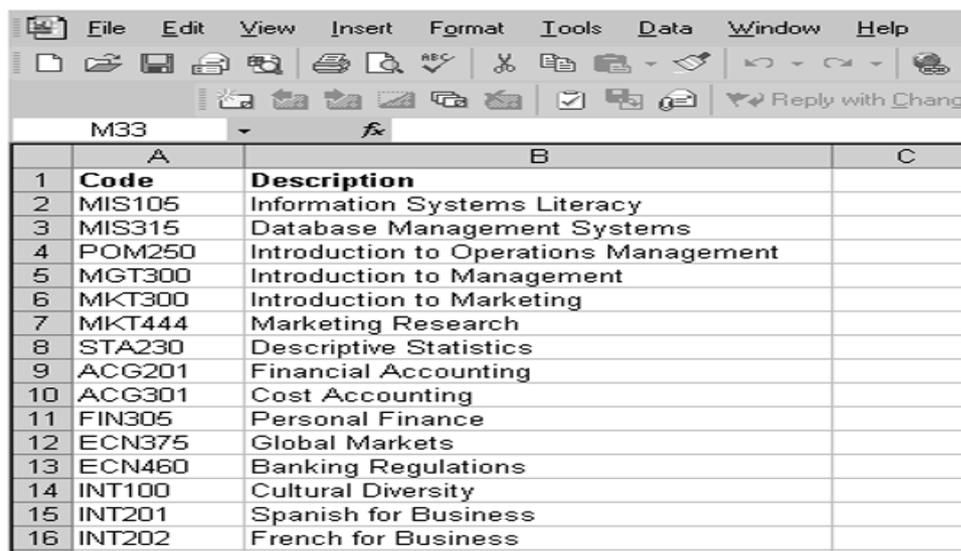
The Spreadsheet as a Simple Database

A table of rows and columns can be represented in a spreadsheet
The columns of the spreadsheet represent the data fields while the column headings contain data field names

Rows of the table contain the field values

Figure 6.1 illustrates an Excel spreadsheet containing the values from the COURSE table shown in Table 6.1

Figure 6.1 Spreadsheet Example of the COURSE Table



	A	B	C
1	Code	Description	
2	MIS105	Information Systems Literacy	
3	MIS315	Database Management Systems	
4	POM250	Introduction to Operations Management	
5	MGT300	Introduction to Management	
6	MKT300	Introduction to Marketing	
7	MKT444	Marketing Research	
8	STA230	Descriptive Statistics	
9	ACG201	Financial Accounting	
10	ACG301	Cost Accounting	
11	FIN305	Personal Finance	
12	ECN375	Global Markets	
13	ECN460	Banking Regulations	
14	INT100	Cultural Diversity	
15	INT201	Spanish for Business	
16	INT202	French for Business	

Problems with a file approach

1) Data redundancy

as application and their data files were created by different programmers over a period of time the same piece of information could be duplicated in several places. in the university example, each data file will contain records about students, many of whom will be represented in other data files, therefore, student's files in the aggregate will contain some amount of duplicate data.

2) Data inconsistency

data redundancy leads to the potential for data inconsistency, which means that the various copies of the data no longer agree, for example, if a student changes his or her address, the new address must be changed across all applications in the university that require the address

3) Data isolation

file organization also leads to difficulty in accessing data from different applications, for example, in a university, an administrator who wanted to know which student taking advanced courses were also starting players on the football team would most likely not be able to get answer from the computer-based file system. The administrator would probably have to manually compare printed output data from the two data files. this manual process would take a great deal of time

Database: The modern approach

a database which is a logical group of related files, can eliminate many of the problems associated with the traditional file environment, with the database approach, all the data are typically contained in the same storage location, rather than residing in many different files across the organization, unlike the traditional approach, in which different programs access the different data files, the database is arranged so that one set of software programs the database management system provides access to all data. therefore data redundancy, data isolation and data inconsistency are minimized, and data can be shared among all users of the data, an addition, security and data integrity are increased.

Locating data in database

A database is collection of related files, and where those related files are located can greatly affect user accessibility, query response times, data entry, security, and cost in general, database files can be centralized or distributed.

Centralized Database

Centralized database has all the related files in one physical location, centralized database files on large mainframe computers were the main database platform for decades. Primarily because of the enormous capital and operating costs

of other alternatives. not only do centralized database save the expenses associated with multiple computers, but they also provide database administrators with the ability to work on a database as a whole at one location. Files can generally be made more consistent with each other when they are physically kept in one location because file changes can be made in a supervised and orderly fashion. Files are not accessible except via the centralized host computer, where they can be protected more easily from unauthorized access or modification. Also, recovery from disasters can be more easily accomplished at a central location. like all centralized system,however,centralized database are vulnerable to a single point of failure, when the centralized database computer fails to function properly, all users suffer,additionally,access speed is often a problem when users are widely dispersed and must do all of their data manipulations from great distances, thereby incurring transmission delays.

Distributed database

Distributed database has complete copies of a database, or portions of a database. in more than one location, which is usually close to the user

There are two types of distributed databases

1)**replicated database** :-has complete copies of the entire database in many locations.primarily to alleviate the single point of failure problems of a centralized database as well as to increase user access responsiveness,there is significant overhead,however.in maintaining consistency among replicated databases, as recorded are added,modified,and deleted.

2) **Partitioned database**:-is subdivided, so that each location has a portion of the entire database (usually the portion that means users' local needs) this type of a database provides the response speed of localized files without the need to replicate all changes in multiple locations. One significant advantage of a partitioned database is that data in the files can be entered more quickly and kept more accurate by the users immediately responsible for the data.

Database Management System (DBMS)

The software program(or group of programs)that provides access to a database is known as a database management system(DBMS).the DBMS permits an organization to store data

in one location, from which it can be updated and retrieved. and it provides access to the stored data by various application programs. DBMS also provide mechanisms for maintaining the integrity of the stored information ,managing security and user access, recovering information when the system fails, and accessing various database functions from within an application written in a third-generation, fourth-generation, or object oriented language. The DBMS provides users with tools to add, delete, maintain, display, print, search, select, sort, and upgrade data. These tools range from easy-to-use natural language interfaces to complex programming languages used for developing database applications.

DBMS components

There are four main components in a database management system:-

1) Data model:-

The data model defines the way data are conceptually structured, examples include the hierarchical, network, relational, object-oriented, object relational, hypermedia.

2) Data definition language:

The data definition language (DDL) defines what types of information are in the database and how they will be structured. The DDL defines each data element as it appears in the database before that data element is translated into the forms required by the applications the DDL is essentially the link between the logical and physical views of database.

3) Data manipulation language

The data manipulation language (DML) is used with third-generation, fourth generation, or object-oriented language to query the contents of the database, store or update information in the database, and develop database applications. the DML allows users to retrieve, sort, displays, and delete the contents of the database.

4) Data dictionary

the data dictionary stores definitions of data elements and data characteristics such as individuals, business functions, programs ,and reports that use the data element, as well as the

physical representation, responsible parties in the organization(data ownership)and security a data element represents a field. Besides listing the standard data name and aliases for the element.

Database management systems provide many advantages to the organization:-

- 1-improved strategic use of corporate data
- 2-reduced complexity of the organization's information system environment
- 3-reduced data redundancy and inconsistency
- 4-enhanced data integrity
- 5-application –data independence
- 6-improved security
- 7-reduced application development and maintenance costs
- 8-improved flexibility of information system
- 9-increased access and availability of data and information

Logical data models

The three most common data models are hierarchical, network, and relational:

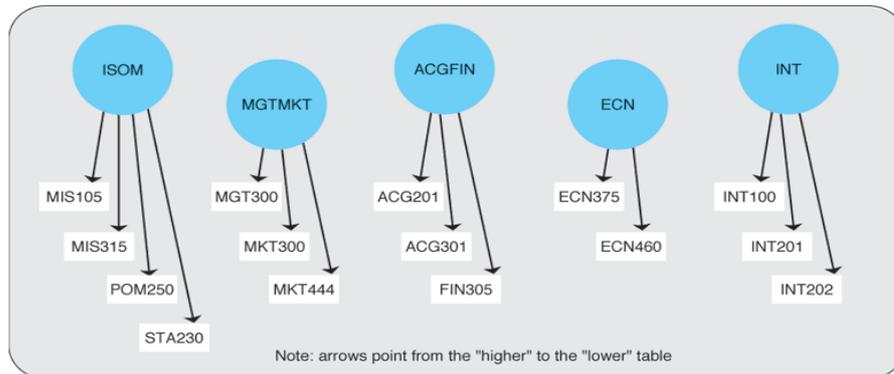
1) Hierarchical database model

The hierarchical database model rigidly structures data into an inverted "tree" in which each record contains two elements, the first is a single root or master field, often called a key, which identifies the type location or ordering of the records, the second is a variable number of subordinate fields, which define the rest of data within a record. As a rule, while all fields have only one "parent", each parent may have many "children", an example of a hierarchal database is shown in figure below.

The hierarchical model was developed simply because hierarchical relationships are commonly found in many traditional business organizations and processes.

The strongest advantage of the hierarchical is the speed and efficiency with which it can be searched for the data

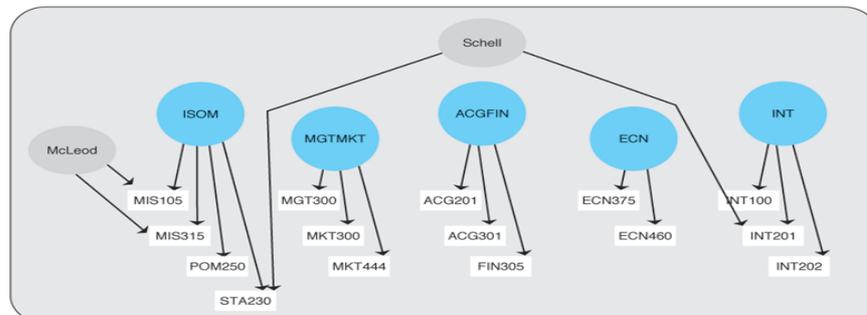
Figure 6.2 The Hierarchical Structure between the DEPARTMENT and COURSE Tables



2) Network database model

the network database model creates relationships among data through a linked list structure in which subroutines records (called members, not children) can be linked to more than one data element (called an owner) similar to the hierarchical model, the network model uses explicit links called pointers, to link members and owners. Physically, pointers are storage addresses that contain the location of a related record. with the network approach, a member record can be linked to an owner record and, at the same time, can itself be an owner record linked to other sets of members, figure below shows the network model.

Figure 6.3 Adding a Table for FACULTY Is Beyond the Ability of Hierarchical Database Structures



3) Relational database model

While most business organizations have been organized in a hierarchical fashion, most business data---especially accounting and financial data---have traditionally been organized into simple tables of columns and rows. tables allows quick comparisons by row or column, and items are easy to retrieve by finding the point of intersections of a particular row and column.

The Database Concept

- The logical integration of records across multiple physical locations is called the **database concept**. It is not dependent on the user's perception of logical location
- Two primary goals of the database concept are to minimize data redundancy and to achieve data independence
- **Data independence** means placing the data specifications in tables and dictionaries that are physically separate from the programs
- **Data dictionary** refers to the definition of data stored within the database and controlled by the DBMS

CREATING A DATABASE

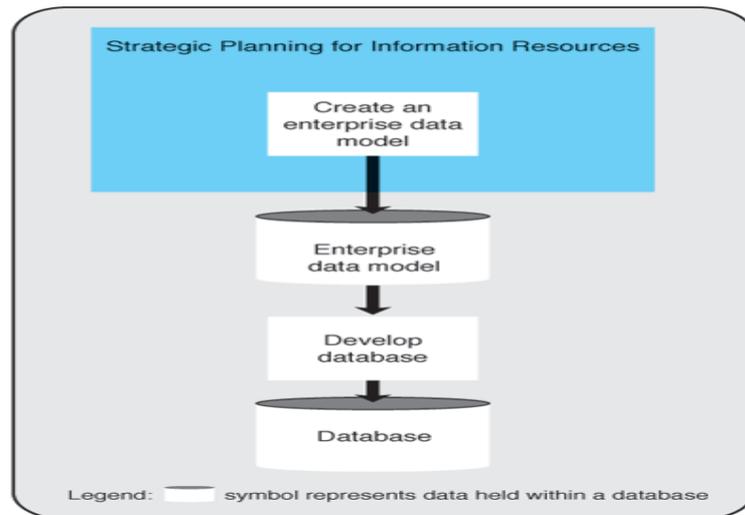
- In the conceptual model you:
 - Determine the data that you need
 - Describe the data
 - Enter the data into the database

Determine the Data Needs

The two main approaches to determine data needs are:

- The Process-Oriented Approach:
 - 1. The *problem* is defined
 - 2. The *decisions* required to solve the problem are identified
 - 3. For each decision the required *information* is described
 - 4. The *processing* necessary to produce the information is determined
 - 5. The *data* required by the processing is specified
- The Enterprise Modeling Approach
 - the firm's entire data needs are determined and then stored in the database
- The **enterprise data model** is shown in Figure 6.8

Figure 6.8 Creating an Enterprise Data Model



Data Modeling Techniques

- Modeling the firm's data needs is supported by techniques that:
 - Describe the data
 - Describe how the data aggregates into tables
 - Describe how tables relate to each other
- Entity-relationship diagrams are used to describe relationships between conceptual collections of data so that their related records can be joined together
- Class diagrams are used to describe both the data relationships and the actions that operate on the data in the relationships

MANAGING THE DATABASE

- Database management systems perform functions that most users never see
- The infrastructure is needed so that the database can be maintained and modified and also to assure its efficient operation

Resources

- The **performance statistics processor** component of the DBMS maintains information that identifies what data is being used, who is using it, when it is being used, and so forth

- As the database management system runs, it keeps a **transaction log** that notes every database action taken as well as the exact time the action was taken
- A **backup** copy of the database is also made periodically

Database Personnel

- The **database administrator (DBA)** has both technical and managerial responsibilities over the database resource.
- **Database programmers** create the database applications required by firms for their corporate use
- The **database end-user**, by virtue of the decisions made and the amount of data retrieved, also has a major impact on database design, use, and efficiency

DATABASE MANAGEMENT SYSTEMS IN PERSPECTIVE

- The DBMS makes it possible to create a database, maintain its contents, and disseminate the data to a wide audience of users without costly computer programming
- Its ease of use allows managers and professional staff to access database contents with only modest training
- Every facet of information technology has both advantages and disadvantages and database management systems are no exception

DBMS Advantages and Disadvantages

- The DBMS enables both firms and individual users to:
 - Reduce data redundancy
 - Achieve data independence
 - Retrieve data and information rapidly
 - Improve security
- A decision to use a DBMS commits a firm or user to:
 - Obtain expensive software
 - Obtain a large hardware configuration
 - Hire and maintain a DBA staff

**END OF
CHAPTER
THREE**

UNIVERSITY OF TECHNOLOGY
COMPUTER SCIENCE DEPARTMENT
CHAPTER 4
Telecommunications and networks

Lecture: MSc. Ikhlas Khalaf

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Learning Objectives

- **Describe the components of telecommunication system.**
- **Describe the five basic types of communication media, including their advantages and disadvantages.**
- **Classify the major types of networks**
- **Differentiate among the three types of distributed processing.**
- **Identify seven telecommunication application.**

Introduction

Computer technology is truly a modern marvel that has transformed how we do business, as well as how we manage our personal affairs. The computer's influence on today's modern competitive environment would be much diminished without the telecommunications and computer networks available today. Their development has accompanied the amazing advances in computing over the last three decades. In most firms, communication between computing technologies is just important as the computer itself.

The telecommunications system

A telecommunication system consists of hardware and of software that transmits information from one location to another. These systems can transmit text, data, graphics,, voice,document,or full –motion video information. The major components of a telecommunications system include the following:

- **Hardware** all types of computers(e.g.,desktop,server,mainframe)and communications processes (such as modems)
- **Communications media** the physical media through which electronic signals are transmitted, including wireless media(used with satellites and cell phones)
- **Communication networks** the links among computers and communications devices.

- **Communication software** that controls the telecommunication system and the entire transmission process.
- **Data communication providers** regulated utilities private firms that provide data communication services.
- **Communication protocols** the rules for transmitting information across the system.
- **Communication applications** electronic data interchange teleconferencing, video conferencing, electronic mail, as well as others.

Signals

Telecommunications media carry two basic types of signals, analog and digital. Analog signals are continuous waves that transmit information by altering the characteristics of the waves. Analog signals have two parameters, amplitude and frequency. For example, voice and all sounds are analog, traveling to human ears in the form of waves. The higher the waves (or amplitude), the louder the sounds; the more closely packed the waves, the higher the frequency. Radio, telephone, and recording equipment historically transmitted and received analog signals, but they are beginning to change to digital signals.

Digital signals do not have the characteristic "wave" shape that analog signals do, rather, they are discrete pulses that are either **on** or **off**. This quality allows them to convey information in a binary form that can be clearly interpreted by computers. Computers typically cannot distinguish whether an analog wave is in an "on" mode or an "off" mode. With digital signals, the signal is clearly on or off.

Communications processors

Communications processors are hardware devices that support data transmission and reception across a telecommunication system. These devices include: modems, multiplexer, front-end processor, and concentrators.

Modems

The U.S. public telephone system (called POTS, for "plain old telephone service") was designed as an analog network to carry voice signals or sounds in an analog wave format. In order for this type of circuit to carry digital information, that information must be converted into an analog wave pattern. The conversion from digital to analog is called modulation, and the reverse is demodulation. The device that performs these two processes is called a **modem**.

Modems are always used in pairs. The unit at the sending end converts a computer's digital information into analog signals for transmission over analog lines at the receiving end; another modem converts the analog signal back into digital. Signals for the receiving computer like most communication equipment, a modem's transmission speed is measured in bits per second (bps), typical modem speeds range from 14,400 to 56,600 bps.

Multiplexer

A multiplexer is an electronic device that allows a signal communication channel to carry data transmissions simultaneously from many sources. multiplexers lower communication costs by allowing devices to share communications channels .multiplexing thus make more efficient use of these channels by merging the transmission of several computers(e.g., personal computers)at one end of the channel ,while a similar unit separates the individual transmissions at the receiving end(e.g., a mainframe).

Front end processor

With most computers, the central processing unit(CPU)must communicate with several computers at the same time routine communication tasks can abcorb a large proportion of the CPU processing time, leading to degraded performance on more important jobs in order not to waste valuable CPU time , many computers systems have a small secondary computer dedicated solely to communication. Known as front end processor, this specialize computer manages all routing communications with peripheral devices. The functions of a front end processor include coding and decoding data; detecting errors; and receiving, recording, interpreting, and processing the control information that is transmitted.

Communication media and channels

For data to be communicated from one location to another, some form of pathway or medium must be used. these pathways are called communications channels. And they include cable **media** and **wireless media**

A) Cable media

Cable media use physical wires or cables to transmit data and information. there are three types of cable media:

1) twisted-pair wire

Is the most prevalent form of communication wiring ;its used for all most all business telephone wiring .twisted-pair wire consists of strands of copper wire twisted in pairs .its relatively inexpensive to purchase ,widely available ,and easy to work with. And it can be made relatively an obtrusive by running it inside walls, floors, and ceilings. However, twisted-pairs wire has some significant disadvantages .it emits

Electromagnetic interference, is relatively slow for transmitting data, is subject to interference from other electrical sources, and can be easily "tapped" for gaining unauthorized access to data by unintended receivers .

2) Coaxial cable

Consists of insulated copper wire .it is much less susceptible to electrical interference than is twisted pair wire and can carry much more data. For these reasons, it is commonly used to carry high –speed data traffic as well as televisions signals.however, coaxial cable is more expensive and more difficult to work with than twisted –pair wire .it is also some what inflexible. Data transmission over coaxial cable is divided into two basic types

1) Base band transmission: transmission is analog, and each wire carries only one signal at a time

2) Broadband transmission: transmission is digital and each wire can carry multiple signals simultaneously.

3) Fiber optical cable

Fiber optics technology combined with the invention of the semiconductor laser provides the means to transmit information through clear glass fibers in the form of light waves ,instead of electric current .fiber optic cables consist of thousand of very thin filaments of glass fibers that conducts light pulses generated by lasers at very – high –speed transmission frequencies

Fiber optics cables offer significant size and weight reduction over traditional cable media. they also provide increased speed ,greater data –carrying capacity ,and greater security from interference and tapping. however ,the costs of fiber and difficulties installing the fiber optic cable slowed its growth

B) Wireless media

With the exception of fiber optic cables, cables present several problems such as the expense of installation and change, as wee as, fairly limited capacity. the alternative is communication over wireless media, the key to mobile communications in today's rapidly moving society is data transmission over electronic magnetic media, the "airwaves"

Common wireless data transmission includes

1) Microwave transmissions

2) Communication satellite

3) Pagers

- 4) Cellular telephones
- 5) Radio
- 6) Infrared
- 7) Cellular radio technology
- 8) Mobile computing
- 9) Personal communication service

Networks

A computer network consists of communication media, devices, and software needed to connect two or more computer systems and/or devices.

Computer networks are essential to modern businesses for many reasons:

- Networked computer systems enable organizations to be more flexible and adaptable to meet rapidly changing business conditions
- Networks enable companies to share hardware, computer applications, and database across the organization
- Networks make it possible for geographically dispersed employees and workgroups to share documents, ideas, and opinions.
- The network is increasingly the link between businesses and between businesses and their customers.
- **There are two general networks sizes :local area network(LAN) and wide area network(WAN)**

Private Lines

- **A private (leased or dedicated) line is a circuit that is always open to carry communication traffic**
- **Provided by the common carrier, the telephone company, your organization pays a fixed monthly fee to use the line. The more use the line receives, the smaller the cost is per-unit of data transmitted**

Virtual Private Network (VPNs)

- VPNs give users the security and speed of a private line along with the low cost of using the Internet
- Tunneling software establishes VPN through a set of intermediary locations that host the data while its being transmitted

- Tunneling is conceptually similar to establishing a private, secure circuit while the data is being sent

COMMUNICATIONS - NETWORKS

- The International Organization for Standardization (www.iso.ch), founded in 1946, established the Open Systems Interconnection (OSI) standard architecture for network connections.
- OSI consists of a seven-layer model (Table 5.6) and the levels are detailed so that the exact function for each layer of communication can be plainly defined
- Two or more levels may be used by a single piece of communications hardware, while end- to- end communications involve all layers of the model
- Common networking devices are listed in Table 5.7.

Protocols for Computer Communication

- **Computers (“mainframes”) were initially designed to share data with terminals that had no storage or processor and to simply provide a means for entering and displaying data from the computer**
- **In response to the communications limitation, IBM and others began developing communications protocols**
- **An open protocol is a format whose specifications are open to the public and can be used at no cost**

Ethernet

- Xerox in cooperation with Intel and Digital Equipment Corporation, developed a different open protocol peer-to-peer communications architecture in the late 1970s called Ethernet
- Unlike Token Ring, Ethernet works over a bus, rather than a ring and doesn't use tokens

- Instead, if a computer on the network wishes to send data over the communications medium it simply checks to see if data is currently being transmitted. If not, it sends its message

Packets

- For large data transfers, messages need to be broken into smaller pieces so that the message from one computer does not dominate the communications medium
- These smaller entities are called packets
- The most important packet-switching protocol is the one used by the Internet, Transmission Control Protocol/Internet Protocol (TCP/IP)
- TCP/IP handles packetization and also decides how the packets are best routed through the network from source to destination computer

Internet Network Addresses

- In order to route packets through the network, each computer handling packets of data must have a unique address
- This is called the IP address
- IP addresses are made up of a set of four 1-byte numbers, each between 0 to 255, separated by periods
- They are often written in dotted decimal notation, such as: 128.64.32.218
- The left part of this number represents the number of the network the computer is on, while the right part is the host number of that specific computer

NETWORK TYPES

- Understanding the different types of networks is important since plays a different role in a firm's communications strategy.
- Different network types can effectively compartmentalize communications
- Computers on local area networks are connected using devices called network interface cards (NICs).

Figure 5.13 Three Common Local Area Network Configurations

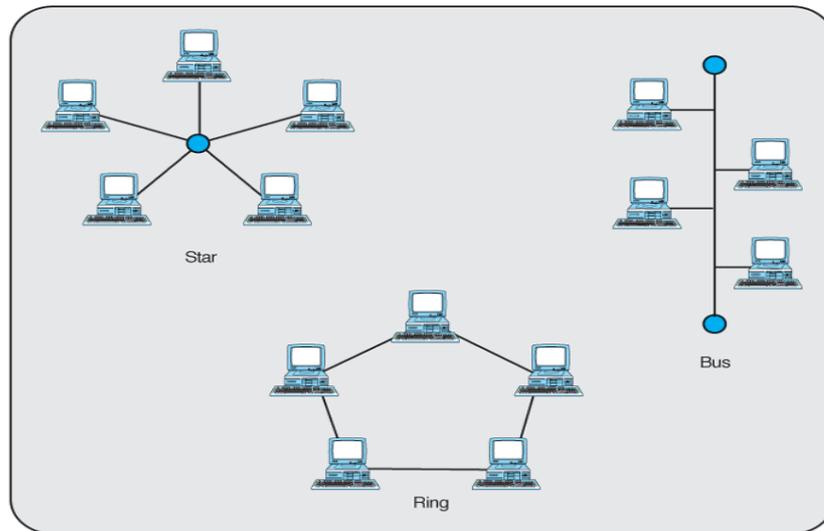
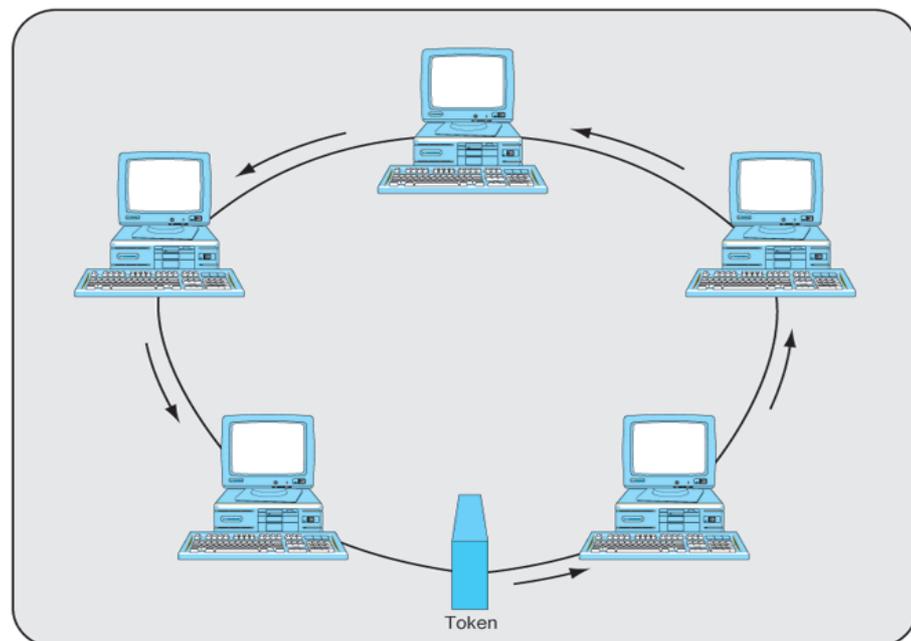


Figure 5.12 Token Ring Protocol Example



Local Area Network

A local area network (LAN) connects two or more communicating devices within 2,000 feet (usually within the same building), so that every user device on the network has the potential to communicate with any other device.

A LAN allows a large number of users to share corporate resources (such as storage devices, printers, program, and data files) and integrates a wide range of functions into a single system .in an office, a LAN can give users fast and efficient

access to a common bank of information while also allowing office to pool resources such as printers and facsimile machines

A LAN comes in an assortment of topologies. **The topology** of a network is the physical layout and connectivity of a network. Special protocols or rules of communications are often used on specific topologies, but the two concepts are different **topology** refers to the way the channels connect the nodes ,whereas **protocol** refers to the rules by which data communication take place over these channels ,**there are five basic network**

topologies:star,bus,ring,hierarchical,and hybrid

A LAN consists of cabling or wireless technology linking individual devices ,network interface cards(special adapters serving as interfaces to the cable).and software to control LAN activities .the LAN network interface card specifies the data transmission on rate ,the size of message units, the addressing information attached to each message ,and network topology..

LANs employ a baseband or a broadband channel technology, in baseband LANs ,the entire capacity of the cable is used to transmit a single digitally coded signal, in broadband LANs ,the capacity of the cable is divided into separate frequencies to transmit it to carry several signals at the same time.

Wide Area Network(WAN)

Although most businesses have to transmit data through a LAN ,most also have to send and receive data beyond the confines of the local area network .this is accomplished by connecting to one or more wide area network .**wide area networks (WAN)** ,are long haul, broadband (analog) networks covering wide geographic areas .they generally are provided by common carriers .WANs include regional networks such as telephone companies or international networks such as global communications services providers .they usually have very large capacity circuits efficiently .WANs may combine switched and dedicated lines ,microwave ,and satellite communications.

Some WANs are commercial, regulated networks, while others are private owned, usually by large businesses that can afford the costs, some WANs, however are "public" in terms of their management, resources, and access .one such public

WANs is the internet, the foundation of the worldwide information superhighway .

WANs can use any of the five basic types of network topologies, but they most generally use the star topology in order to more tightly control the network .

Network Communications Software

Communications software provides many functions in a network. These functions include

- Error checking
- Message formatting
- Communications logs (listing of all jobs and communications in a specified period of time).
- Data security and privacy.
- Translation capabilities

These functions are performed by various parts of network communications software, which includes **1-network operating system**, **2-network management software**, and **3-protocols**.

1-Network Operating Systems

A network operating system (NOS) is system software that controls the hardware devices, software, and communications media and channels across a network, the NOS enables various devices to communicate with each other, NETWARE by Novell and Windows NT from Microsoft are popular network operating systems for LANs.

2-Network Management Software

Network management software has many functions in operating a network, these functions

- reduce time spent on routine tasks, such as remote, electronic installation of new software on many device across a network,
- They also provide faster response to network problems, greater control over the network, and, remote diagnosing of problems in devices connected to the network.
- Network management software performs functions that decrease the human resources needed to manage the network.

3-Protocols

Computing devices that are connected to the network (often referred to as "nodes" of the network) access and share the network to transmit and receive data. These components work together by adhering to a common set of rules that enable them to communicate with each other, this set of rules and procedures governing transmissions across a network is a **protocol**

The principle function of protocols in a network are line access and collision avoidance, line access concerns how the sending device gains access to the network to send a message, collision avoidance refers to managing message transmission so that two messages do not collide with each other on the network, other functions of protocols are to identify each device in the communication path, to secure the attention of the other device, to verify correct receipt of the transmitted message, to verify that a message requires retransmission because it cannot be correctly interpreted, and to perform recovery when errors occur.

The most common protocol is **Ethernet, TCP/IP**
The transmission control protocol/internet protocol (TCP/IP) is a file transfer protocol that can send large files of information across sometimes-unreliable networks with assurance that the data will arrive in uncorrupted form. TCP/IP allows efficient and reasonably error-free transmission between different systems and is the protocol of the internet, TCP/IP is becoming popular with businesses organization due to its reliability and the ease with which it can support intranets and related functions.

Telecommunications applications

The workplace of today differs drastically from the workplace of just five years ago, within that brief span of time various telecommunications applications have been put in wide use of companies large and small, such applications have brought new efficiencies to the workplace, and they have the potential to help businesses achieve competitive advantages.

1-Electronic mail

computer-based messages can be electronically manipulated, stored, combined with other information, and transmitted through telephone wires or wireless networks ,with electronic mail(called e-mail) the sender inputs the message at a terminal and includes address and routing instructions to get the message to the intended recipient. Any other electronic objects, such as, graphic, sounds, motion, or application files, may be attached to the message .the system then automatically routes the message to the recipient .at the receiving end ,e recipient can read the message on a computer terminal, print it ,file it edit it, and /or forward it to other recipient.

2-Videoconferencing

Videoconferencing allows two or more people to have "face-to-face" communications with a group in another location(s) without having to be present in person .although limited by the inherent limitations of audio and video, these visual conferences save the time and expenses involved in travel. The ability to use Videoconferencing can be key to achieving business goal. Videoconferencing is much more expensive than audio conferencing, due to more expensive equipment requirements and the need for greater bandwidth .however communications research has shown that much of the information conveyed between individuals in person is communicated by nonverbal means .therefore; videoconferencing provides a richer means of communicating than text or audio alone.

3-Distance Learning

Telecommunications technology is enabling many people to learn outside the classroom, a process called **distance learning**,

Distance learning can be point to point, where students gather at a specific location and the class is transmitted to them in real time (different place, same time).the students are able to see and hear the professor ,and the professor can hear the students offsite and may be able to see them as well the off-site location may be around the same campus or across the world

END OF
CHAPTER
FOUR

**UNIVERSITY OF TECHNOLOGY
COMPUTER SCIENCE DEPARTMENT
CHAPTER FIVE
THE INTERNET AND INTRANET
Lecture: MSc. Ikhlas Khalaf**

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Turban&Rainer&Potter 2001
- 2-Introduction to information systems by James.OBrien 1997
- 3 -Raymond McLeod, Jr. and George P. Schell-© 2004,
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Learning Objectives

Describe what the internet is?, how it work

And how users connect to it

Describe the capabilities that the internet offers to users

Describe the world wide web and differentiate it from the internet

Identify and describe the tools that allow users to view and search the web

Define the term intranet and discuss how intranet are use by businesses.

THE INTERNET AND INTRANETS

What is the internet?

The internet, which is the largest computer network in the world, is actually a network of networks .it is a collection of more than 200,000 **individual** computer networks owned by governments, universities, nonprofit groups, and companies. These interconnected networks exchange information seamlessly by using the same open, nonproprietary standards and protocols. They are connected via high –speed, long distances, and backbone networks.

Thus, the internet forms a massive electronic communications network among businesses, consumers, government's agencies, schools, and other organizations world-wide. Equally important, the internet has opened up exciting new possibilities that challenge traditional ways of interacting, communicating, and doing business.

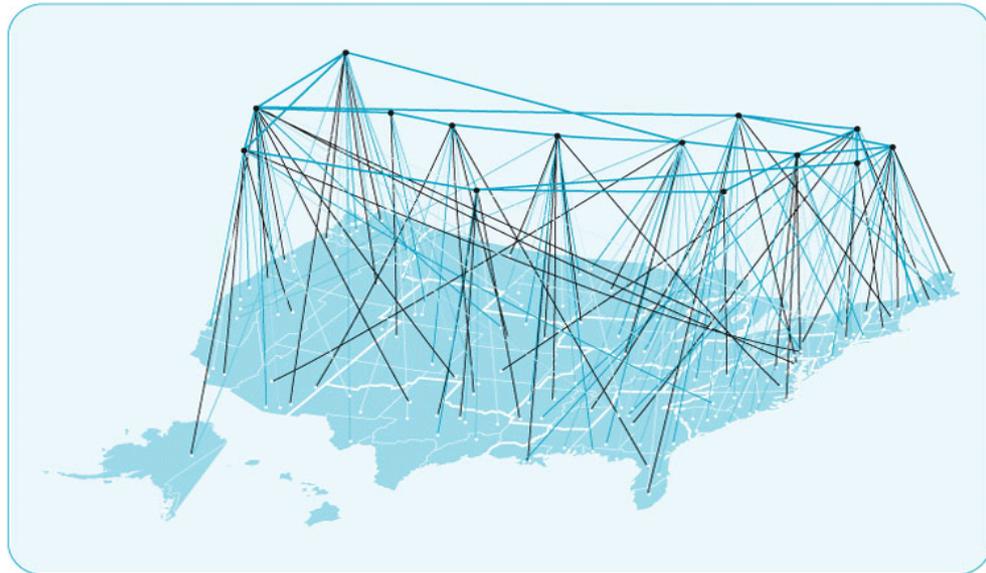
The Evolution of the Internet

The internet began as one network, called the ARPANET, the ARPANET was a 1969 U.S. government experiment in packet-switched networking .ARPA was the department of defense advanced research projects agency. the ARPANET originally linked a largely technical audience composed of the military government agencies ,and academic researchers and scientists .the original goal of the project were to allow researchers and scientists to share computing resources and exchange information ,regardless of their location ,and to create a resilient ,fault tolerance ,wide area network for military communications ,the original ARPANET split into two networks in the early 1980s,the ARPANET and MILNET ,but connections between two networks allowed communications to continue .

Access to the ARPANET in the early years was limited to the military, defense contractors, and universities doing defense research. cooperative ,decentralized networks such as UUCP, a worldwide UNIX communications networks, and USENET (user's network)originated in the late 1970s,initially serving the academic community and later serving commercial organizations .in the early 1980s,more networks ,such as the computer science network(CSNET)and BITNET began providing nationwide networking to the academic and research communities .these networks were not part of the internet ,but special connections were made to allow the exchange of information between the networks .the national science foundation network (NSFNET)originated in the 1986,the linked researchers across the country with five supercomputer centers, the seamless internetworking of all these networks gave rise to the internet we know today.

- Understanding the Internet's evolution can help forecast future opportunities
- ARPANET makes it possible for military personnel and civilian researchers to exchange information relating to military matters. It forms a major portion of what has come to be known today known as the Internet
- In 1989, Tim Berners-Lee, working at CERN, came up with a way for physicists to communicate using **hypertext** electronically linked documents.
- This system quickly evolved into what is now known as the World Wide Web

Figure 3.6 The Internet Is a Network of Networks



Source: Based on Parsons and Oja, "New Perspectives on Computer Technology," Course Technology, 1994, p. NP212.

The Internet Today

The number of computers and networks connected to the internet continues to grow rapidly. these computers and networks have been set up voluntarily to conform to the internet's set of nonproprietary standard protocols .the power of the internet rests in this uniform, open architecture .in 1998 less than 2 percent of the world's adults had access to the internet .it is estimated that at beginning of the twenty –first century ,750 million people _around 25 percent of the world's adults _will have access to the one million networks that will make up the internet .

The Operation of the Internet

The set of rules used to send and receive packets from one machine to another over the internet is known as the internet protocol (IP), which operates at the network layer of the seven-layer ISI-OSI model. Other protocols are used in connection with IP, the best known of which is the transport control protocol (TCP), which operates at the transport layer of the ISO-OSI model. The IP and TCP protocols are so commonly used together that they are referred to as the TCP/IP protocol used by most internet applications.

The internet, a packet-switching network, breaks each message into packets; each packet contains the addresses of the

sending and receiving machines as well as sequencing information about its location relative to other packets in the message. Each packet can travel independently across various network interconnections. Therefore, packets may utilize different paths across the internet and arrive out of the sequence. When all packets arrive at the receiving computer, they are reassembled into the complete message.

Addresses on the Internet

Each computer on the internet has an assigned address. Called the IP address, that uniquely identifies it from other computers. The IP numbers have four parts, separated by dots. For example, the IP address of one computer may be 135.62.128.91

Most computers also have names, which are easier for people to remember than IP addresses, these names are derived from a naming system called the domain name system (DNS).

Services Provided by the Internet

The internet provides three major types of services:

- 1) Communications services which include electronic mail, USENET newgroups, LISTSERVs, chatting, instant messaging, internet telephony, and internet fax.
- 2) Information retrieval: include gophers, archie, WAIS, file transfer protocol (FTP)
- 3) World wide web (www)

BUSINESS APPLICATIONS OF THE INTERNET

- The Internet can be used for any business application that involves data communication, including both communication inside the firm and with the environment
- Unlike proprietary networks, the Internet can be used with any computer platform without any special effort to access the network
- The Internet also makes it possible to transmit a wider variety of media than can be handled over most conventional networks
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Suggestions for Successful Internet Use

1. Make sure your Web site is robust
2. Make sure your browser and database structure are both flexible and intuitive
3. Emphasize content

4. Update often
5. Look beyond customers
6. Target content to specific users' needs
7. Make the interface intuitive
8. Be in the right Web location
9. Create a sense of community
10. Get help if you need it

the world wide web

Many people believe that the web is synonymous with the internet, but that is not the case. The internet functions as the transport mechanism, and the world wide web (called the web, WWW, or w3) is an application that uses those transport functions. Other applications also run on the internet. With e-mail being the most widely used.

The web is a system with universally accepted standards for storing, retrieving, formatting, and displaying information via a client/server architecture. The web handles all types of digital information including text, hypermedia, graphics, and sound.

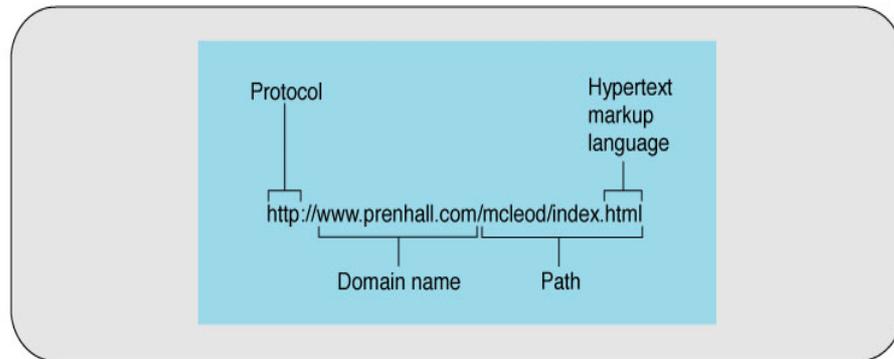
The web is based on a standard hypertext language called hypertext markup language (HTML) which formats documents and incorporates dynamic hypertext links to other documents stored on the same or different computers.

Offering information through the web requires establishing a home page, which is a text and graphical screen display that usually welcomes the user and explains the organization that has established the page. In most cases, the home page will lead users to other pages. All the pages of a particular company or individual are known as a web site. Most web pages provide a way to contact the organization or the individual. The person in charge of an organization's web site is called webmaster.

To access a web site, the user must specify a uniform resource locator (URL), which points to the address of a specific resource on the web. For instance, the URL for Microsoft is <http://www.microsoft.com>. HTTP stands for **hypertext transport protocol**. Which is the communications standard used to transfer pages across the WWW portion of the internet? HTTP defines how messages are formatted and transmitted and what actions web servers and browsers should take in response to various commands. www.microsoft.com is

the domain name identifying the web server storing the web sites.

Figure 3.7 World Wide Web Terminology



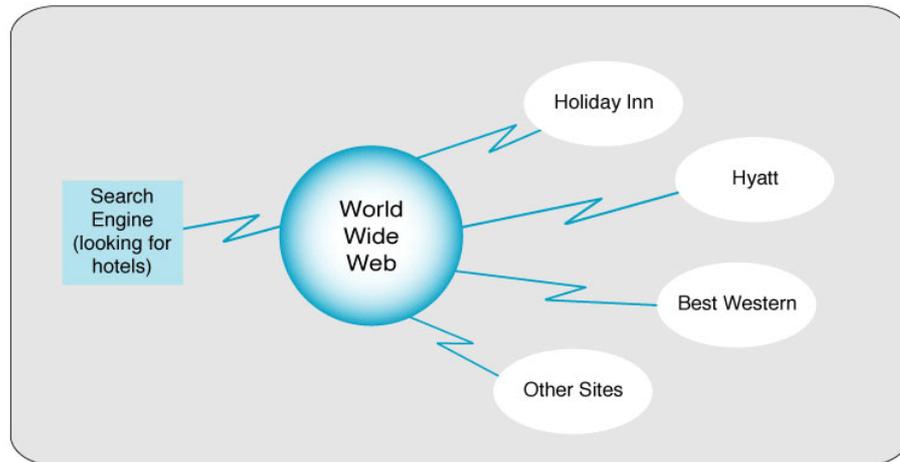
Browsers

Users primarily access the web through software applications called browsers .at a minimum a browser is capable of communicating via http, managing HTML .and displaying certain data types, such as GIF (graphics interchange format),and JPEG(joint photographic experts group)for graphics and Microsoft windows WAV for sound.

Search engine

Are programs that return a list of websites or pages (designated by URLs) that match some user –selected criteria such as "contains the words new, automobile, buy." to use one of the publicly available search sites, the user navigates to the search engine's site and types in the subject of the search.

Figure 3.2 Search Engines Explore the Internet to Find Sites Containing Information You Seek.



Intranets

An intranet is a private network that uses internet software and TCP/IP protocols. In essence, an intranet is a private internet, or group of private segments of the public internet network, reserved for use by people who have been given the authority to use that network. Companies are increasingly using intranets powered by internal web servers to give their employees easy access to corporate information. Intranets also are an effective medium for application delivery, although communications traffic is restricted to corporate LANs and WANs, key partners and suppliers often may be part of an extended intranet as well. This outward-facing extension of an intranet is often called extranet.

Security

With this number and variety of applications, intranet security is very important; companies can prevent unwanted intrusion into their intranets in several ways:

- Public key security is used to broker authorization to enter into a private internet. It has two parts: encryption and certificate authorities.
- Firewall is a device located between a firm's internal network (e.g. intranets) and external networks (e.g. the internet). The firewall regulates access into and out of a company's network.

- Pipelines:for higher security ,companies can implement assured pipelines.wheresa a firewall examines only the header information of a packet ,an assured pipelines examines the entire request for data and then determines whether the request is valid

END OF CHAPTER FIVE