DCAM-03

Vardhaman Mahaveer Open University, Kota

Computer Applications in Management

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Editing and Course Writing

Editor:
Dr. Deepak Shrivastava
Institute of Management Studies,
Devi Ahilya University, Indore (MP)

Writers:
Dr. N.K. Joshi (Unit 1)
Head, Department of Computer Application,
MIMT, Kota
Praveen Kumar Sharma (Unit 2, 3, 9, 10)
Former lecturer, Department of Computer Science & IT,
LBITS College, Kota
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Course Material Production

Mr. Yogendra Goyal
Assistant Production Officer, Vardhaman Mahaveer Open University, Kota

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Unit - 1 : History and Classification of Computer

Structure of Unit:

1.0 Objectives
1.1 Introduction
1.2 Classification of Computer
1.3 The Computer Evolution
1.4 Block Diagram of Computer
1.5 Area of Application
1.6 Summary
1.7 Self Assessment Questions
1.8 Reference Books

1.0 Objectives

After completing this unit you will be able to:

- Understand the classification of computers
- Learn about development and evolution of computer
- Understand the application areas of computer
- Understand the working of computer system.

1.1 Introduction

The word 'computer' is an old word that has changed its meaning several times in the last few centuries. Originating from the Latin, by the mid-17th century it meant 'someone who computes'. The American Heritage Dictionary (1980) gives its first computer definition as "a person who computes." The computer remained associated with human activity until about the middle of the 20th century when it became applied to "a programmable electronic device that can store, retrieve, and process data" as Webster's Dictionary (1980) defines it. Today, the word computer refers to computing devices, whether or not they are electronic, programmable, or capable of 'storing and retrieving' data.

The Techencyclopedia (2003) defines computer as "a general purpose machine that processes data according to a set of instructions that are stored internally either temporarily or permanently." The computer and all equipment attached to it are called hardware. The instructions that tell it what to do are called "software" or "program". A program is a detailed set of humanly prepared instructions that directs the computer to function in specific ways. Furthermore, the Encyclopedia Britannica (2003) defines computers as "the contribution of major individuals, machines, and ideas to the development of computing." This implies that 2the computer is a system. A system is a group of computer components that work together as a unit to perform a common objective.

The term 'history' means past events. The encyclopedia Britannica (2003) defines it as "the discipline that studies the chronological record of events (as affecting a nation or people), based on a critical examination of source materials and usually presenting an explanation of their causes." The Oxford Advanced Learner's Dictionary (1995) simply defines history as "the study of past events…." In discussing the history of computers, chronological record of events – particularly in the area of technological development – will be explained. History of computer in the area of technological development is being considered because it is usually the technological advancement in computers that brings about economic and social advancement. A faster computer brings about faster operation and that in turn causes an economic development. This unit

will discuss classes of computers, computer evolution and highlight some roles played by individuals in these developments.

1.2 Classification of Computer

Computing machines can be classified in many ways and these classifications depend on their functions and definitions. They can be classified by the technology from which they were constructed, the uses to which they are put, their capacity or size, the era in which they were used, their basic operating principle and by the kinds of data they process. Some of these classification techniques are discussed as follows:

1.2.1 Classification by Technology

This classification is a historical one and it is based on what performs the computer operation, or the technology behind the computing skill.

I Flesh: Before the advent of any kind of computing device at all, human beings performed computation by themselves. This involved the use of fingers, toes and any other part of the body.

II Wood: Wood became a computing device when it was first used to design the abacus. Shickard in 1621 and Polini in 1709 were both instrumental to this development.

III Metals: Metals were used in the early machines of Pascal, Thomas, and the production versions from firms such as Brundsviga, Monroe, etc

IV Elector Mechanical Devices: As differential analyzers, these were present in the early machines of Zuse, Aiken, Stibitz and many others

V Electronic Elements: These were used in the Colossus, ABC, ENIAC, and the stored program computers.

This classification really does not apply to developments in the last sixty years because several kinds of new electro technological devices have been used thereafter.

1.2.2 Classification by Capacity

Computers can be classified according to their capacity. The term 'capacity' refers to the volume of work or the data processing capability a computer can handle. Their performance is determined by the amount of data that can be stored in memory, speed of internal operation of the computer, number and type of peripheral devices, amount and type of software available for use with the computer.

The capacity of early generation computers was determined by their physical size - the larger the size, the greater the volume. Recent computer technology however is tending to create smaller machines, making it possible to package equivalent speed and capacity in a smaller format. Computer capacity is currently measured by the number of applications that it can run rather than by the volume of data it can process. This classification is therefore done as follows:

I Micro Computers: The Microcomputer has the lowest level capacity. The machine has memories that are generally made of semiconductors fabricated on silicon chips. Large-scale production of silicon chips began in 1971 and this has been of great use in the production of microcomputers. The microcomputer is a digital computer system that is controlled by a stored program that uses a microprocessor, a programmable read-only memory (ROM) and a random-access memory (RAM). The ROM defines the instructions to be executed by the computer while RAM is the functional equivalent of computer memory.

The Apple IIe, the Radio Shack TRS-80, and the Genie III are examples of microcomputers and are essentially fourth generation devices. Microcomputers have from 4k to 64k storage location and are capable of handling small, single-business application such as sales analysis, inventory, billing and payroll.

II Mini Computers: In the 1960s, the growing demand for a smaller stand-alone machine brought about the manufacture of the minicomputer, to handle tasks that large computers could not perform economically. Minicomputer systems provide faster operating speeds and larger storage capacities than microcomputer systems. Operating systems developed for minicomputer systems generally support both multiprogramming and virtual storage. This means that many programs can be run concurrently. This type of computer system is very flexible and can be expanded to meet the needs of users.

Minicomputers usually have from 8k to 256k memory storage location, and a relatively established application software. The PDP-8, the IBM systems 3 and the Honeywell 200 and 1200 computer are typical examples of minicomputers.

III Medium-size Computers: Medium-size computer systems provide faster operating speeds and larger storage capacities than mini computer systems. They can support a large number of high-speed input/output devices and several disk drives can be used to provide online access to large data files as required for direct access processing and their operating systems also support both multiprogramming and virtual storage. This allows the running of variety of programs concurrently. A medium-size computer can support a management information system and can therefore serve the needs of a large bank, insurance company or university. They usually have memory sizes ranging from 32k to 512k. The IBM System 370, Burroughs 3500 System and NCR Century 200 system are examples of medium-size computers.

IV Large Computers: Large computers are next to Super Computers and have bigger capacity than the Medium-size computers. They usually contain full control systems with minimal operator intervention. Large computer system ranges from single-processing configurations to nationwide computer-based networks involving general large computers. Large computers have storage capacities from 512k to 8192k, and these computers have internal operating speeds measured in terms of nanosecond, as compared to small computers where speed is measured in terms of microseconds. Expandability to 8 or even 16 million characters is possible with some of these systems. Such characteristics permit many data processing jobs to be accomplished concurrently.

Large computers are usually used in government agencies, large corporations and computer services organizations. They are used in complex modeling, or simulation, business operations, product testing, design and engineering work and in the development of space technology. Large computers can serve as server systems where many smaller computers can be connected to it to form a communication network.

V Super Computers: The supercomputers are the biggest and fastest machines today and they are used when billion or even trillions of calculations are required. These machines are applied in nuclear weapon development, accurate weather forecasting and as host processors for local computer and time sharing networks. Super computers have capabilities far beyond even the traditional large-scale systems. Their speed ranges from 100 million-instruction-per-second to well over three billion. Because of their size, supercomputers sacrifice a certain amount of flexibility. They are therefore not ideal for providing a variety of user services. For this reason, supercomputers may need the assistance of a medium-size general purpose machines (usually called front-end processor) to handle minor programs or perform slower speed or smaller volume operation.

1.2.3 Classification by their Basic Operating Principle

Using this classification technique, computers can be divided into Analog, Digital and Hybrid systems. They are explained as follows:

I Analog Computers: Analog computers were well known in the 1940s although they are now uncommon. In such machines, numbers to be used in some calculation were represented by physical quantities - such as

electrical voltages. According to the Penguin Dictionary of Computers (1970), "an analog computer must be able to accept inputs which vary with respect to time and directly apply these inputs to various devices within the computer which performs the computing operations of additions, subtraction, multiplication, division, integration and function generation…." The computing units of analog computers respond immediately to the changes which they detect in the input variables. Analog computers excel in solving differential equations and are faster than digital computers.

II Digital Computers: Most computers today are digital. They represent information discretely and use a binary (two-step) system that represents each piece of information as a series of zeroes and ones.

The Pocket Webster School & Office Dictionary (1990) simply defines Digital computers as "a computer using numbers in calculating." Digital computers manipulate most data more easily than analog computers. They are designed to process data in numerical form and their circuits perform directly the mathematical operations of addition, subtraction, multiplication, and division. Because digital information is discrete, it can be copied exactly but it is difficult to make exact copies of analog information.

III Hybrid Computers: These are machines that can work as both analog and digital computers.

1.3 The Computer Evolution

The computer evolution is indeed an interesting topic that has been explained in some different ways over the years, by many authors. According to The Computational Science Education Project, US, the computer has evolved through the following stages:

The Mechanical Era (1623-1945)

Trying to use machines to solve mathematical problems can be traced to the early 17th century. Wilhelm Schickhard, Blaise Pascal, and Gottfried Leibnitz were among mathematicians who designed and implemented calculators that were capable of addition, subtraction, multiplication, and division included The first multi-purpose or programmable computing device was probably Charles Babbage's Difference Engine, which was begun in 1823 but never completed. In 1842, Babbage designed a more ambitious machine, called the Analytical Engine but unfortunately it also was only partially completed. Babbage, together with Ada Lovelace recognized several important programming techniques, including conditional branches, iterative loops and index variables.

Babbage designed the machine which is arguably the first to be used in computational science. In 1933, George Scheutz and his son, Edvard began work on a smaller version of the difference engine and by 1853 they had constructed a machine that could process 15-digit numbers and calculate fourth-order differences. The US Census Bureau was one of the first organizations to use the mechanical computers which used punch-card equipment designed by Herman Hollerith to tabulate data for the 1890 census. In 1911 Hollerith's company merged with a competitor to found the corporation which in 1924 became International Business Machines (IBM).

First Generation Electronic Computers (1937-1953)

These devices used electronic switches, in the form of vacuum tubes, instead of electromechanical relays. The earliest attempt to build an electronic computer was by J. V. Atanasoff, a professor of physics and mathematics at Iowa State in 1937. Atanasoff set out to build a machine that would help his graduate students solve systems of partial differential equations. By 1941 he and graduate student Clifford Berry had

succeeded in building a machine that could solve 29 simultaneous equations with 29 unknowns. However, the machine was not programmable, and was more of an electronic calculator.

A second early electronic machine was Colossus, designed by Alan Turing for the British military in 1943. The first general purpose programmable electronic computer was the Electronic Numerical Integrator and Computer (ENIAC), built by J. Presper Eckert and John V. Mauchly at the University of Pennsylvania. Research work began in 1943, funded by the Army Ordinance Department, which needed a way to compute ballistics during World War II. The machine was completed in 1945 and it was used extensively for calculations during the design of the hydrogen bomb. Eckert, Mauchly, and John von Neumann, a consultant to the ENIAC project, began work on a new machine before ENIAC was finished. The main contribution of EDVAC, their new project, was the notion of a stored program. ENIAC was controlled by a set of external switches and dials; to change the program required physically altering the settings on these controls. EDVAC was able to run orders of magnitude faster than ENIAC and by storing instructions in the same medium as data, designers could concentrate on improving the internal structure of the machine without worrying about matching it to the speed of an external control. Eckert and Mauchly later designed what was arguably the first commercially successful computer, the UNIVAC; in 1952. Software technology during this period was very primitive.

Second Generation (1954-1962)

The second generation witnessed several important developments at all levels of computer system design, ranging from the technology used to build the basic circuits to the programming languages used to write scientific applications. Electronic switches in this era were based on discrete diode and transistor technology with a switching time of approximately 0.3 microseconds. The first machines to be built with this technology include TRADIC at Bell Laboratories in 1954 and TX-0 at MIT's Lincoln Laboratory. Index registers were designed for controlling loops and floating point units for calculations based on real numbers.

A number of high level programming languages were introduced and these include FORTRAN (1956), ALGOL (1958), and COBOL (1959). Important commercial machines of this era include the IBM 704 and its successors, the 709 and 7094. In the 1950s the first two supercomputers were designed specifically for numeric processing in scientific applications.

Third Generation (1963-1972)

Technology changes in this generation include the use of integrated circuits (ICs) semiconductor devices with several transistors built into one physical component, semiconductor memories, microprogramming as a technique for efficiently designing complex processors and the introduction of operating systems and time-sharing. The first ICs were based on small-scale integration (SSI) circuits, which had around 10 devices per circuit ('chip'), and evolved to the use of medium-scale integrated (MSI) circuits, which had up to 100 devices per chip. Multilayered printed circuits were developed and core memory was replaced by faster, solid state memories.

In 1964, Seymour Cray developed the CDC 6600, which was the first architecture to use functional parallelism. By using 10 separate functional units that could operate simultaneously and 32 independent memory banks, the CDC 6600 was able to attain a computation rate of one million floating point operations per second (Mflops). Five years later CDC released the 7600, also developed by Seymour Cray. The CDC 7600, with its pipelined functional units, is considered to be the first vector processor and was capable of executing at ten Mflops. The IBM 360/91, released during the same period, was roughly twice as fast as the CDC 660.

Early in this third generation, Cambridge University and the University of London cooperated in the development of CPL (Combined Programming Language, 1963). CPL was, according to its authors, an attempt to capture only the important features of the complicated and sophisticated ALGOL. However, like ALGOL, CPL was large with many features that were hard to learn. In an attempt at further simplification, Martin Richards of Cambridge developed a subset of CPL called BCPL (Basic Computer Programming Language, 1967). In 1970 Ken Thompson of Bell Labs developed yet another simplification of CPL called simply B, in connection with an early implementation of the UNIX operating system. comment)

Fourth Generation (1972-1984)

Large scale integration (LSI - 1000 devices per chip) and very large scale integration (VLSI - 100,000 devices per chip) were used in the construction of the fourth generation computers. Whole processors could now fit onto a single chip, and for simple systems the entire computer (processor, main memory, and I/O controllers) could fit on one chip. Gate delays dropped to about 1ns per gate. Core memories were replaced by semiconductor memories.

Large main memories like CRAY 2 began to replace the older high speed vector processors, such as the CRAY 1, CRAY X-MP and CYBER In 1972, Dennis Ritchie developed the C language from the design of the CPL and Thompson's B. Thompson and Ritchie then used C to write a version of UNIX for the DEC PDP-11. Other developments in software include very high level languages such as FP (functional programming) and Prolog (programming in logic).

IBM worked with Microsoft during the 1980s to start what we can really call PC (Personal Computer) life today. IBM PC was introduced in October 1981 and it worked with the operating system (software) called 'Microsoft Disk Operating System (MS DOS) 1.0. Development of MS DOS began in October 1980 when IBM began searching the market for an operating system for the then proposed IBM PC and major contributors were Bill Gates, Paul Allen and Tim Paterson. In 1983, the Microsoft Windows was announced and this has witnessed several improvements and revision over the last twenty years.

Fifth Generation (1984-1990)

This generation brought about the introduction of machines with hundreds of processors that could all be working on different parts of a single program. The scale of integration in semiconductors continued at a great pace and by 1990 it was possible to build chips with a million components - and semiconductor memories became standard on all computers. Computer networks and single-user workstations also became popular.

Parallel processing started in this generation. The Sequent Balance 8000 connected up to 20 processors to a single shared memory module though each processor had its own local cache. The machine was designed to compete with the DEC VAX-780 as a general purpose Unix system, with each processor working on a different user's job. However Sequent provided a library of subroutines that would allow programmers to write programs that would use more than one processor, and the machine was widely used to explore parallel algorithms and programming techniques. The Intel iPSC-1, also known as 'the hypercube' connected each processor to its own memory and used a network interface to connect processors. This distributed memory architecture meant memory was no longer a problem and large systems with more processors (as many as 128) could be built. Also introduced was a machine, known as a data-parallel or SIMD where there were several thousand very simple processors which work under the direction of a single control unit. Both wide area network (WAN) and local area network (LAN) technology developed rapidly.

Sixth Generation (1990 -)

Most of the developments in computer systems since 1990 have not been fundamental changes but have been gradual improvements over established systems. This generation brought about gains in parallel computing in both the hardware and in improved understanding of how to develop algorithms to exploit parallel architectures. Workstation technology continued to improve, with processor designs now using a combination of RISC, pipelining, and parallel processing.

Wide area networks, network bandwidth and speed of operation and networking capabilities have kept developing tremendously. Personal computers (PCs) now operate with Gigabit per second processors, multi-Gigabyte disks, hundreds of Mbytes of RAM, colour printers, high-resolution graphic monitors, stereo sound cards and graphical user interfaces. Thousands of software (operating systems and application software) are existing today and Microsoft Inc. has been a major contributor.

Finally, this generation has brought about micro controller technology. Micro controllers are 'embedded' inside some other devices (often consumer products) so that they can control the features or actions of the product. They work as small computers inside devices and now serve as essential components in most machines.

1.4 Block Diagram of Computer

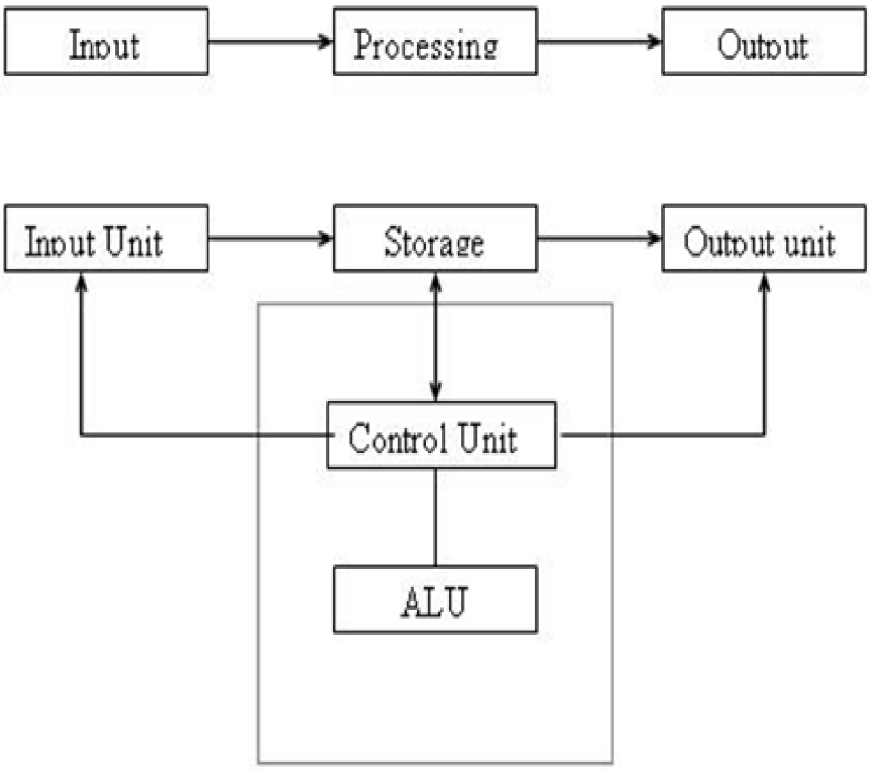


Figure 1.1 : Block Diagram of Computer

A computer can process data, pictures, sound and graphics. They can solve highly complicated problems quickly and accurately.

Input Unit:

Computers need to receive data and instruction in order to solve any problem. Therefore we need to input the data and instructions into the computers. The input unit consists of one or more input devices. Keyboard

is the one of the most commonly used input device. Other commonly used input devices are the mouse, floppy disk drive, magnetic tape, etc. All the input devices perform the following functions.

- Accept the data and instructions from the outside world.
- Convert it to a form that the computer can understand.
- Supply the converted data to the computer system for further processing.

Storage Unit:

The storage unit of the computer holds data and instructions that are entered through the input unit, before they are processed. It preserves the intermediate and final results before these are sent to the output devices. It also saves the data for the later use. The various storage devices of a computer system are divided into two categories.

1. **Primary Storage:** Stores and provides data very fast. This memory is generally used to hold the program being currently executed in the computer, the data being received from the input unit, the intermediate and final results of the program. The primary memory is temporary in nature. The data is lost, when the computer is switched off. In order to store the data permanently, the data has to be transferred to the secondary memory. Very small portion of primary storage memory is permanent is nature eg. ROM which holds the data permanent even if power off.

   The cost of the primary storage is more or compared to the secondary storage. Therefore most computers have limited primary storage capacity.

2. **Secondary Storage:** Secondary storage is used like an archive. It stores several programs, documents, data bases etc. The programs that you run on the computer are first transferred to the primary memory before it is actually run. Whenever the results are saved, again they get stored in the secondary memory. The secondary memory is slower and cheaper than the primary memory. Some of the commonly used secondary memory devices are Hard disk, CD, etc.,

Memory Size:

All digital computers use the binary system, i.e. 0's and 1's. Each character or a number is represented by an 8 bit code.

- The set of 8 bits is called a byte.
- A character occupies 1 byte space.
- A numeric occupies 2 byte space.
- Byte is the space occupied in the memory.

The size of the primary storage is specified in KB (Kilobytes) or MB (Megabyte). One KB is equal to 1024 bytes and one MB is equal to 1000KB. The size of the primary storage in a typical PC usually starts at 16MB. PCs having 32 MB, 48MB, 128 MB, 256MB memory are quite common.

Output Unit:

The output unit of a computer provides the information and results of a computation to outside world. Printers, Visual Display Unit (VDU) are the commonly used output devices. Other commonly used output devices are floppy disk drive, hard disk drive, and magnetic tape drive.

Arithmetic Logical Unit:

All calculations are performed in the Arithmetic Logic Unit (ALU) of the computer. It also does comparison and takes decision. The ALU can perform basic operations such as addition, subtraction, multiplication, division, etc and does logic operations viz, >, <, =, 'etc. Whenever calculations are required, the control unit transfers the data from storage unit to ALU once the computations are done, the results are transferred to the storage unit by the control unit and then it is send to the output unit for displaying results.

Control Unit:

It controls all other units in the computer. The control unit instructs the input unit, where to store the data after receiving it from the user. It controls the flow of data and instructions from the storage unit to ALU. It also controls the flow of results from the ALU to the storage unit. The control unit is generally referred as the central nervous system of the computer that control and synchronizes it's working.

Central Processing Unit:

The control unit and ALU of the computer are together known as the Central Processing Unit (CPU). The CPU is like brain performs the following functions:

- It performs all calculations.
- It takes all decisions.
- It controls all units of the computer.

A PC may have CPU-IC such as Intel 8088, 80286, 80386, 80486, Celeron, Pentium, Pentium Pro, Pentium II, Pentium III, Pentium IV, Dual Core, and AMD etc.

1.5 Area of Application

Digital Media

Digital media, including both graphics and sound, have become central both to our culture and our science. There are (at least) three general areas that might serve as a focus for certificate students interested in these computer applications.

Graphics

Courses for a graphics media track might include COS 426 (Computer Graphics) or COS 429 (Computer Vision), plus COS 436 (Human Computer Interface Technology) or COS 479 (Pervasive Information Systems). The choices are wide and will vary with the student. Those interested in a graphics track for the applications certificate should see Prof. Adam Finkelstein.

Music

The collaboration between Music and Computer Science at Princeton has a long and rich history. Specific cross-listed COS/MUS courses include MUS/COS 314 (Introduction to Computer Music) and COS 325/MUS 315 (Transforming Reality by Computer). A music track for the certificate might include one of these two, plus COS 436 (Human Computer Interface Technology) or COS 479 (Pervasive Information Systems). Again, a wide range of choices is possible.

Policy and Intellectual Property

The legal and political aspects of digital media are becoming increasingly important in our society. A track for the certificate that focused in this area might typically include COS 491 (Information Technology and The Law), plus any one of many other possible courses, depending on the student's particular interest.

1.6 Summary

Development of computer system is twofold ways. In one direction it is technological development & in other uses is high. Expectation & demand increases in business. User are becoming more matured towards its uses and demand also increases.

1.7 Self Assessment Questions

1. Write the difference between fifth & sixth generation computer system.
2. Explain draw backs of first generation.
3. Describe application area of computer in education.
4. List input devices.
5. Differentiate Primary & Secondary storage.
6. Write an essay on "Evolution of compute"
7. Explain the Block diagram of computer in detail. And also explain the classification of computer in detail.

1.8 Reference Books

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Unit - 2 : Computer Hardware

Structure of Unit:

2.0 Objectives
2.1 Introduction
2.2 Input Devices
2.3 Output Devices
2.4 Processor
2.5 Computer Network
2.6 Summary
2.7 Self Assessment Questions
2.8 Reference Books

2.0 Objectives

After completing the unit, you will be able to:

- Understand input and output devices
- Types of input & output devices
- Types of processors.
- Concept of computer network.
- Application of computer network.

2.1 Introduction

The computer is dependent upon data and instructions before it can perform any computation and produce the results. This job of entering the data to the computer and displaying the final results is done by input - output devices. They are also known as peripheral devices, because they surround the CPU. The devices that are used to enter data and instructions into the computer are known as input devices. Some most common input devices are keyboard, mouse, Joystick, scanners etc. The device which accept the result from the computer and display them to the users or store the results for further processing are known as output devices. The most commonly used output devices are CRT terminal, printers, etc. Apart from providing the facility of feeding the data into the system and displaying the final results, the input - output devices also convert the input data to the internal codes used by the computer and convert the internal codes to human readable form while supplying the output.

Now let us discuss the various types of Input - Output (I/O) devices that are used for different types of applications.

2.2 Input Devices

Any device that allows information from outside the computer to be communicated to the computer is considered an input device. All computer input devices and circuitry must eventually communicate with the computer in discrete binary form because CPU (Central Processing Unit) of a computer can understand only discrete binary information. A few common computer input devices are -

1. Punched Cards
2. Card Readers
3. Key Punching Machines
4. Keyboard

5. Mouse
6. Joystick
7. Trackball
8. Magnetic Tablet
9. Optical Recognition
10. Scanners

These can be mainly divided into two basic categories :

(a) Analog Device :- An analog device is a continuous mechanism that represents information with continuous physical variations.

(b) Digital Device :- A digital device is a discrete mechanism which represents all values with a specific number system.

Punched Cards

In the early years of computer evolution the punched cards were the most widely used input medium for most computer system. These days they are not used in computer industry as number of fast input devices are available. There are two types of punched cards - one has eighty columns and the other has ninety six columns.

Punched cards are rarely used today. However you may occasionally encounter them in large companies such as public utilities, where they are used still for billing.

Advantages of Punched Cards:

- Cards are standardized and can be used with any hardware system without much difficulty,
- Cards are easily read by humans and are easy to handle.
- Cards are multi - purpose media, they can be used for input, output of storage.

Limitations of Punched Cards

- Due to low data density, card files are bulky. Such bulky card decks make processing slow since lot of paper has to be moved.
- A card can't be erased and reused to enter new data and must be stored and processed in designated order.
- Cards are quite costly and card readers operate at very slow speed.

Card Reader

A card reader is an input device. It transfers data from the punched card to the computer system. The card reader will read each punch card by passing light on it. Each card will be passed between a light source and a set of light detectors. The presence of hole causes the light to produce a pulse in the director, These pulses are transformed into binary digits by the card reader and sent to the computer for storage. Card readers can read upto 2000 cards per minute.

There are two types of card readers depending upon the mechanism used for sensing the punched holes in the cards. The two types of card readers are Photoelectric Card Reader and Wire Brush Card Reader.

Key - Punching Machines

There is another device to punch data on a punch card - the key punch. It contains a keyboard which looks like a typewriter keyboard. When characters are typed in the Keyboard, corresponding holes are punched in the blank card. Then these cards will be sent to card reader to feed the information to the computer. The commonly used key punch machines have the following components.

- Keyboard
- Card hopper
- Punching station
- Backspace key
- Card stacker
- Column indicator
- Program control unit
- Program drum
- Reading section
- Switches
- Printing mechanism etc.

Keyboard

Keyboard is the most popular and widely used device for entering data and instructions in a computer system. A keyboard is similar to the keyboard of a typewriter.

A keyboard has alphabets, digits, special characters and some control keys. A keyboard also has cursor control keys and function keys. Function keys allow user to enter frequently used operations in a single keystroke, and cursor - control keys can be used to select displayed objects. Some of the special keys on a keyboard are given below:

- Arrow Keys - To move the cursor in the top, down, left and right direction in a document.
- Backspace key - To delete the character on the left of the cursor.
- Caps Lock - To capitalise letters
- Del - To delete the character from the current position of the cursor.
- End - To move the cursor to the end of the line.
- Enter - To start a new paragraph in a document.
- Esc - To cancel a command.
- Home - To move the cursor to the beginning of the line.
- Shift - To type the special characters above the numeric keys or to change the case of the of alphabet
- Space bar - To enter a space.
- Tab - To enter multiple spaces between two words in a document.



Figure 2.1 : Keyboard

Mouse

A mouse is a pointing device. It is used to position the cursor on the screen. A mouse can be cursor click. The mouse can be used to drag and drop objects on the screen. A mouse has a wheel or roller on the bottom of the mouse, which can be used to detect the amount and the direction of movement. The distance moved is determined by the number of pulses emitted by the mouse. A mouse is a usual pointing tool for interacting with a graphical user interface (GUI) applications.



Figure 2.2 : Mouse

Joystick

A Joystick is a device used in video games. It is also a pointing device, which is used to move the cursor position on the screen. A joystick consists of a small, vertical liver fitted on a base. This lever is used to move the cursor on the screen. The screen-cursor movement in any particular direction is measured by the distance that the stick is shifted or moved from its center position. The amount of movement is measured by the potentiometers that are plugged at the base of the joystick. When the stick is released, a spring brings it back to its center position. A joystick has a click, double click and drag switch inputs. When you push the stick, the cursor does not go flying, no matter what the user does. The joystick can move right or left, forward or backward. It moves in that direction at a given speed, controlled by the supervisor from a switch underneath.

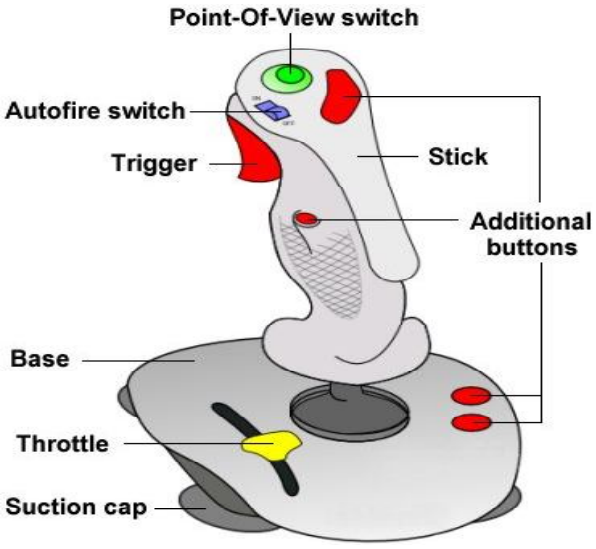


Figure 2.3 : Joystick

Trackball

A trackball is also a pointing device. It consists of a ball which is fitted on a box. The ball can be rotated with the figures or palm of the hand to move the cursor on the screen. The amount and direction of rotations can be detected by the potentiometers which are attached to the ball. Track balls are generally fitted on key-boards. Before the advent of the touch pad, small trackballs were common on portable computers, where there may be no desk space on which to run a mouse. The trackball was invented by Tom Cranston and Fred Longstaff as part of the Royal Canadian Navy's system in 1952, eleven years before the mouse was invented.



Figure 2.4 : Trackball

Advantages of Trackball

1. It can be placed on any type of surface, including our palm or lap.
2. It is stationary so it does not need much space for its use.
3. Due to their compact size these are most suitable for portable computer.

Magnetic Tablet (DIGITIZER)

A magnetic tablet is also known as - digitizer, digitizing tablet, graphics tablet, graphics pad or drawing tablet. These tablets may also be used to capture data or handwritten signature. It can also be used to trace an image from a piece of paper which it taped or otherwise secured to the surface. Capturing data in this way, either by tracing or entering the corners of linear polylines or shapes is called digitizing.

A graphics tablet consists of a flat surface upon which the user may "draw" or trace an image using an attached stylus, a pen-like drawing apparatus. The image generally does not appear on the tablet itself but, rather is displayed on the computer monitor. Some tablets, come as a functioning secondary computer screen that you can interact with images directly by using the stylus, some tablets are intended as a general replacement for a mouse as the primary pointing and navigation device for desktop computers.

Advantages of Digitizer

1. Interactive graphics is possible using digitizer.
2. The sketches displayed on the monitor are neater and more precise than those on paper.

Disadvantages

1. They are quite costly.
2. These suite to applications which require high resolution graphics only.

Optical Recognition

Optical recognition occurs when a device scans a printed surface and translates the image the scanner sees into a machine-readable format that is understandable by the computer. The three types of optical recognition devices are as follows-

1. Optical Character Recognition (OCR)
2. Optical Mark Recognition (OMR)
3. Optical Bar Recognition (OBR)

1. Optical Character Recognition (OCR): An OCR is the mechanical or electronic translation of scanned image of handwritten, typewritten or printed text into machine encoded text. It is widely used to convert books and documents into electronics files, to computerize a record-keeping system in an office or to publish the text on a website. An OCR system require calibration to read a specific font, Some systems are capable of reproducing formatted output that closely approximates the original scanned page including images and other non-textual components.

2. Optical Mark Recognition (OMR): Many traditional OMR devices work with a dedicated scanner device that shines a beam of light onto the form paper. The contrasting reflectivity at predetermined positions on a page is then utilized to detect the marked areas because they reflect less light than the blank areas of the paper.



Figure 2.5 : OMR

Some OMR devices use forms which are pre-printed onto "transoptic" paper and measure the amount of light which passes through the paper thus a mark on either side of the paper will reduce the amount of light passing through the paper OMR is generally distinguished from OCR by the fact that a complicated pattern recognition engine is not required. One of the most familiar application of OMR is the use of HB pencil bubble optical answer sheets in multiple choice question examinations.

3. Optical Bar Recognition (OBR): It is slightly more sophisticated type of optical recognition. The bar codes are the vertical zebra-striped marks you see on most manufactured retail products-every candy to cosmetics to comic books. The usual bar-code system in use is called the Universal Product Code (UPC). Bar codes represent data, such as name of the manufacturers and the type of product, The code is interpreted on the basis of the width of the lines rather than the location of the bar code. The barcode does not have the price of the product. Bar code readers are photoelectric (optical) scanners that translates the symbols in the bar code into digital code. In this systems, the price of a particular item is set with in the store's computer. Once the bar code has been scanned the corresponding price appears on the sales clerk's point-of-sale (POS) terminal and on your receipt.





Figure 2.6 : Bars **Figure 2.7 : Barcode-reader**

Scanner

An scanner is also refer to as image scanner. It is an input device that optically scans images, printed text, handwritten text or an object, and converts it to a digital image. Common examples found in offices are variations of the desktop (or flatbed) scanner where the document is placed on a glass window for scanning. Hand-held scanners, where the device is moved by the hand, have evolved from text scanning used for industrial design, reverse engineering, test and measurement, gaming and other applications.

Modern scanners typically use a Change-Coupled Device (CCD) or a Contact Image Sensor (CIS) as the image sensor, where as older drum scanners use a photomultiplier tube as the image sensor. Another category of scanner is digital camera scanners, which are based on the concept of reprographic cameras. Due to increasing resolution and new features such as anti-shake, digital cameras have become an attractive alternative to regular scanners. New scanning technologies are combining 3D scanners with digital cameras to create full-color, photo realistic 3D models of objects.



Figure 2.8 : Scanner

2.3 Output Devices

An output device is a device which accepts results from the computer and displays them to user. The output device also converts the binary code obtained from the computer into human readable form.

Output devices generates two types of output copy of results.

1. **Hard Copy Output** - it is a computer output, which is permanent in nature and can be kept in paper files, or can be looked at a later stage, when the person is not using the computer. For example, output produced by printers or plotters on paper.
2. **Soft Copy Output** - it is a computer output, which is temporary in nature, and vanishes after its use. For example, output shown on a terminal screen, or spoken out by a voice response system.

The commonly used output devices are : CRT screen/TFT screen, printers and plotters.

2.3.1 Hard Copy Output Devices

Hard copy is printed output for example, printouts, whether text or graphics, from printers. The hard copy output devices are printers.

2.3.1.1 Printer

A printer is an output device that prints characters, symbols and graphics on paper or another hard copy medium. There are a variety of printers available for various types of applications. Depending upon the speed and approach of printing. Printers can be classified as :

(a) Character Printers

(b) Line Printers

(c) Page Printers (Laser Printer)

There is yet another classification depending upon the technology used for printing. According to this classification, printers are of two types :

(i) Impact Printers - do have contact with paper.

(ii) Non-impact printers - do not have contact with paper and output is generated by hammering on the ribbon.

(a) Character Printers :

Character printers print only one character at a time. They are low-speed printers and are generally used for low volume printing work. Characters to be printed are sent serially to the printer. Three of the most commonly used character printers are described as follows :

(i) Letter Quality Printers (Daisy Wheel): Letter quality printers are used where good printing quality is needed. These printers use a print wheel font known as a daisy wheel. There is a character embossed on each petal of daisy wheel. The wheel is rotated of a rapid rate with the help of a motor. In order to print a character, the wheel is rotated. When the desired character spins to the correct position, a print hammer strikes it to produce the output.

Thus, daisy wheel printers are impact printers. It has a fixed font type. It cannot print graphics.



Figure 2.9 : Daisy Wheel Printer

(ii) Dot-Matrix Printer (DMP): A dot-matrix printer prints the character as a patterns of dots. The print head contains a vertical array of 7, 9, 14, 18 or even 24 pins. A character is printed in a number of steps. One dot column of the dot-matrix is taken up at a time. The selected dots of a column are printed by the print head at a time as it moves across a line. The shape of each character is detained from the information held electronically in the printer.

The dot-matrix printers are faster than daisy wheel printers. This speed lies in the range of 30-600 cps. Dot-matrix do not have fixed character font. So they can print any shape of character. This allows for many special characters and the ability to print graphics such as graphs and charts.

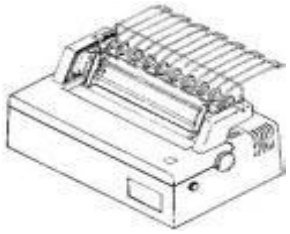


Figure 2.10 : Dot-matrix Printer

(iii) Inkjet Printers: Inkjet printers are non-impact printers. They employ a different technology to print character on the paper. They print character by spraying small drops of ink onto the paper. Special type of ink with high iron content is used. Each droplet is changed when it passes through the valve. Then is passes through a region having horizontal and vertical deflection plates. These plates deflect the ink drops to the desired spots on the paper to form the desired character.

The concept of inkjet printing originated in the 19th century and the technology was first extensively developed in the early 1950. Inkjet printers produce high quality printing output. The speed of inkjet printers lies in the range of 40-300 cps. They allow all types of fonts and styles. Colour printing is also possible by using different coloured inks.

The advantage of inkjet printer is that it is quieter in operation than impact dot matrix. It can print finer, smoother details through higher printhead resolution.



Figure 2.11 : Inkjet Printer

(b) Line Printer:

The line printer is a form of high speed impact printer in which one line of text is printed at a time. They are mostly associated with the early days of computing, but technology is still in use. They are fast printers and the speed lies in the range of 600 to 1200 lines per minute (approximately 10 to 20 paper per minute) were common.

The drum printer and chain printer are the most commonly used line printers.

(i) Drum Printer: A drum printer consists of a solid, cylindrical drum which contains complete raised character set in each band around the cylinder. The number of bands are equal to the number of printing positions. Each band contains all the possible characters. The drum rotates at a rapid speed. There is a magnetically driven hammer for each possible print position. The hammer hits the paper and the ribbon

against the desired character on the drum when it comes in printing position. Causing the desired character to be recorded on the continuous paper. The speed of a drum printer is in the range of 200 to 2000 lines per minute.

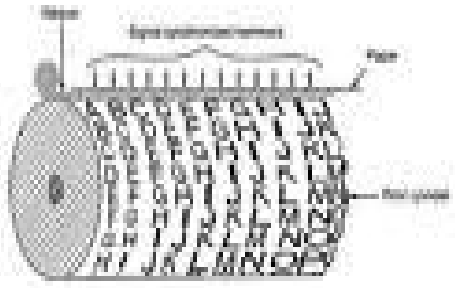


Figure 2.12 : Drum Printer

(ii) Chain Printer : Chain printers (also known as train printers) use a rapidly rotating chain which is called print chain. The print chain contain characters. Each link of the chain is character font. There is a magnetically driven hammer behind the paper for each print position. The processor sends all the characters to be printed in one line to the printer. When the desired character comes in the print position the hammer strikes the ribbon and paper against the character. A chain may contain more than one character set, for example, 4 sets. As compared to chain printer, chain printer had the advantage that the type chain could usually be changed by the operator. The speed lies in the range of 400-2400 lines per minute.

(c) Page Printer (Laser Printer)

Page printers or laser printers are non-impact printers. It is a common type of computer printer that rapidly produces high quality text and graphics on plain paper. Page printers are very costly and are economical only when printed volume is very high. Page printers are based on a number of technologies like electronics, xerography and laser, These techniques are called Electro-photographic techniques. In these printers, an image is produced on a photosensitive surface using a laser beam of other light source. The laser beam is turned off and on under the control of a computer. The areas that are exposed to the laser attract toner, which is generally an ink power. Thereafter the drum transfers the toner to the paper. Then the toner is permanently fused on the paper with heat or pressure in a fusing station. After this drum is discharged cleaned so that it is ready for next processing.

The cost of this technology depends on a combination of factors, including the cost of paper, toner and infrequent drum replacement as well as the replacement of other consumable such as the fuser assembly and transfer assembly.

The laser printer speed can vary widely, and depends on many factors, including the graphic intensity of the job being processed. The fastest models can print over 200 monochrome pages per minute (12000 pages per hour).

The major advantage of laser printers are:

- Very high speed.
- Low noise level.
- Low maintenance requirements.
- Very high image quality
- Excellent graphics capability
- A variety of type sizes and styles.



Figure 2.13 : Laser Printer

2.3.1.2 Plotters

A plotter is a computer printing device for printing vector graphics. In the past, plotters were widely used in application such as CAD (computer - aided design), though they have generally been replaced with the wide-format conventional printers. It is now common place to refer to such wide-format printers as "plotters".

A plotter is an output device used to produce hard copies of graphs and designs. They use ink pen or inkjet to draw graphics and drawings. Pen could be monochrome or multi-coloured. Pen plotters print by moving a pen or other instrument across the surface of a piece of paper. Pen plotters can draw complex line art, including text, but do so slowly because of the mechanical movement of the pens. They are often incapable of efficiently creating a solid region of color, but can draw an area by drawing a number of close, regular lines. Plotters offered the fastest way to efficiently produce very large drawing.

Pen plotters have essentially become absolute, and have been replaced by large-format inkjet printers and LED toner based printer. Such device may still understand vector language originally designed for plotter use, because in many uses, they offer a more efficient alternative to restore data.

Plotters are primarily used in technical drawing and CAD applications, where they have the advantage of working on very large paper sizes while maintaining high resolution. Another use has been found by replacing the pen with a cutter, and in this form plotters can be found in many garment and sign shops. A niche application of plotter is in creating tactical images for visually hand capped people on special thermal cell paper.



Figure 2.14 : Plotter

2.3.2 Soft Copy Output Devices

Softcopy is data that is shown on a display screen or is in audio or Voice form. This kind of output is not tangible, it cannot be touched. The softcopy devices are CRT display screen, Flat - panel display screen (for example, liquid-crystal display).

Monitor is the most commonly used word for softcopy output device. Monitors are also known as display screens, CRT or simply screens are output devices that show programming instructions and data as they are being input and information after it is processed. The size of a computer screen is measured diagonally from corner to corner in inches. For desktop microcomputers, the most common size are 13, 15, 17, 19 and 21 inches, for laptop computers, 12.1, 13.3, and 14.1 inches. There are two types of monitors

1. CRT (Cathode-Ray Tube)
2. Flat - panel or LCD (Liquid Crystal Display)

2.3.2.1 CRT (Cathode-Ray Tube)

A CRT is a vacuum tube used as a display screen in a computer or video display terminal. The same kind of technology is found not only in the screens of desktop computers but also in television sets and flight information monitor in airports.

A CRT display comes in two varieties. Monochrome (only one colour) and colour (multicolour). Monochrome displays come in single colour like green, blue, yellow, orange, pink, red and white depending upon the type of phosphor material used.

Coloured displays are developed by using a combination of phosphors that emit different coloured light. To produce coloured display, three phosphors-red, blue and green are used. CRT are considerable cheaper (5-10 times) than flat-panel displays.



Figure 2.15 : CRT Monitor

2.3.2.2 Flat-panel/LCD (Liquid Crystal Displays)

As compared to CRT , the flat-panel displays are much thinner, lighter and consume less power. Thus they are most useful for portable computers, although they are available for desktop computers as well. Flat-panel displays are made up of two plates of glass separated by a layer of a substance in which light is manipulated. A technology, liquid crystal display (LCD) is used, in which molecules of liquid crystals line up in a way that after their optical properties, creating images on the screen by transmitting or blocking out light.



Figure 2.16 : LCD

Flat panel screens are either active - matrix or passive matrix displays, depends on the location of their transistors.

In an active - matrix display, also known as TFT (thin film transistor) display, each pixel on the screen is controlled by its own transistor. Active - matrix displays are much brighter and sharper than passive matrix displays. But they are more expansive.

In a passive - matrix display, a transistor controls a whole row or columns of pixels. It provides a sharp image for one colour (monochrome) screen. The advantage is that it is less expansive and use less power than active - matrix display.

2.4 Processor

The processor is the brain of the CPU. It is the main portion of a computer system that carries out the instruction of a computer program, and is the primary element carrying out the functions of the computer or other processing device. It executes instructions, allowing a computer to perform all kind of tasks. It carries out each instruction of the program in sequence, to perform the basic arithmetical, logical and input/output operation of the system. Processor consists of two parts : The Arithmetic Unit, which performs math and logical operations, & The Control Unit, Which decodes instructions. The form, design and implementation of CPUs have changed dramatically since the earliest examples, but their fundamental operation remains much the same. Over the years, processors have become extremely fast. AMD and Intel are the two primary manufactures.

CPU technology constantly changes, probably faster than any other type of hardware. When looking at a CPU, you don't really see the processor itself. The little piece of silicon that contains the circuitry is very small. What you actually see is the package that it's in. Package are usually square with pins underneath that fit into holes on the CPU's slot. This arrangement is known as Pin Grid Array (PGA) and is now only used by AMD.

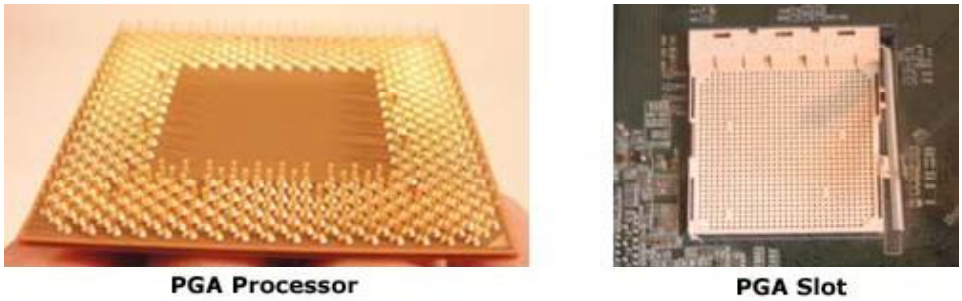


Figure 2.17 : PGA Processor & slot.

Intel abandoned PGA years ago and now have the pins located on the slots themselves, called Land Grid Array (LGA).

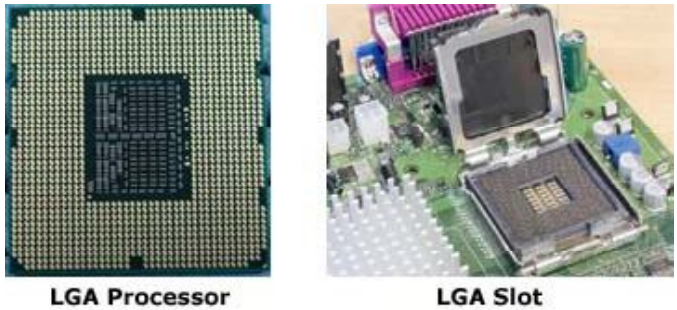


Figure 2.18 : LGA Processor & slot

The CPU itself is an internal component of the computer. The CPU is inserted directly into a CPU socket, pin side down, on the motherboard. Each motherboard will support only a specific type of range of CPU so that one has to check the motherboard manufacturer's specifications before attempting to replace or upgrade a CPU.

2.4.1 Operation

The fundamental operation of most CPU's regardless of the physical form they take, is to execute a sequence of stored instruction called a program. The program is represented by a series of numbers that are kept in some kind of computer memory. There are four steps that nearly all CPU use in their operation : fetch, decode, execute and write back.

The first step, fetch involves retrieving an instruction from program memory. The instruction that the CPU fetches from memory is used to determine what the CPU is to do. In the decode step, the instruction is broken up into parts that have significance to other portion of the CPU. After the fetch and decode steps, the execute step is performed. During this step, various portions of the CPU are connected so they can perform the desired operation. The final step, writeback, simply "writes back" the results of the execute step to some form of memory.

2.4.2 Rates and Data Transfer

Computer processor is characterizes by its speed or rate-how fast it can execute instructions. Processor speed is measured in gigahertz (GHz), or billions of cycles a second. Some CPU rates are 2.0 GHz, 2.40 GHz and 3.20 GHz. These rates and others are obtained by using the motherboard's bus speed. CPU's are either 32-bit or 64-bit. This means how much data that can be processed in terms of bits. A 32-bit CPU can process a max of $_{2}$**32** (2 raised to 32nd power) or about 4.3 billion bits per cycle. A 64-bit processor $_{2}$**64** of data per cycle. The more data a computer can handle means improved performance.

2.4.3 Dual Core & Multi Core Processor

Most computer processors today are dual core or multi core. Both terms are generic for any processor that literally contains two or more CPU's in one package. Both Intel and AMD produce versions of these processors. AMD's Athlon X2, Turion X2, and Intel's Core 2 Duo and Core 2 Extreme are example of dual core CPU's. Multicore examples are the AMD Phenom X3 and X4, and Intel's Core 2 Quad and the Core i7. These powerful CPU's allow users to run several applications & simultaneously as well as play the latest games which requires high processing speed.

2.4.4 Performance

The performance or speed of a processor depends on the clock rate (generally given in multiples of Hz) and the instructions per clock (IPC), which together are the factors for the instructions per second (IPS) that the CPU can perform. The performance of the memory hierarchy greatly processor performance. Because of this problem, various standardized tests such as SPECint have been developed to measure the real effective performance in commonly used applications.

The processing performance of computer is increased by using multi-core processors, which essentially is plugging two or more individual processors into one integrated circuit.

2.5 Computer Network

A Computer Network may be defined as an interconnection of two or more autonomous computers. Two computers are said to be interconnected if they can share or exchange information. A computer network

system is often confused with a distributed system. A distributed system, like a computer network system, is also an interconnection of computer which are geographically dispersed or distributed. In a computer network each computer operates independently on separate tasks. Each computer is a complete unit itself with its own CPU, memory and other peripheral devices. On the other hand, a distributed processing system consists of a large powerful central computer with large memory and generally a high speed printer. A member microcomputer or minicomputers known as terminals are connected to this central computer. Typically all networks consists of the following components-

- **Server** - a server is a computer that provides resources to the other computers present on the network.
- **Client -** client refer to the set of computer that access shared network resources provided by the server.
- **Media** - media is the way in which the computers are connected .
- **Resources -** resources are files, printers etc. used by network users.
  Diagram of Computer Network

2.5.1 Advantages of Networks

Computer Networks have highly benefited various fields of educational sectors, business world, and many organization. They can be seen everywhere they connect people all over the world. There are some major advantages which computer Networks has provided making the human file more relaxed and easy, some of them are listed below -

(i) Date Sharing : Data sharing is one of the biggest advantages provided by the computer networks. All the data and resources like documents, files, accounts information, reports, multi media etc. can be shared with the help of computer networks. Hardware sharing and application sharing is also allowed in many organizations such as banks and small firms.

(ii) Instant and Multiple Accesses : Computer Networks are multiply processed, many of users can access the same information at the same time. Immediate commands such as printing commands can be made with the help of computer networks.

(iii) High Reliability : High reliability is achieved by replicating important data or files on two or three machines. This cause that if one of machines goes down, the user can still access the data through some other machines on the network. High reliability is the keyword for organization like military, banks, air traffic control etc. which need to be operational even if some hardware problem arises.

(iv) Video Conferencing : Before the arrival of the computer networks there was no concept for the video conferencing. LAN and WAN have made it possible for the organizations and business sectors to call the live video conferencing for important discussions and meeting.

(v) Internet Service : Computer networks provide internet service over the entire network. Every single computer attached to the network can experience the high speed internet, fast processing and work load distribution.

(vi) Broad Casting : With the help of computer networks news and important messages can be broadcast just in the matter of seconds who saves a lot of time and effort of the work. People, can exchange messages immediately over the network any time or we can say 24 hours.

(vii) Saves Cost : Computer networks save a lot of cost for any organizations in different ways. Building up links through the computer networks immediately transfers files and message to the other people which reduced transportation and communication expanse. It also raises the standard of the organization because of the advanced technologies that reused in networking.

(viii) Remote Access and Login : Employees of different or same organization connected by the networks can access the networks by simply entering the network remote IP or web remote IP. In this the communication gap which was present before the computer networks no more exist.

(ix) Flexibility : Computer networks are quite flexible all of its topologies and networking strategies supports addition for extra components and terminals to the network. They are equally fit for large as well as small organizations.

(x) Communication : Computer networks serves as a powerful medium of communication between people who are separated by geographical distance. Communication the biggest one advantage by the computer networks. Different computer networking technology has improved the way of communication people from the same or different organization can communicate in the matter of minutes for collaborating the work activities. In offices and organizations computer networks are serving the backbone of the daily communication from top to bottom level of organization. Different types of softwares can be installed which are useful for transmitting messages and emails at fast speed.

2.5.2 Computer Networking Devices

Computer networking devices are units the mediate data in a computer networks. These are also called networks equipment, Intermediate System (IS) or Inter Working Unit (IWU). Units which are the last receiver or generate data are called hosts or data terminal equipment. Computer networking devices also known as communication devices and they constitute a data communication network.

The common basic computer networking devices are -

(i) Router: A router is communication device that is used to connect two logically and physically different networks, two LANs, two WANs, and a LAN with WAN. The main function of the router is to sorting and the distribution of the data packets to their destination based on their IP addresses. Routers provide the connectivity between the enterprise business, ISPs and in the internet infrastructure, router is a main device. Cisco routers are widely used in the world. Every router has routing software which is known as routing table. Routing table is used to store source and destination address. Router operates at the network layer of the OSI model. Router does not broad cast the data packets.

(ii) Network Switch: A network switch or switching hub is a computer networking devices that connects network segments. The term commonly refers to a multi-port network bridge that processes and routes data at the data link layer (layer 2) of the OSI model. Switches that additionally process data at the network layer (Layer 3) and above are often referred to as Layer 3 switches or multilayer switches. The first Ethernet switch was introduced by Kalpana in 1990.

An Ethernet switch operates at the data link layer of the OSI model to create a separate collision domain for each switch port. With 4 computers (e.g., A, B, C, and D) on 4 switch ports, A and B can transfer data back and forth, while C and D also do so simultaneously, and the two conversations will not interfere with one another. In the case of a hub, they would all share the bandwidth and run in half duplex, resulting in collisions, which would then necessitate retransmissions. Using a switch is called micro-segmentation. This allows computers to have dedicated bandwidth on a point-to-point connections to the network and to therefore run in full duplex without collisions.

Switches may operate at one or more layers of the OSI model, including data link, network, or transport (i.e. end-to-end). A device that operates simultaneously at more than one of these layers is known as a multilayer switch.

(iii) Modem: A **modem** (**mo**dulator-**dem**odulator) is a device that modulates an analog carrier signal to encode digital information, and also demodulates such a carrier signal to decode the transmitted information. The goal is to produce a signal that can be transmitted easily and decoded to reproduce the original digital data. Modems can be used over any means of transmitting analog signals, from light emitting diodes to radio. The most familiar example is a voice band modem that turns the digital data of a personal computer into modulated electrical signals in the voice frequency range of a telephone channel. These signals can be transmitted over telephone lines and demodulated by another modem at the receiver side to recover the digital data.

Modems are generally classified by the amount of data they can send in a given unit of time, usually expressed in bits per second (bit/s, or bps). Modems can alternatively be classified by their symbol rate, measured in baud. The *baud* unit denotes symbols per second, or the number of times per second the modem sends a new signal.

(iv) Firewall: The term *firewall* originally referred to a wall intended to confine a fire or potential fire within a building. A **firewall** is a device or set of devices designed to permit or deny network transmissions based upon a set of rules and is frequently used to protect networks from unauthorized access while permitting legitimate communications to pass.

Many personal computer operating systems include software-based firewalls to protect against threats from the public Internet. Many routers that pass data between networks contain firewall components and, conversely, many firewalls can perform basic routing functions.

(v) Proxy Server: In computer networks, a proxy server is a server (a computer system or an application) that acts as an intermediary for requests from clients seeking resources from other servers. A client connects to the proxy server, requesting some service, such as a file, connection, web page, or other resource, available from a different server. The proxy server evaluates the request according to its filtering rules.

The proxy concept was invented in the early days of distributed systems as a way to simplify and control their complexity. Today, most proxies are a **web proxy**, allowing access to content on the World Wide Web.

A proxy server has a large variety of potential purposes, including:

- To keep machines behind it anonymous (mainly for security).
- To speed up access to resources (using caching). Web proxies are commonly used to cache web pages from a web server.
- To apply access policy to network services or content, e.g. to block undesired sites.
- To log / audit usage, i.e. to provide company employee Internet usage reporting.
- To bypass security / parental controls.
- To scan transmitted content for malware before delivery.
- To scan outbound content, e.g., for data leak protection.
- To circumvent regional restrictions.
- To allow a web site to make web requests to externally hosted resources (e.g. images, music files, etc.) when cross-domain restrictions prohibit the web site from linking directly to the outside domains.

A proxy server that passes requests and responses unmodified is usually called a gateway or sometimes *tunneling proxy*. A proxy server can be placed in the user's local computer or at various points between the user and the destination servers on the Internet.

(vi) Repeater: A repeater is an electronic device that receives a signal and retransmits it at a higher level and/or higher power, or onto the other side of an obstruction, so that the signal can cover longer distances. The term "repeater" originated with telegraphy and referred to an electromechanical device used by the army to regenerate telegraph signals. Use of the term has continued in telegraphy and data communication.

In telecommunication, the term **repeater** has the following standardized meanings:
1. An analog device that amplifies an input signal regardless of its nature (analog or digital).
2. A digital device that amplifies, reshapes, retimes, or performs a combination of any of these functions on a digital input signal for retransmission.

Repeaters are used in both copper-wire cables carrying electrical signals, and in fiber-optics carrying light. Repeaters are used in radio communication services. Radio repeaters often transmit and receive on different frequencies. A special subgroup of those repeaters is those used in amateur radio. Repeaters are also used extensively in broadcasting, where they are known as translators, boosters or TV relay transmitters.

2.6 Summary

Computer is the most powerful and versatile tool even created by man. Computer performs the instructions given by a user. User use different kind of input devices to give instruction and output devices to access results from computer. After reading this unit you will be able to use and operate almost all kinds of peripheral devices. This unit provides you a lot of knowledge about computer network, network terminology and network devices with their use.

Now, you have sufficient knowledge about various computer devices such as input – output as well as processors and computer networking devices.

Data: Unprocessed raw facts and figures.

Information: Processed data which convey proper meaning.

Hardware: Physical parts of computer that can be seen and touched.

Network: Group of devices linked to one another.

Keyboard: Generally used to type or select an option on the screen. It is an input device.

Mouse: It is an input device which is used to point and select some option on VDU

Mother Board: This is the main circuit board that all of the other internal components connect to. The CPU and memory are usually on the motherboard.

CPU: The "microprocessor" brain of the computer system is called the central processing unit consist of ALU and Control Unit.

Hard Disk: This is large-capacity permanent storage used to hold information such as programs and documents.

Sound Card: This is used by the computer to record and play audio by converting analog sound in to digital information and back again.

VDU (Visual Display Unit): It is an output device where the output of any command is displayed ie. the screen.

DVD-Rom: DVD-Rom is similar to CD-Rom but is capable **of holding much more information.**

CD-Rom Drive: It is an input device. To read a CD-Rom disk a CD-Rom drive is required. One can only read from it and cannot write on it.

CD-Writer: It is input device. To write from other CD to your CD, writer is used.

Modem: This is the standard method of connecting to the Internet.

LAN Card: This is used by many computers, particularly those in an Ethernet office network to connected to each other.

USB (Universal Serial Bus) : This port is becoming most popular external connection, USB ports offer power and versatility and are incredibly easy to use.

2.7 Self Assessment Questions

1. What do you mean by input devices? Explain the functioning of punched cards.
2. Differentiate between mouse and trackball?
3. What is optical recognition system? Explain OCR and OMR.
4. Define the output units in brief?
5. Explain the functioning of plotters?
6. What are the impact and non-impact printers? Give one example of each and explain.
7. What do you mean by computer processor? Explain in brief.
8. What is a computer network? Write down its advantages?
9. Explain the different kinds of computer networking devices briefly?
10. Explain the functioning of laser printer?

2.8 Reference Books

- Henry.C.Lucas, Jr. (2001) 'Information Technology'; Tata Mc Graw Hill Publication Company Limited, New Delhi.
- D.P.Sharma (2008); 'Information Technology'; College Book Centre, Jaipur.
- Jain, Jalan, Ranga, Chouhan, (2009); 'Information Technology'; Ramesh Book Depot, Jaipur.
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Unit - 3 : Computer Software

Structure of Unit:

3.0 Objectives
3.1 Introduction
3.2 Types of Software
3.3 Types of Application Software
3.4 Device Drivers
3.5 Types of System Software
3.6 Operating System
3.7 Types of Operating System
3.8 Summary
3.9 Self Assessment Questions
3.10 Reference Books

3.0 Objectives

After completing the unit, you will be able to:

- Understand software and their importance
- Know the classification of softwares
- System software & application softwares
- Operating system and the classification.

3.1 Introduction

A system can be defined as a group of interrelated components that achieve a common goal by accepting input and producing output with the help of organized processing. For example, a manufacturing system accepts row material as input and producer finished goods as output with the help of production process.

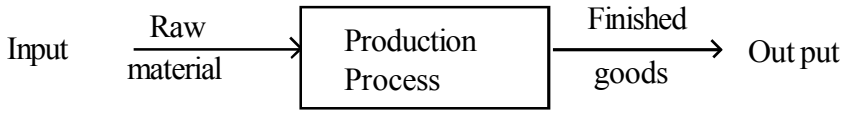


Figure 3.1 : Manufacturing Unit

So, we can define a computer as an electronic device which processes information under the control of a set of instructions called "Program". It has the ability to accept data, execute the programme for program mathematical and logical operations on data. The results of the operations can be reported through output. A computer is a complete system itself.

The computer as a system is, infect, a combination of hardware, operating system, system software and application programme and user.

3.2 Types of Software

A computer is not capable of performing any task with just the hardware. It requires instructions to determine is to be done. Instructions are also entered like the data using keyboard. A sequence of instructions given to a computer to perform a particular task is called a program. A set of programs written by specialist

called programmers for a computer is called software. Softwares used on computers may be of different types. Some important types of Software are discussed below:

3.2.1 System Software

System software helps the computer perform essential operating tasks buy a computer and enables the application software to interact with the computer it also helps the computer to manage its internal and external resources. The system software includes operating system, compilers, interpreters, assemblers etc.

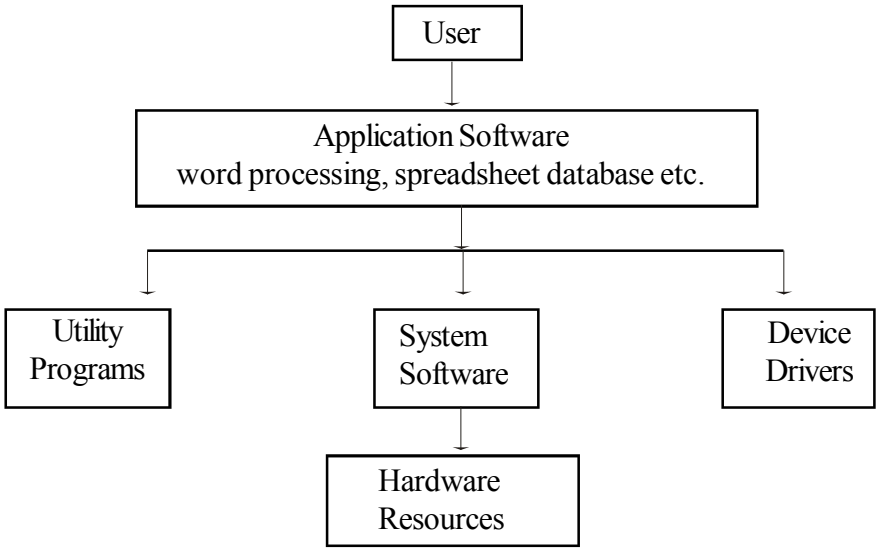


Figure 3.2 : System Software

3.2.2 Utility Software

The softwares which are used for developing, writing, debugging and documenting programs are known as utility software. These help the users in the preparation of programs. There are two types of utilities:

(i) File management utilities.

(ii) Program development utilities.

(i) File management utilities - These are a part of operating system and help the user in copying, erasing (deleting), renaming and printing the files.

(ii) Program development utilities - These are used for writing and testing of programs. These include editor, compiler, assembler, linker, loader, debuger etc. A simple text editor is a part of operating system but an elaborate editor is stored separately. The compilers are stored separately.

All the softwares are controlled by the operating system. Utilities are those helpful programs that ensure the smooth functioning of the computer. Utilities are meant to assist your computer. Some utilities help you backup data, some help remove outdated files or recover data that has been accidentally erased. Some make it easier to find and arrange the information you need. And some help you avoid virus attacks or clean viruses, if any. In other words, the utility programs perform housekeeping functions.

It is an established truth that everything comes with certain pros and cons. Software also are not an exception to it. Utilities bridge the gaps by helping to solve the problems and maximize your computer's potential. Some important utilities are being discussed below.

1. Text Editor: This utility program is used for creating, editing text files. Using this program any text manner can be typed and saved on a disk file. This file can be retrieved any time and can also be edited, corrected etc. Text editor software supports special commands for text editing i.e., you can insert, delete, find, replace characters, lines and paragraphs etc.

2. Backup Utility: This utility program facilitates the backing-up of disk. Back-up means duplicating the disk information so that in case of any damage or data-loss, this backed up data may be used the files or folders or even drives can be backed up using this utility. You can back up files floppy disk, a tape drive or even on another computer on your network. The backed up data may be restored when needed i.e., if your original files are damaged or lost.

3. Compression Utility: This utility program facilitates compression of files. Large files can be compressed so that they take less storage area. When needed, these compressed files can be exploded back to their original form. By compression, the files are stored in a special format that takes less space. However, these compressed files cannot be directly used, they need to be exploded back to their original form before they can be worked upon.

4. Disk Defragment: This utility program attempts to minimize the fragmentation on your disk. A file is fragmented when it becomes too large for your computer to store in a single location on a disk. When this happens, your computers split the file up and store it in pieces. You can use fragmented files, but it takes your computer longer to access them.

Disk Defragment or speeds up disk access by rearranging the files and free space on your computer, so that files are stored in contiguous units and free space is consolidated in one contiguous block.

5. Antivirus Software: This utility program ensures virus-free work environment. A computer virus is a computer program that can inject other computer programs by modifying them in such a way as to include a copy of itself A virus not only copies itself but also makes the computer system behave abnormally. For instance, unknown or unasked messages may get flashed or unwanted music get played or unwanted graphical displays might occur. An antivirus software scans your disk for viruses and removes them, if any virus is found Moreover, some antivirus software remains present in memory all the time so that they can detect the viruses (as soon as they occur) and counterattack them.

3.2.3 Application Software

A computer can perform different functions by changing programs. Many tasks that you work on with a computer are known as applications and the programs you use to perform them are known as application software or application programs. For example, an application is writing a letter, preparing a budget or creating a mailing list. The application programs you use for these applications are word processors, spreadsheets and database managers. The development and wide distribution of these inexpensive and useful application programs is what has made the computer an extremely useful tool for everyone throughout the world. The application program you use depends on the task you want to perform. New PCs are usually equipped not only with system software but also with some application software. The relationship between hardware, software and the computer user is shown in the figure 3.3.

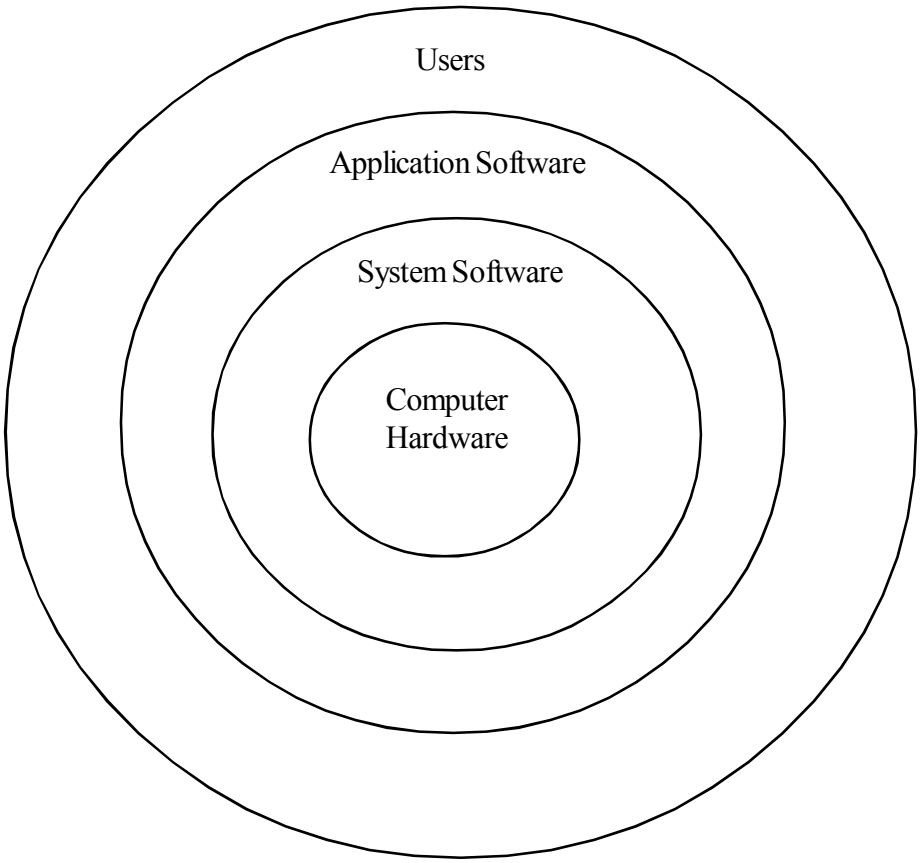


Figure 3.3 : Relationship Between Hardware, Software and User

In the diagram, the hardware is at the centre of computer system, which consists of the physical devices or components. The system software layer surrounds the hardware, which comprises the operating system and programming environment of the computer system. This software layer is designed to hide the hardware details of the computer from application programmers, and to co-ordinate the operations of the different hardware devices for optimizing their performance. The application software layer, which surrounds the system software, consists of a variety of software which are designed for performing specific tasks, or for solving a particular problem. The outermost layer is the layer of users who generally interact with the computer system using the user interface provided by the application software. Different interfaces are supported by different application software. Hence the user interaction with computer system, depends on his/her application of use at a particular moment.

3.3 Types of Application Software

In the early days of computers, everyone just paid for PC application software. Users brought it as part of a computer or in a software store, or download it online with a credit card charge. There are following types of application softwares are available in market :

(i) Commercial Software:

It is also known as proprietary software or packaged software. It is the software that is offered for sale, such as MS-ward or Office 2000. Generally, we pay for it as part of the purchase of a new PC We pay for a new game or other commercial program which are generally copyrighted. A copyright is the exclusive legal right that prohibits copying of intellectual property without the permission of the copyright holder.

Software manufacturers don't sell us their software but provide us a license to become an authorized user of it. In paying for a software license, we sign a contract in which we agree not to make copies of the software to give away or for resale. That is we have only the permission to use the software and not the software itself.

(ii) Public - domain Software:

It is not protected by copyright and thus may be duplicated by everyone at will. These are oftenly available through sites on the Internet. We can duplicate public domain software without fear of legal prosecution.

(iii) Freeware:

It is copyrighted software that is distributed free of charge, today most often over the internet. It is due to the wish of some developers to see the response of the users, so that they can make modifications in a later version. Linux is an example of such a program. In its most recent form, freeware is made available by companies trying to get money some other way -actually, by attracting viewers to their advertising. The web browsers Internet Explorer and Netscape Navigator are examples of this type. The copyrights of freeware are generally retained by its developers.

(iv) Rental Ware:

It is software that users lease for a fee. This is the concept behind Application Service Providers (ASPs), firms that lease software on the Internet. Users download programs whenever they require it.

(v) Printed Software:

It is an illegal copy of a software For example a commercial video game. In doing so the original copyright owners are not paid for their creative work. A risk of picking up a virus is always there. Occasionally, companies or individuals require software written specifically, to meet their unique needs. This software is known as custom software, and it is developed by software engineers and programmers.

Some of the most commonly used application softwares are

(i) **Word Processing Software:** It helps us to use the computer system for document preparation, text file manipulation like edit, create, view, format, store, retrieval and print documents / files. It is useful for writing books, letters and other documents.

(ii) **Education Software:** It helps us to use the computer as a teaching and learning tool. NCERT has effectively used educational software for providing quality education to the students of different classes in India.

(iii) **Graphics Software:** It helps us to use computer system for creating, editing, viewing, storing, retrieving and printing designs, pictures, graphics, drawings and everything that can be drawn manually.

(iv) **Entertainment Software:** These softwares are used in computer systems as tools for developing and playing video games.

(v) **Spreadsheet Software:** It is used in computer system for numeric data analysis. This software maintains computerized ledger for financial, educational organizations, eg. MS-Excel.

(vi) **Database Software:** A database software helps us to use computer system for creation, maintenance (add, delete, and update the records), organization and retrieval of data information from the database. A database is a collection of files for storage and retrieval of data

(vii) **Personal Help software:** It helps us to use computer for storage and retrieval our personal information. For example, planning and managing students personal schedules, such as study, play, entertainment etc.

3.4 Device Drivers

Device drivers are essential piece of system software. As you know by now that an operating system act as a link between the hardware and software enabling both to communicate and do their tasks.

A device driver or simply a drive, is a specially written program which translate the commands form the operating system into commands that the specific hardware will understand. Each piece of hardware e.g., a printer, monitor, scanner, mouse, keyboard, modem etc. has its own driver. Devices from different manufacturers work in different ways e.g., a printer from manufacturer HP will need a different driver than a printer from manufacture Epson. If you try to use a device without the correct driver, then it probably will not work or produce correct results.

Today, new operating systems like Windows Vista come pre-equipped with many derivers. So you simply need to plug the device and it works as its driver is already available with the operating system. But this is possible for commonly used devices.

3.5 Types of System Software

There are a lot of system software which are used to solve the system's problem. Most commonly used system softwares are language translator. A language translator is a program which converts statements written in one language into statements in another language. There are basically there types of translators.

1. Assembler
2. Compiler
3. Interpreter

1. Assembler:

A computer can only understand machine language. Hence, the programs written in other language must be translated into the machine language of the computer. Such translation is performed with the help of a software. A program which translates an assembly language program into a machine language program is called Assembler. An Assembler which runs on a computer for which it produces object codes (machine code) is called a self Assembler (or Resident Assembler). A program written in assembly language is called source program. The assembler converts the source program into machine language program known as object program. In fact an assembler is a look-up table which contains machine language equivalent of the mnemonics and memory addresses used in assembly language programs.

Working of an Assembler: An assembly language program (source program) is fed to the computer though an input device. The assembler program present in the computer memory translates this source program to an equivalent machine language program called the object program by translating one instruction at a time.

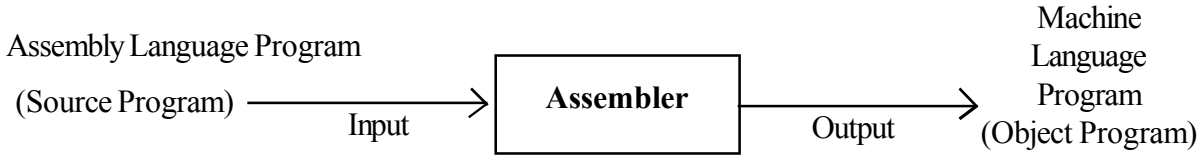


Figure 3.4 : Illustration of the Translation by an Assenbler

In the assembler reads the program twice. During first reading it develops the table of names used in the source program, assign and stores the numerical address for each name. Then in the second reading it translates the instructions into machine language and generates the object program. The object program is stored on the disk. Such an assembler is called Two- Pass Assemble.

2. Compiler:

A program written in high level language needs to be translated into machine language before it can be executed by the computer. This job of translation is performed with the help of a software program. This program is known as a compiler. A Compiler is so called because for every program instruction of a high level language, it compiles a set of machine language instructions. A program written in a high level language is known as source program. The program obtained after compilation is known as the object program.

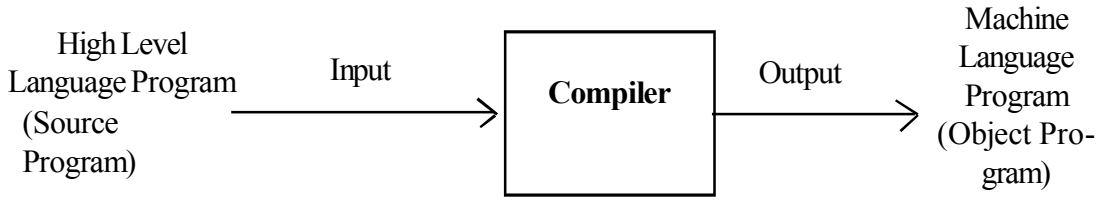


Figure 3.5 : Illustration of the translation by Compiler

Every high level language has its own compiler and it can translate only those programs which are written in that particular language compilers are large programs which reside permanently on secondary storage. When a program is to be compiled the compiler is copied into the main memory of the computer and is executed in the CPU. During compilation the compiler analyses each statement in the source program and generates a sequence of machine instructions the instruction. Besides translating in high level language into machine language instructions, the compiler also brings out any errors related to the syntax (grammar) or semantics (meaning) of the specified high level language.

A compiler can detects following kinds of errors :

(i) Illegal characters.
(ii) Illegal combination of characters
(iii) Improper sequencing of instructions in a program

3. Interpreter:

An interpreter is a translating program for the purpose of converting high level language in to machine language. An interpreter translates only one statement of a high level language at a time. After translation the statement is immediately executed. This is in contrast to a compiler which translator the entire source program into object program. This object code is saved permanently for future use and is used every time the program is to be executed. In this manner repeated compilation is not necessary for repeated execution of a program. However, in the case of an interpreter the object program is not stored because the translation and execution take place alternately. So it a statement is to be used again then it must be interpreted again.

The advantage of an interpreter over a compiler is, fast response to changes in the source program. Moreover, a compiler is a complex program compared to an interpreter. Interpreter are easy to write and do not require large memory space in the computer. The interpreter, however is a time consuming translation method because each statement must be translated every time it is executed from the source program. Thus, a compiled machine language program runs much faster than an interpreted one.

3.6 Operating System

An operating system is an important part of every computer system. A computer can be divided into four components. The hardware, the operating system, the application program and the user.

The operating system controls and co-ordinate the use of the hardware among the various application programs for the various users. The operating system (OS) provides the means for the proper use of these resources in the operation of the computer system. The operating system can be explored from two viewpoints: **the user** and **the system**.

User View

The user view of the computer varies by the interface being used. Most computer users sit in front of a PC, consisting of a monitor, keyboard, mouse and system unit. Such a system is designed for one user to monopolize its resources, to maximize the work that the user is performing. In this case, the operating system is designed mostly for ease use of, with some attention paid to performance.

Some users sit at a terminal connected to a mainframe or minicomputer. Other users accessing the same computer through other terminals. These users share resources and may exchange information. The operating system is designed to maximize resource utilization.

Other users sit at workstations, connected to networks of other workstations and servers. These users have dedicated resources at their disposal, but they also share resources such as networking and servers – file, compute and print servers. Therefore, their operating system is designed to compromise between individual usability and resource utilization. Some computers have little or no user view. For example, embedded computers in home devices but mostly they and their operating systems are designed to run without user intervention.

System View

The operating system is the program that is most intimate with the hardware, it work as a resource allocator. A computer system has many resources – hardware and software – that may be required to solve a problem such as CPU time, memory space, file-storage space, I/O devices and so on. The operating system acts as the manager of these resources. The operating system must decide how to allocate resources to specific programs and users so that it can operate the computer system efficiently and fairly.

A slightly different view of an operating system emphasizes the need to control the various I/O devices and user programs. An operating system is a control program. A control program manages the execution of user programs to prevent errors and improper use of the computer. It is especially concerned with the operation and control of I/O devices.

3.7 Types of Operating System

Multi-user and Single-user Operating Systems

Computer operating systems of this type allow multiple users to access a computer system simultaneously. Time-sharing systems can be classified as multi-user systems as they enable a multiple user access to a

computer through time sharing. Single-user operating systems, as opposed to a multi-user operating system, are usable by a only one user at a time. Being able to have multiple accounts on a Windows operating system does not make it a multi-user system. Rather, only the network administrator is the real user. But for a Unix-like operating system, it is possible for two users to login at a time and this capability of the OS makes it a multi-user operating system.

Multi-tasking and Single-tasking Operating Systems

When a single program is allowed to run at a time, the system is grouped under the single-tasking system category, while in case the operating system allows for execution of multiple tasks at a time, it is classified as a multi-tasking operating system. Multi-tasking can be of two types namely, pre-emptive or co-operative. In pre-emptive multitasking, the operating system slices the CPU time and dedicates one slot to each of the programs. Unix-like operating systems such as Solaris and Linux support pre-emptive multitasking. If you are aware of the multi-threading terminology, you can consider this type of multi-tasking as similar to interleaved multi-threading. Cooperative multitasking is achieved by relying on each process to give time to the other processes in a defined manner. This kind of multi-tasking is similar to the idea of block multi-threading in which one thread runs till it is blocked by some other event. MS Windows prior to Windows 95 used to support cooperative multitasking.

Embedded System

The operating systems designed for being used in embedded computer systems are known as embedded operating systems. They are designed to operate on small machines like PDAs with less autonomy. They are able to operate with a limited number of resources. They are very compact and extremely efficient by design. Windows CE, FreeBSD and Minix 3 are some examples of embedded operating systems.

Mobile Operating System

Though not a functionally distinct kind of operating system, mobile OS is definitely an important mention in the list of operating system types. A mobile OS controls a mobile device and its design supports wireless communication and mobile applications. It has built-in support for mobile multimedia formats. Tablet PCs and smart phones run on mobile operating systems. Operating systems thus contribute to simplifying human interaction with the computer hardware. They are responsible for linking application programs with the hardware, thus achieving an easy user access to computers.

3.8 Summary

We have learnt about computer software. We can differentiate between application, system and utility software. We can complete your office work in less time and correctly by using office application software. We have got little more knowledge about the operating system and its types. There are different system software which are used by system components. System software controls internal computer operations. Device drivers are essential piece of system software. We know that if we try to use a device without the correct driver, then it probably will not garbled results.

Key Words

Application software: Software that pertains to a specific application

DBMS : Data Base Management System. A software that can handle an manage bulk of stored data.

Electronic Spreadsheet: Software that processes data in tabular form and allows manipulations, calculations, analysis of data.

System Software: Software that controls internal computer operations.

Utility Software: A software that assists the computer by performing housekeeping functions.

Word Processor: Software that processes textual matter and creates organized documents.

Software: A set of programs that govern the operation of a computer system.

Multimedia Software: A software that incorporates images, text, sound, computer animation and video sequences.

Graphic Software: A software that manipulates images.

Fragmentation: Scattered storage of files across disk.

Language Processor: Software that converts a high level language code into machine understandable form.

Software: Instructions given to computer to make it work.

Operating System*:* Interface between a user and the hardware.

3.9 Self Assessment Questions

1. What are various categories of software?
2. What is application software? Why is it required?
3. List all types of application software and explain each in brief?
4. What is system software? Why system software is required?
5. What is the difference between an interpreter and a compiler?
6. What is an assembler? Explain its functioning.
7. What do you mean by operating system? List and explain types of operating system.
8. What do you understand by utility software? Explain briefly.

3.10 Reference Books

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Unit - 4 : Windows and its Application

Structure of Unit:

4.0 Objectives
4.1 Introduction
4.2 Windows Operating System
4.3 Elements of Desktop
4.4 File Handling in Windows
4.5 Application and Document Window
4.6 Summary
4.7 Self Assessment Questions
4.8 Reference Books

4.0 Objectives

After going through this lesson, you would be able to:

- Explain the basics of operating system
- Create file or folder in XP
- Change system settings
- Get familiar with basic concepts & elements of windows
- Know different parts of Window

4.1 Introduction

Some popular Operating System's are:

1. **Unix:** multi-tasking, multi-processing, multi-user, protected, with built-in support for networking but not graphics.
2. **Windows NT:** multi-tasking, multi-processing, single-user, protected, with built-in support for networking and graphics.
3. **Windows 95/98:** multi-tasking, multi-processing, single-user, unprotected, with built-in support for networking and graphics.
4. **Windows 3.x:** single-tasking, single-processing, single-user, unprotected, with built-in support for graphics but not networking.
5. **DOS:** single-tasking, single-processing, single-user, unprotected with no built-in support for graphics or networking.
6. **NetWare:** multi-tasking, multi-processing, single-user, unprotected, with built-in support for networking but not graphics.

4.2 Windows Operating System

The windows operating system started with the introduction of Windows OS and Windows for work group for networking. Since then it has come a long way and Windows 95, 98 and 2000 family of operating systems were introduced. It provided the computer user with the most integrated and easy to use operating system with all the facilities in built. The Windows XP is the newborn baby in the Windows family. It is build on the windows 2000 concept and framework. It has more features to provide the user with greater stability, security and enhanced performance.

History of Operating Systems

An operating system (OS) is a software program that manages the hardware and software resources of a computer. The OS performs basic tasks, such as controlling and allocating memory, prioritizing the processing of instructions, controlling input and output devices, facilitating networking, and managing files. The first computers did not have operating systems. However, software tools for managing the system and simplifying the use of hardware appeared very quickly afterwards, and gradually expanded in scope. By the early 1960s, commercial computer vendors were supplying quite extensive tools for streamlining the development, scheduling, and execution of jobs on batch processing systems. Examples were produced by UNIVAC and Control Data Corporation, amongst others.

Through the 1960s, several major concepts were developed, driving the development of operating systems. The development of the IBM System/360 produced a family of mainframe computers available in widely differing capacities and price points, for which a single operating system OS/360 was planned (rather than developing ad-hoc programs for every individual model). This concept of a single OS spanning an entire product line was crucial for the success of System/360 and, in fact, IBM's current mainframe operating systems are distant descendants of this original system; applications written for the OS/360 can still be run on modern machines. OS/360 also contained another important advance: the development of the hard disk permanent storage device (which IBM called DASD). Another key development was the concept of time-sharing: the idea of sharing the resources of expensive computers amongst multiple computer users interacting in real time with the system. Time sharing allowed all of the users to have the illusion of having exclusive access to the machine; the Multics timesharing system was the most famous of a number of new operating systems developed to take advantage of the concept.

Multics, particularly, was an inspiration to a number of operating systems developed in the 1970s, notably Unix. Another commercially-popular minicomputer operating system was VMS. The first microcomputers did not have the capacity or need for the elaborate operating systems that had been developed for mainframes and minis; minimalistic operating systems were developed. One notable early operating system was CP/M, which was supported on many early microcomputers and was largely cloned in creating MS-DOS, which became wildly popular as the operating system chosen for the IBM PC (IBM's version of it was called IBM-DOS or PC-DOS), its successors making Microsoft one of the world's most profitable companies. The major alternative throughout the 1980s in the microcomputer market was Mac OS, tied intimately to the Apple Macintosh computer. By the 1990s, the microcomputer had evolved to the point where, as well as extensive GUI facilities, the robustness and flexibility of operating systems of larger computers became increasingly desirable. Microsoft's response to this change was the development of Windows NT, which served as the basis for Microsoft's entire operating system line starting in 1999. Apple rebuilt their operating system on top of a Unix core as Mac OS X, released in 2001. Hobbyist-developed reimplementation of Unix, assembled with the tools from the GNU project, also became popular; versions based on the Linux kernel are by far the most popular, with the BSD derived UNIXes holding a small portion of the server market.

Types of Windows operating system

- **Windows 1.01:** Windows 1.0 presents incomplete multitasking of the MS-DOS programs and focuses on generating an interfacial pattern, an effecting replica and a steady API for indigenous programs for the next generation.

• **Windows 2.03:** Windows 2.0 permits functional windows to overlie on one another, dissimilar to Windows 1.0, which is capable just to exhibit tiled windows. Windows 2.0 has also brought up additional stylish keyboard-shortcuts and the terms like "Maximize", and "Minimize" as opposite to "Zoom" and "Iconize" in Windows 1.0.

• **Windows 2.11:** Before the year passed after the production of Windows 2.0, Windows/286 2.1 and Windows/386 2.1 were made. These versions are able to obtain the benefit of the explicit features of the Intel 80286 and Intel 80386 processors.

• **Windows 3.0:** Windows 3.0 was the 3rd most important production of Microsoft Windows which was released on 22nd May 1990. It turned out to be the 1st broadly used version of Windows.

• **Windows 3.1**

• **Windows For Workgroups 3.1:** Windows 3.1 (also known as Janus), had came up on March 18, 1992. This version includes a TrueType inbuilt font system making the Windows a solemn desktop issuing platform for the 1st time. Windows 3.0 could have similar functionality with the use of the Adobe Type Manager (ATM) font system from Adobe.

• **Windows NT 3.1**

• **Windows For Workgroups 3.11:** Microsoft's Windows NT line of server and business desktop operating systems had 1st released Windows NT. Progress of it had started in November 1988 and was unconfined on July 27, 1993.

• **Windows 3.2:** This is the 1st version of Windows NT having the names like Windows NT Server and Windows NT Workstation for its versions.

• **Windows NT 3.5**

• **Windows NT 3.51:** Windows 95 Windows 95 was planned to amalgamate MS-DOS and Windows goods and contain an improved version of DOS.

• **Windows NT 4.0**

• **Windows 98:** Windows 98 is a modernize version of Windows 98. It was released on May 5, 1999.

It solves many minor issues, the substitute of Internet Explorer 4.0 by relative faster Internet Explorer 5and better USB support.

• **Windows 98 SE**

• **Windows 2000:** Windows 2000 (also called Windows Me) is an extension of the Windows 9x version, but with access to the actual mode MS-DOS limited so as to get a move for the system boot time.

It was one of the most revealed alterations in Windows Me. Because of some applications that require actual mode DOS to run those could not be made to run on Windows Me.

• **Windows Me**

• **Windows XP:** Microsoft has developed Windows XP is a line of operating systems for applying on general functional computer systems which includes business and home desktops, media centers and notebook computers. Windows XP was released on 25th October 2001.

- **Windows XP 64-bit Edition 2003**
- **Windows Server 2003**
- **Windows XP Professional x64 Edition**
- **Windows Fundamentals for Legacy PCs**
- **Windows Vista:** After a world-wide success of XP and its service packs Microsoft has designed and created Windows Vista the operating system for use on personal computers, including business and home desktops, Tablet PCs, laptops and media centers.

  It was first named as "Longhorn" but later on 22nd July 2005, the name was announced as Windows Vista. The development of Vista was finished on 8th November, 2006. In the next three months Vista was available in steps to computer software and hardware manufacturers, retail counters, and business organizations. It was released globally on 30th January 2007, for the general public.
- **Windows Home Server**
- **Windows Server 2008**
- **Windows 7**

4.3 Elements of Desktop

Windows is loaded into the memory of the computer; the focus is placed on the desktop. The desktop is designed to act just like an actual desktop. The desktop is a window that covers your entire computer screen. It is the interface through which all of the programs are accessed. All other programs run on the top of the Windows desktop.

The Windows desktop is comprised of three key elements:

1) Icons
2) Start menu
3) Taskbar

1) Icons: Icons can be further classified into five categories:

- **Folder Icons:** When a folder icon is double clicked, a folder window is opened displaying the contents of the folder.
- **Program Icons:** When a Program icon is double clicked, the corresponding program is loaded into the memory of the computer and the application starts running in a Window.
- **Document Icons:** When a document icon is double clicked, the document itself is opened. For e.g., (Word processing program, spreadsheet, database etc.
- **Shortcut Icons:** Shortcut icons provide an alternate way to open programs, documents, and folders.
- **System Icons:** System icons are mandatory programs or files that are located on your desktop. User is not allowed to delete the system icon, since deleting the system icon would mean deleting the actual program from the hard drive of the computer. Examples of System Icons are Recycle Bin, My Computer, and Network Neighborhood etc.

2) Start Menu: The Start Menu and Start Button are user interface elements used in the later versions of the Microsoft Windows operating systems and in some X window managers. The Start Button provides a central launching point for application and tasks.

In Windows operating systems prior to Windows Vista, the Start Button consists of the word "Start" and the Windows Logo (the word "Start" was localized for each different language version of the system, for instance reading Avvio in Italian). On the Windows Vista and Windows 7 desktop, the word "Start" has been replaced by a blue Windows "orb" logo. However the user can revert to displaying the word "Start" and the Windows Logo by setting the theme to Windows Classic.

Traditionally, the Start Menu provided a customizable nested list of programs for the user to launch, as well as a list of most recently opened documents, a way to find files and get help, and access to the system settings. Later enhancements via Windows Desktop Update included access to special folders like "My Documents" and "Favorites" (browser bookmarks). Windows XP's Start Menu was expanded to encompass various My Documents folders (including My Music and My Pictures), and transplanted other items like My Computer and My Network Places from the Windows desktop.

The Start Menu is not a truly essential feature, as programs and files can also be opened by navigating to them in the Windows Explorer interface. However, the Start Menu provides a much quicker and easier way to open programs, even for experienced users, and consolidates a list of programs into one place. Microsoft uses the Start Menu more in each version of Windows as a way to shield novice users from the complexities of the operating system. For example, in Windows XP, the root, Program Files and Windows folders are hidden from the user by default, and access to programs is expected to be achieved through the Start Menu.

3) Task Bar: When you start the computer system, then start and task bar appears on the bottom of the screen and by default remains visible when Windows is running.

Task bar indicates the number of programme/application running at a moment of time. Whenever a program is run or a window is opened, an icon representing the program appears on the taskbar. To switch between windows or program, click on the icon representing the window on the task bar. When the program or window is closed, the icon disappears from the task bar.

Recycle Bin: Any file that is deleted from the hard disk of the computer is moved to a separate folder called Recycle Bin. The files stored in the bin can be restored to their original location by using the 'Restore' option of Recycle Bin. To empty the Recycle Bin, simply right click on this icon and-select 'Empty Recycle Bin' option.

My Computer: Double clicking the "My Computer" icon will open a window that displays the contents of the computer. All the files and folders available in the computer can be viewed here. It also allows you to display the system and hardware information.

Network Neighborhood: "Network Neighborhood" icon displays windows from other computers and resources, like printer, connected to the network

Menus and Bars

Desktop contains the following control elements:

Table 4.1

Element	Description
Menu bar	Contains both standard Eclipse and Voice Objects-specific menus.
Toolbar	Contains shortcut buttons to frequently used commands.
Status bar	Displays the most recent information about the current project and the Voice Objects environment.

Menu bar:

A menu bar is a horizontal strip that contains lists of available menus for a certain program. In Windows programs, the menu bar resides at the top of each open window, while the menu bar is always fixed on the top of the screen. Despite this major difference, the menu bar serves the same purpose on each platform.



Toolbar:

In a graphical user interface, on a computer monitor, a toolbar is a GUI widget on which on-screen buttons, icons, menus, or other input or output elements are placed. Toolbars are seen in office suites, graphics editors, and web browsers. Toolbars are usually distinguished from palettes by their integration into the edges of the screen or larger windows, which results in wasted space if too many under populated bars are stacked atop each other (especially horizontal bars on a landscape oriented display) or interface inefficiency if overloaded bars are placed on small windows.

Status bar:

A status bar, similar to a status line, is an information area typically found at the bottom of windows in a graphical user interface. A status bar is sometimes divided into sections, each of which shows different information. Its job is primarily to display information about the current state of its window, although some status it also shows things bars has extra functionality.

4.4 File Handling in Windows

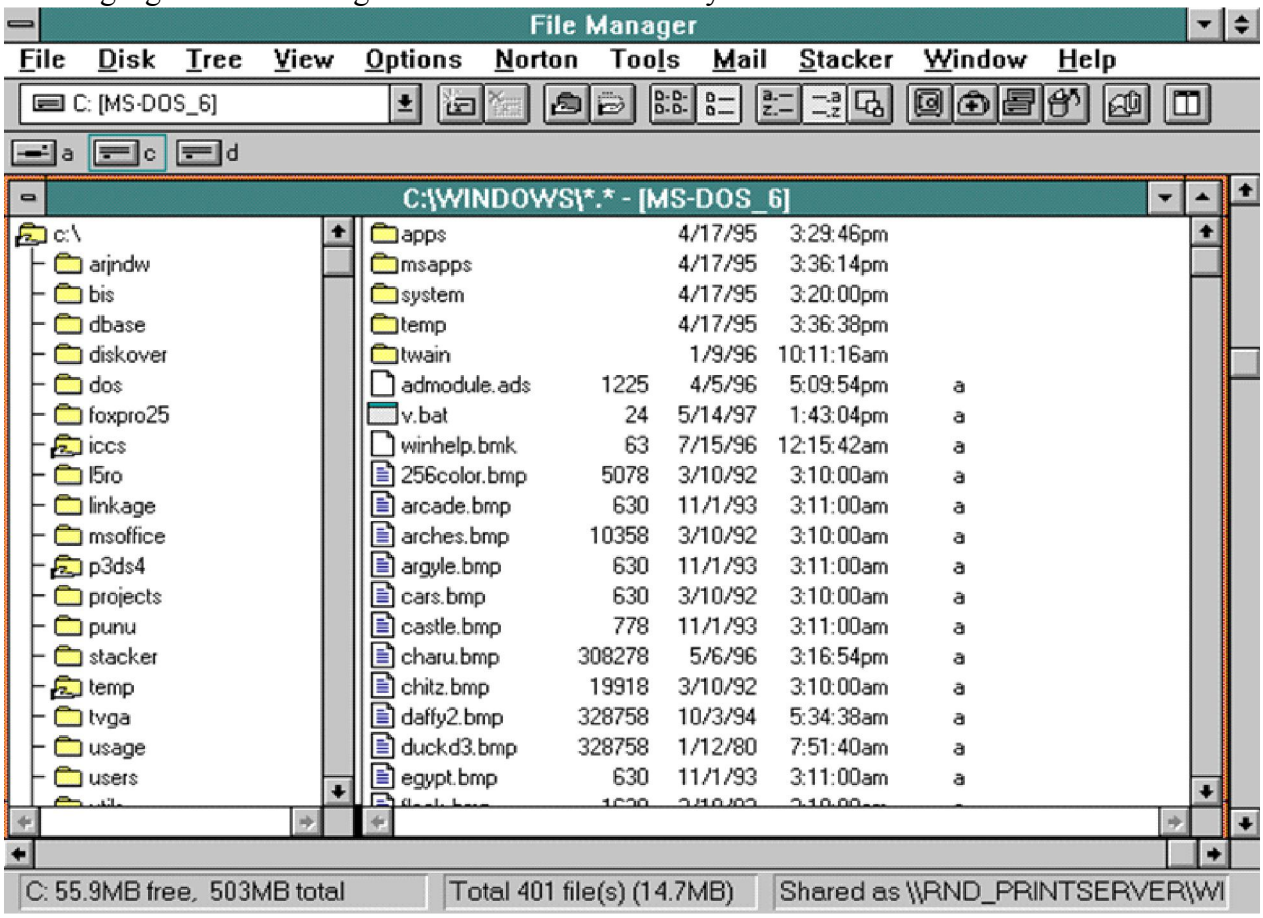
4.4.1 Introduction

Windows being a GUI, gives better flexibility and easier to use for file management. Using the File Manager feature of Windows, one can easily copies, move, delete, rename files and also create and remove directory. This avoids the painful task of remembering all the file management DOS commands.

Windows can run two types of applications, standard DOS based applications and Windows based applications. DOS based applications are standard DOS programs such as WordStar, dBase etc. developed to run in DOS environment, and not specifically meant for windows. Whereas a windows application is specifically developed to run under Windows environment which support GUI.

4.4.2 Directory and File Management in Windows

Windows provides File manager for manipulating Directory and Files of a system. It is an essential part of Windows and run like any other windows program. Main program consists the icon for File Manager. Double clicking on the File Manger icon activates it from the Main program group. Other way of activating it is to highlight the File Manager icon and hit the Return key



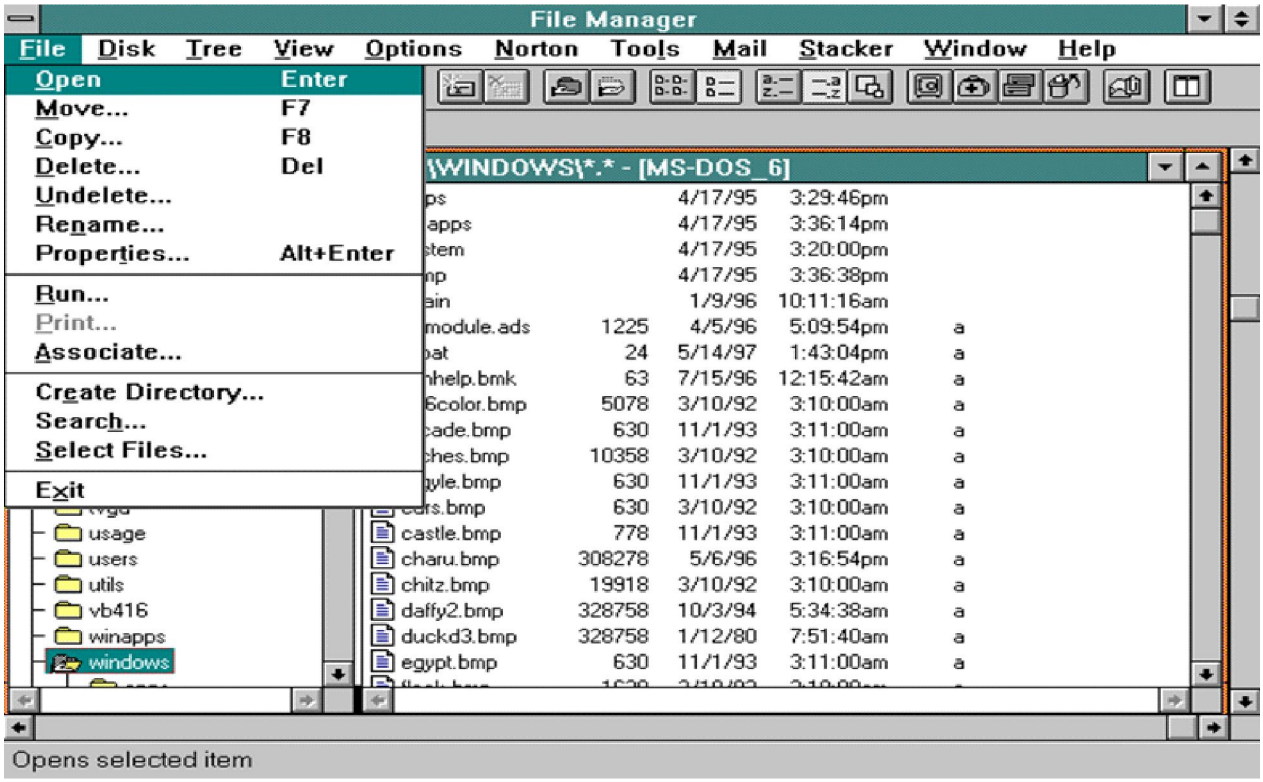
File Manager can be closed like any other windows program. File Manager can be minimized while running some other application and expanded once the execution is over. The total amount of disk space, free disk space available, the size of the selected file is shown for the currently open directory on the status bar, which appears at the bottom of the File Manager.

(a) Drive Window : Currently selected drive is displayed as other windows within the File Manager window. The command to resize, move or minimize is same as that of any other window. The only difference is that it is divided in two parts; right one displays the directory structure of the currently selected drive and the left part displays the contents (such as files, sub-directory etc.) of the currently selected directory.

(b) Directory Operations: File Manager provides the features to manage all the drives in your system and/or connected to your system through network. It allows copying, moving or deleting files within a drive, between drives of the system and systems connected through network. Once the drive is changed, directory and files under the newly selected drive will be displayed in the current directory window.

(c) Changing Disk Drives: To change drive, click on the desired drive icon or press <CTRL> and the designated drive letter such as C, D E etc. Other way of selecting a drive is to click on the Disk option of the File Manager menu bar, and select the desired drive letter.

(d) Creating a New Directory: A new directory or sub-directory under an already existing directory can be created using File Manager. First click on the File menu option of the File Manager. This will bring up the pull down menu having Create Directory. Selecting this option will activate the Create



Directory dialog box with current directory path. To create a sub directory under the current directory, type down the new sub-directory name in the text box. To create a sub-directory under some other directory, type the entire path in the name text box. To finish the entry and create the new sub-directory, click on the OK button.

(e) Changing Directory: To go to the desired directory under the currently selected drive, double click on the directory name. This will make the selected directory as the currently active directory and all the sub-directory and files under this directory will be displayed at the right pane of the document window.

File manager has the flexibility of displaying different groups of files in the currently selected directory. Click on the View option of the File Manager menu bar, which will activate the pull-down menu with option 'By File Type'. Selecting this will bring up the 'By File Type' dialog box. Use the wild card characters to enter in the name text box, the desired file type you want to see.

In File Manager, it can also be specified what all information for files can be displayed. In addition to the File name, File path one can display file size, date and time it was created/or last modified etc. To display all file information, select the VIEW option on the File Manager menu bar and activate the option 'All File Details'. In File Manager, sub-directory and file under the currently selected directory are displayed in alphabetical order. However they can also be displayed in order of file type, date or file size. To change the displays option, select the VIEW option on the menu bar and selected the desired option. Available options are:

- Sort by Name: Displays all files in alphabetical order of File name.
- Sort by Type: Displays all files in alphabetical order of extension Name
- Sort by Date: Displays File in order of creation/last modification Date.
- Sort by Size: Display all files in order of File Size.

4.4.3 File Operations

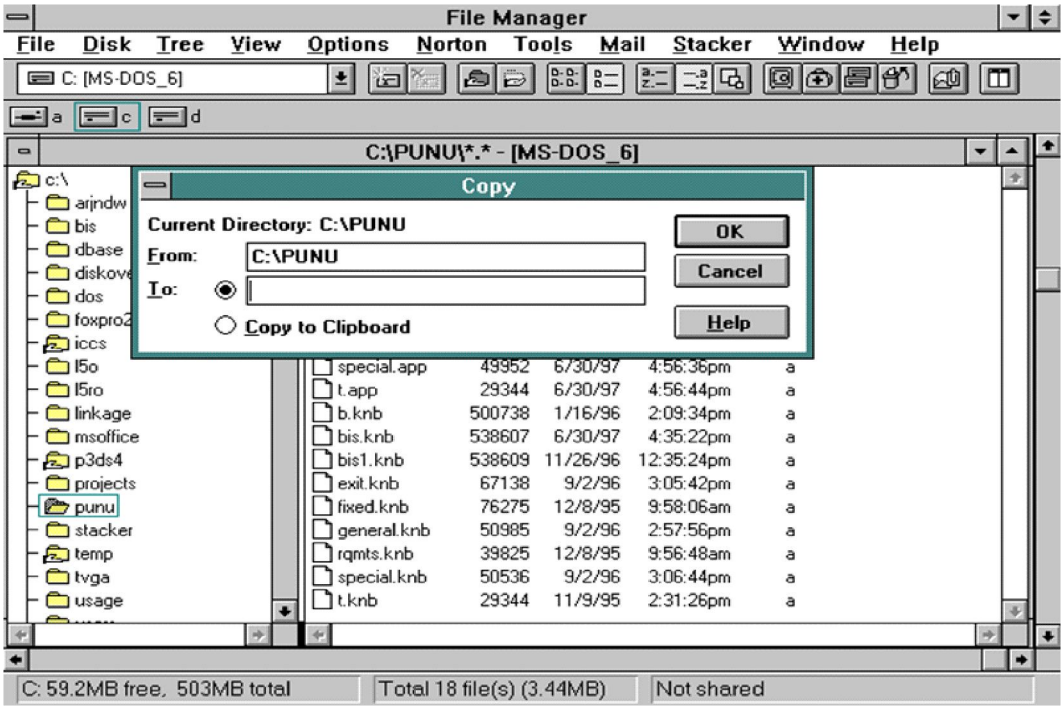
File Manager provides tools such as copy, rename, move, rename for management of files within directory, between directories and also between drives.

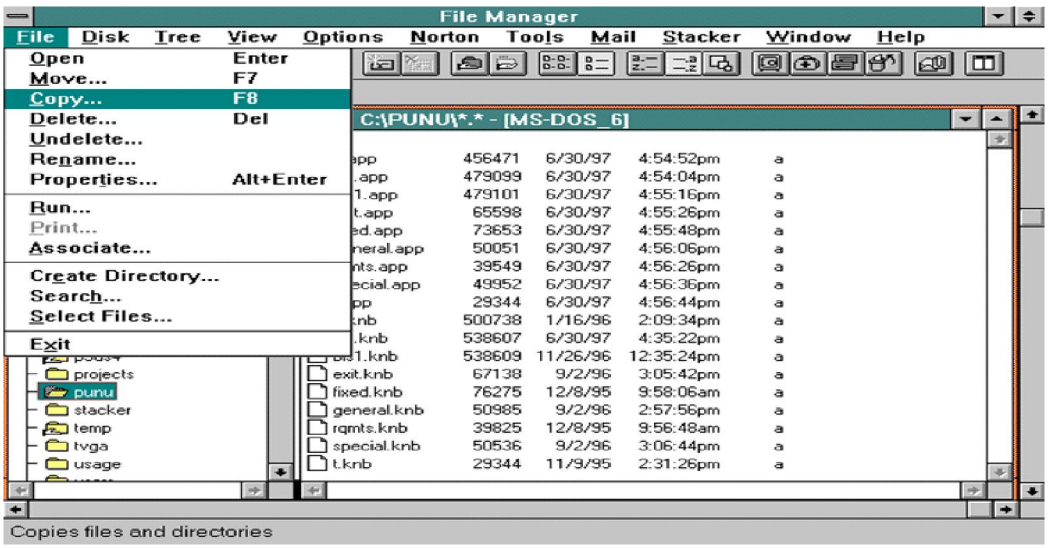
Copying/Moving Directory or Files

In file Manager, one or more files or Directory can be copied or moved into different location using two different methods; Drag-and-Drop method and Keyboard method.

- **Drag-and-Drop Method:** File Manager has the capabilities of copying or moving files and directories in more interactive and visual ways as compared to MS-DOS. Open the source directory select the files to be copied and then drag them in to the desired target directory, another drive icon, another directory window or to a file list in a different directory window and drop them.

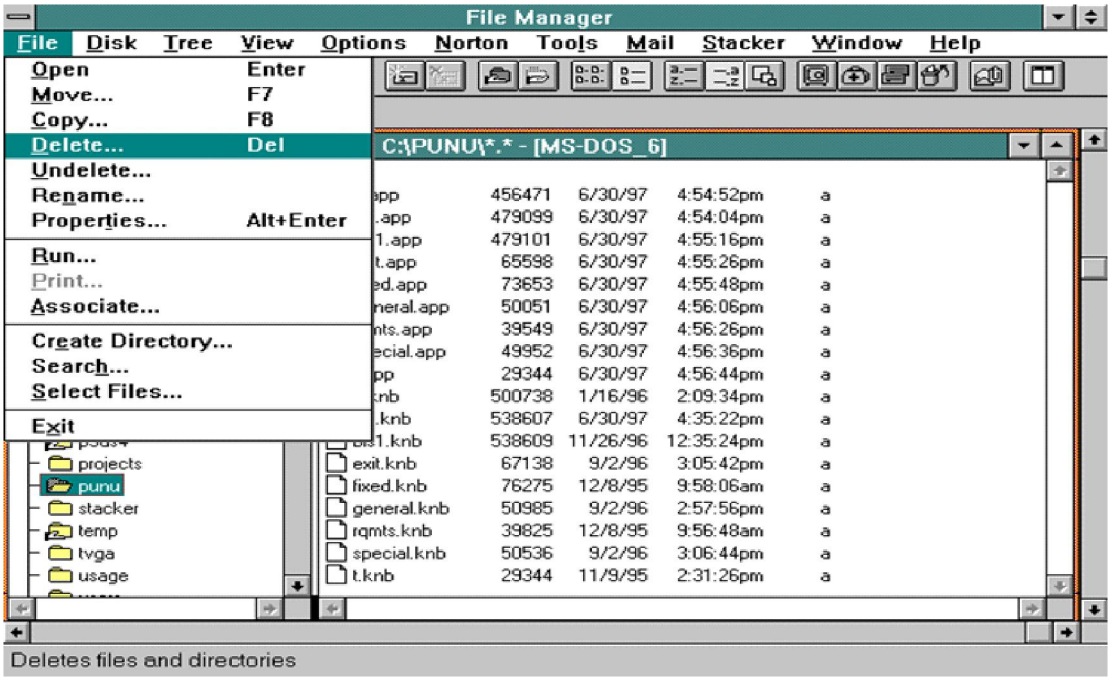
  Confirm the copying operation, by clicking on the OK button of the dialog box. This will copy the selected files in to the target drive. If the file(s) to be copied is/are already presents on the destination directory or drive, confirm replace message by clicking on the YES button of the dialog box.



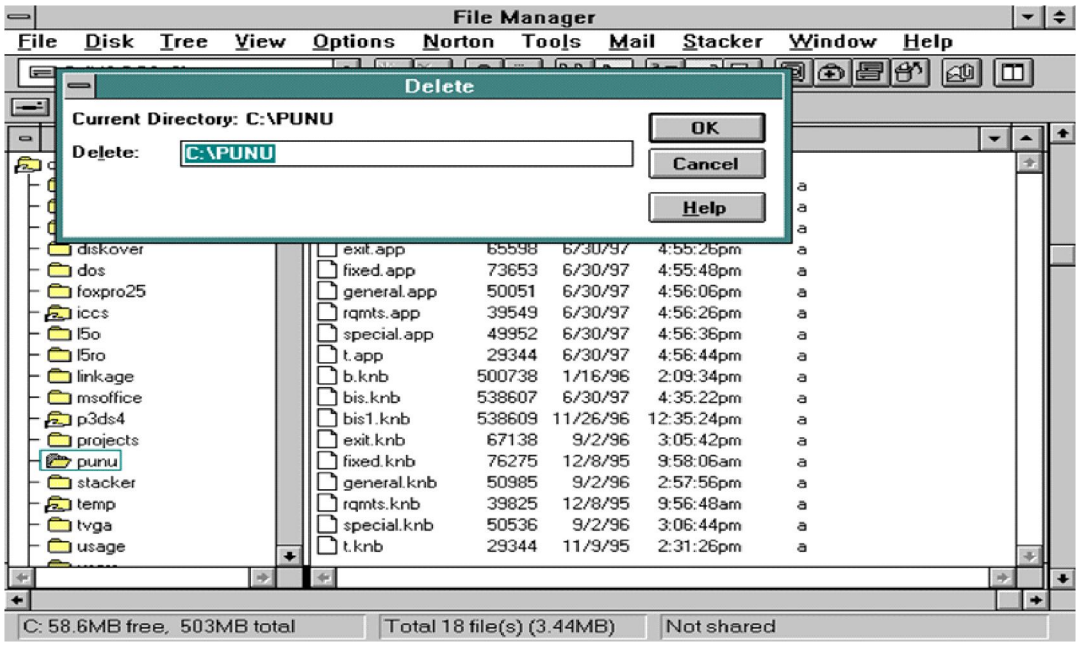


- **Keyboard Method:** Instead of using mouse for the above operation, one can alternatively use the keyboard to select COPY and MOVE command. As in the case of drag-and-drop method, the destination can be a directory window, directory icon or drive icon. Click on the desired file name to be copied or use the direction key to highlight it. Select the COPY or MOVE option from the File menu bar of File Manager as per the requirement. Alternatively press F8 for copy or F7 for MOVE operation to start. As in the case of drag-and-drop method, COPY or MOVE dialog box appears on the screen. Enter the destination path or drive. If the destination directory does not exist, it will ask whether to create a new one. To start the operation, click on the OK button or press Enter key.

4.4.4 Deleting Files and Directories



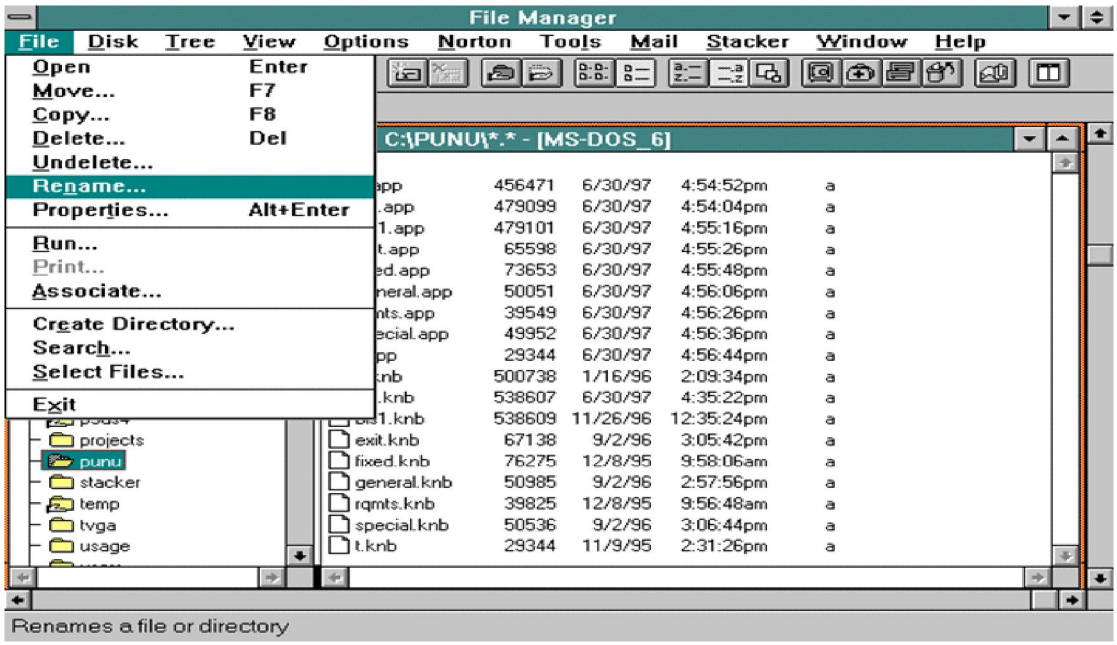
File Manager provides greater flexibility in deleting files and directories. However in the case of network drive, one cannot delete files or directories if he has not the privilege or permission of doing so. File Manager allows to delete an entire directory including all its files and subdirectory in a single command. However, in DOS, one first needs to delete all the files and sub-directory of the desired directory to be deleted.



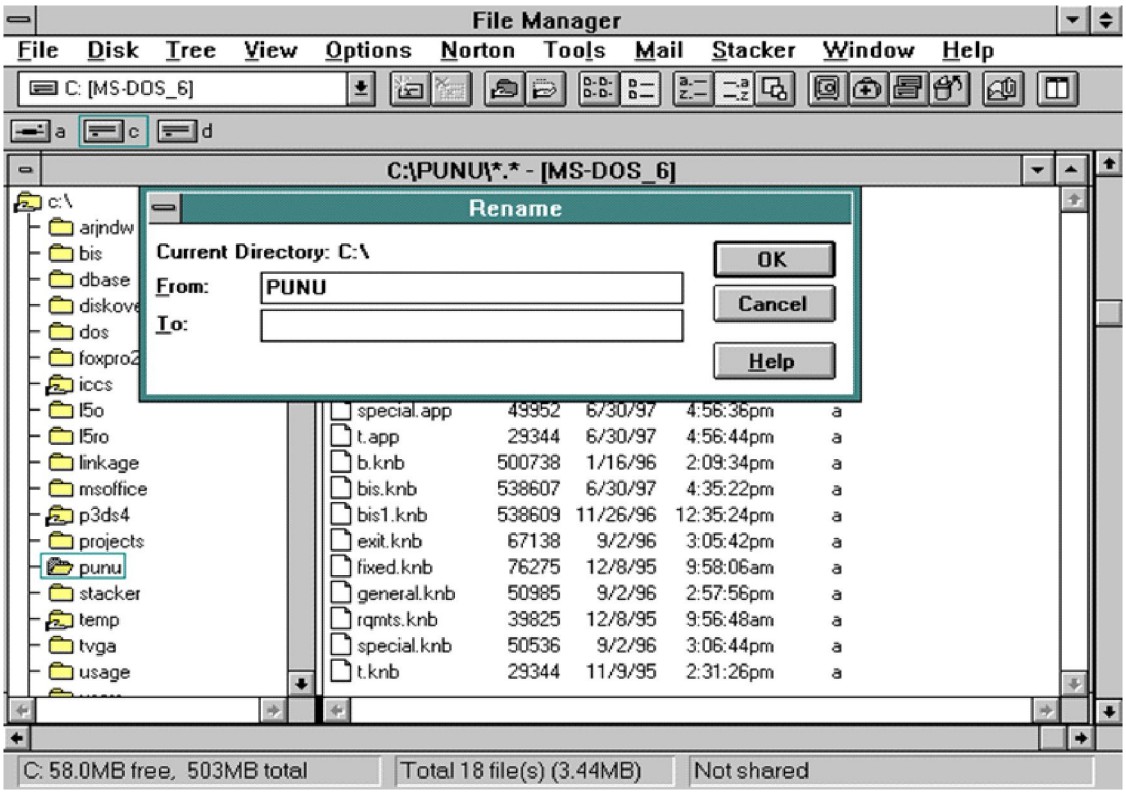
Select the file(s) or directory to be deleted (alternatively use tab to move the cursor to the desired location and use direction keys to select the files). Activate the Delete option from the File menu bar of File Manager and the delete dialog box appears on the window desktop. To delete the already select files or directory, click on the OK button. To delete other files or directory, enter the file name or path and click on the OK button.

This will activate directory delete dialog box. Click on YES button to confirm the deletion. Click on Yes to All to delete all selected files or click on Cancel button to cancel the delete operation.

4.4.5 File Renaming

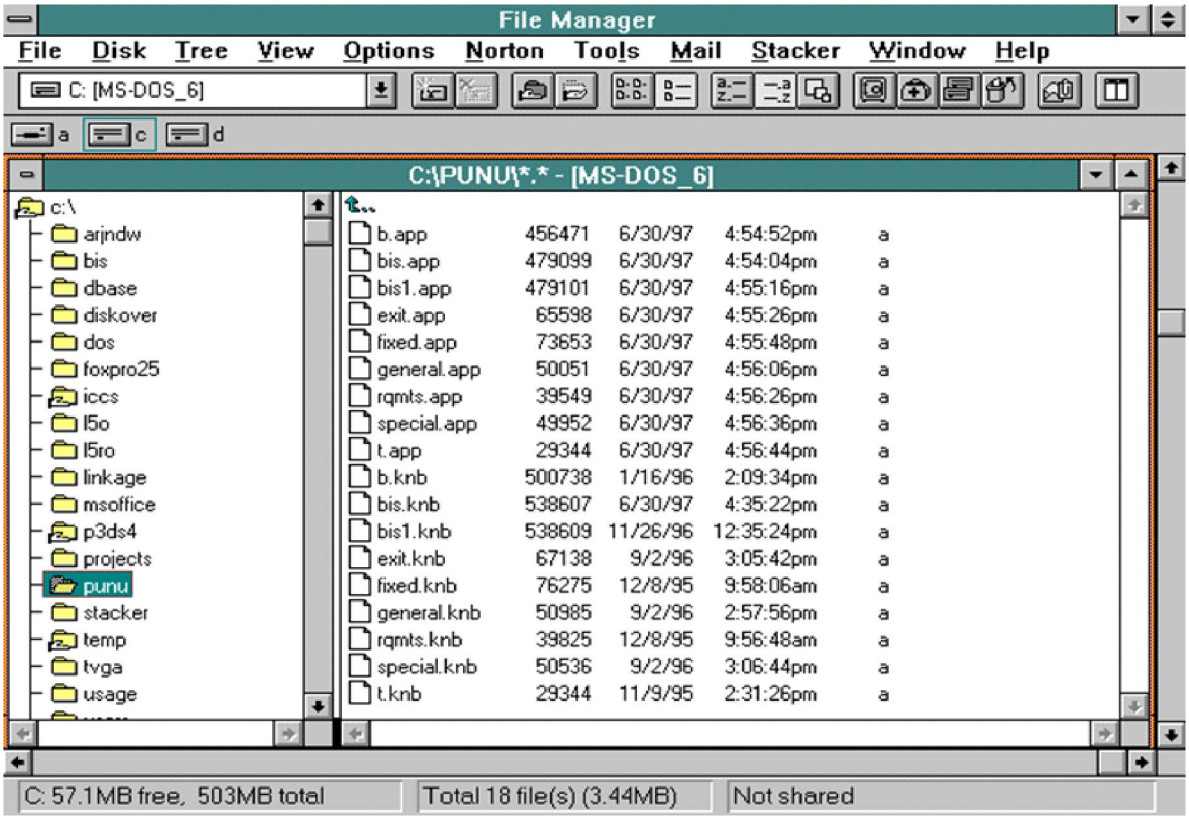


File Manager allows changing the name of a file with a restriction that the new file name should follow the DOS file naming conventions. The new file name should not be more than eight characters long with an optional three characters extension or secondary name with permissible set of characters.

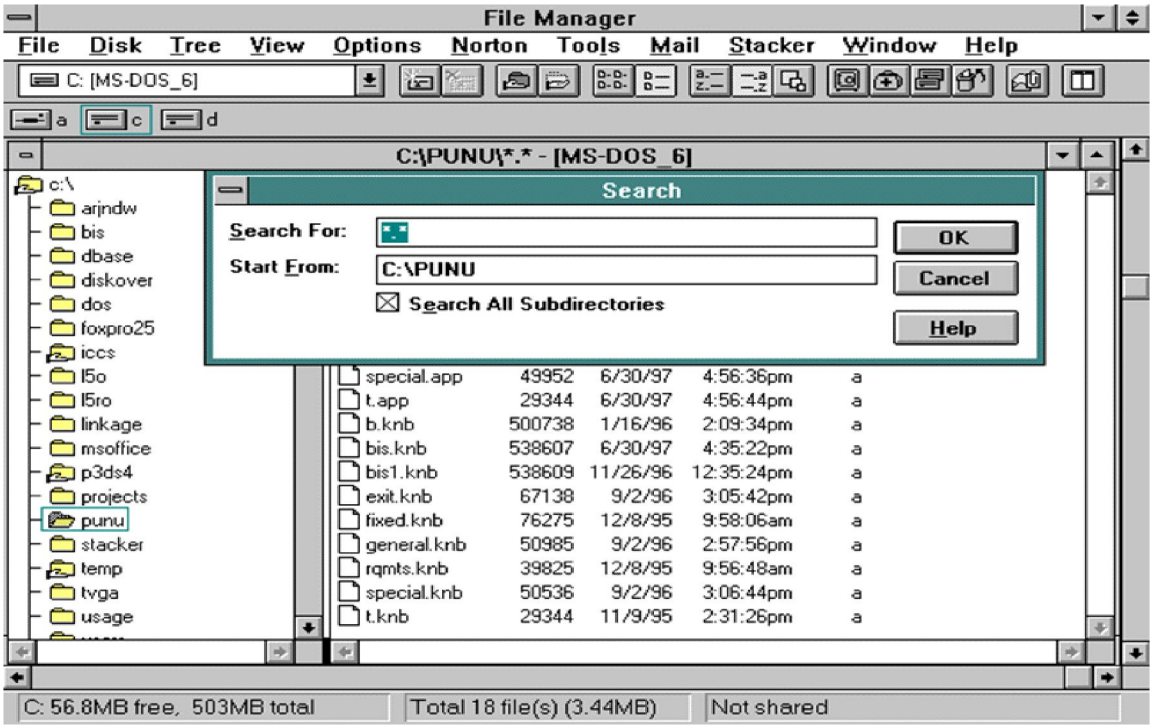


First select the file to be renamed, and then chose the Rename option from the File menu bar of File manger. The Rename dialog box appears with name of the currently selected file in the from text box. Now enter the new name for the file in the to text box and click OK button or press Enter key. This completes the renaming process.

4.4.6 Searching for Files and Directories



File Manager provides the tool to search a file, a group of files or subdirectories. This is particularly helpful, if you know a particular file is on your disk, but you don't remember where the file exists. Here you can conduct a search on your disk, directory to locate the file. The result is displayed in Search Result window, which can be resized, minimized or maximized, closed the same way as other window.



Click or select the directory to be searched and then choose Search option from the File menu. Specify the filename, or use wildcard character (such and * or?) in the Search For text box to search for a group of files or directories that have related file names or extensions. The Search Result windows will contain all the files that meet the search criteria. To cancel the search operation, press ESC key.

4.5 Application and Document Window

What is Application Window?

An application window is a high-level "main window", with built-in support for an optional menu bar with standard menus, an optional toolbar, and an optional status line.

Creating an application window involves the following steps:

- Creating an instance of Application Window.
- Assigning the window to a window manager (optional).
- Opening the window by calling open.

Only on the last step, when the window is told to open, are the window's shell and widget tree created. When the window is closed, the shell and widget tree are disposed of and are no longer referenced, and the window is automatically removed from its window manager. Like all windows, an application window may be reopened.

An application window is also a suitable context in which to perform long-running operations (that is, it implements Runnable Context).

What is Document Window?

The Document Window displays index information along with its document attachment. The attachment can be a scanned document image, an imported image file, documents printed from a Windows program directly into DocuXplorer using the DocuXplorer PDF Print Driver or an icon representing an Associated Application Document. In the Document Window a user can also create a new document from an existing document.

You can change the display of the Document Viewer Window by moving the borders of the panes on the screen. For example, point to the right border of the Index Information Pane, and when the pointer becomes a double-headed arrow, drag the border to the left or right.

Image attachments can be annotated and edited in the Image Document Window. Users with permission to add documents document can create a new document from specific pages of an existing document.

4.6 Summary

Windows operating system provides life to modern PCs. It provides graphical interface which in easy to use and one can see what is being done. Unix operating system from Bell Labs is one of the most powerful, versatile and flexible operating system. It can be run on a wide variety of machines, from micros to supercomputers. Its portability feature has made it very popular. In other words Operating systems are software that controls the execution of a computer program that may provide scheduling, debugging, input/ output control, accounting, compilation, storage assignment, data management and related services.

4.7 Self Assessment Questions

1. What do you mean by Operating System ? Explain various types of windows operating system.

2. Explain various elements of Desktop ?

3. Explain file handling in windows with the help of necessary figures.

4. What are the steps to delete a file or folder from the computer.

5. Write short note on :
   (a) Application window
   (b) Document window
   (c) Recycle bin

4.8 Reference Books

- Brian.K.Williams & Stacey C.Sawyer (2005) 'Using Information Technology' ; Tata McGraw Hill Publication company limited, Delhi.
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Unit - 5 : MS - Word

Structure of Unit:

5.0 Objectives
5.1 Introduction
5.2 MS-Word Environment
5.3 Working with Text Document in MS-Word
5.4 Working with Text
5.5 Formatting Style
5.6 Header and Footer
5.7 Tables and Borders Tool Bar
5.8 Summary
5.9 Self Assessment Questions
5.10 Reference Books

5.0 Objectives

After completing this unit, you would be able to:

- Understand word processing.
- Understand concept of formatting, tables.
- Understand electronic documentation.
- Understand concept of tables, macro, indentation.
- Know about various applications of MS-Word.
- Understand use of commands in MS-Word.
- Know how to do formatting.
- Understand how to work with text.

5.1 Introduction

Word enables us to create documents. Word processing is manipulation of characters, text, words, sentences, numeric values, and paragraphs in a document in presentable form. Initially, this work was done manually and later on typewriters were sued for this work. But, typewriter was not much effective due to no storage and unattractive quality of words and symbols. A word processor is software used for word processing work. It results is fast typing, better editing, easy to duplicate data, and error free copy. MS word is popular word processor.

In word processor programme, we can create letters, tables, legal documents, new letters, and academic paper. Some of popular word processing packages available in the market are: Word Perfect, Word Star, Microsoft Word etc.

5.2 MS-Word Environment

Starting word: Double click MS-Word option or select MS Word and open it with the help of Mouse. On the main screen of MS-Word, you will find window with many options. These options are:-

Menu Bar : It has sub-menus. MS-Word 2000 has nine menus. For example file menu has new, open, save, save as commands.

Tool Bars: Tools are available just below menu bar. Formatting of the document deals with characters, text, symbols, numbers, sentences and paragraphs. It Contain variety of tools which could be used is creation. editing, alteration, saving etc. of a document for example-font size, type, Bold, underline etc.

Soft wares for documentation: Many softwares came out in the market for documentation purpose e.g. Word by Micro-soft, Start Word in Linux, Word Start etc. Each software has its own set of commands for different functions.

Starting Word package: There are two ways to start word 1) double click on word icon 2) click start button, select MS-Word through All Programmes. Start à All Programmes à Word

Title Bar : It is located on the top of the window. It display name of application and active document or currently open document. There is control menu icon of the left of the title bar. You can display pull-down menu by clicking on the control menu icon of title bar. Title bar also has minimization, maximization, restore buttons.

Menu bar: It consists different sub-menu e.g. file, view, edit, window, help. MS-Word 2000 has 9 menus.

Tool bars: It is located below Menu bar. It has many icons. It consist many command buttons. It provides single click entry to the command.

Ruler: Ruler used to change the format of document by using indent, margin, tab stops, and table columns. Word has two tool bars horizontal and vertical. It can be changed by using ruler option.

Status Bar: It is located at the bottom of the window. From status bar, we can find out cursor position, current page number, programme status notes (e.g. spell check, overwrite mode indicator) and total number of pages in the active document. .

Work Area: Area in the window for typing text, inserting image, tables etc. is known as work area. A small blinking line appears in this area is cursor. It marks currently selected location on the page.

Document view: Word display document in various levels. These views used to display document differently while working. These views are:-

Normal View: It displays text for formatting. It does not display header and footer. This view separates pages by a dotted line.

Web Layout View: Document appears in large font in this view. There is more space between consecutive lines in this view. It is designed keeping in mind screen not page.

Print Layout View: It displays document in Shat You See is what you Get (WYSISYG) form. All text (character, paragraphs) and document formatting option are displayed with header and footer.

Outline view: This view displays document as it is on outline with expandable and collapsible heading levels. It is used to brose whole document and re-arrange it e.g. moving the specified place in the document.

Help: Help option is available in all word processor packages. Whenever you face problem in Word, follow the given sequence:-

- Select Help option in title bar in help menu
- Press F1 key on the keyboard
- Click Help button/icon

It provides interactive help option in automated mode known as office assistance. It provides help through useful hints, instructions and appropriate interface between user and Word. You can drag office assistant to anywhere in the screen.

Screen Tips: It is the message that appear on the screen to give information about the tool bar button. It appears when the user put the mouse pointer on the icon. It disappears when mouse pointer is moved away from the button (icon).

5.3 Working with text Document in MS-Word

In this part we will discuss how to deal with the word document. A new document can be opened by selecting new from file menu. After this you have to select black document and press ok. You can also create a new Letters, Memos, Reports and Web Pages by selecting appropriate icons.

An existing document can be opened by using following command sequence:

1. Select open from file menu or click open button in the tool bar or double click on the word file icon.
2. Specify name of the file.
3. Saving a document: It is advised to save document after regular interval of time. To save:- Select file and then save (for existing document) and save as (for a new document). You can also click on the save button on the standard tool bar. It will allow you to specify file name. You can change folder also. MS-Word saves a document with doc or docx extension by default. It can also be saved as .txt, .rtf and .html.
4. Closing a document: After finishing your work, you can close the document by following command sequence:-
   (i) Select close in file menu.
   (ii) Click of close window button at the upper right corner of the word to close the currently active document.

5.4 Working with text

Now we will learn how to format and work on text.

Selecting text in a document

It is necessary to select text before working on it. Selected text may change its colour, so that you could differentiate selected part from rest of the portion of text. Following procedure may be adopted to select a text:

Table 5.1

To select	keyboard	mouse action
word	ctrl+shift+right arrow or ctrl+shift+left arrow	double-click any where on the word
Line	Shift+end or shift+end	Click on the margin next to the line. Note that the mouse cursor will change to arrow
Multiple line	Shift+ up arrow or shift+ down arrow	Click on left margin and keep and drag it till desired lines are slected
Paragraph	ctrl+shift+up arrow or ctrl+shift+down arrow	triple click any where in the paragraph
Whole document	Crtl+A	triple click left margin
Rectangular area	Ctrl+shift+F8 and use arrow key	Press alt and drag the mouse.

Formatting Text: Appearance of text can be changed by using many function is known as formatting of text. Command sequence for formatting is given below:-

- Select text to be formatted using mouse or key board functions.
- Use buttons for formatting. Few buttons and their meaning is given below:-

Table 5.2

Command	Description
font	To change the font of text under selection.
Font size	To change size of letters of selected font.
bold	to change normal to bold or vice versa
Italics	To italicise the selected text.
Under line	To underline selected text
Highlight	To highlight selected text
Font colour	Change font colour of selected text.

Font dialog box is also used to format text. Following sequence may be used to format text.

- Select text to be formatted.
- Select font from the format menu.
- From font dialogue box font, font style, and text size can be changed.
- You may see format in preview box at the bottom of font dialogue box.

Highlight and change colour of text: By default Word provides fonts in black colour. Colour may be changed by:-

- Clicking the highlighter button on the formatting tool bar.
- Select the particular colour to be changed.

- Click and drag the mouse to select the text to be highlighted.
- After highlighting click on the highlighter button again to turn it off (or press the escape key)

To change colour of text, you may follow given sequence:-

- Select the text which you want to change.
- Click the down arrow beside font colour button from the formatting toolbar.
- Select the desired colour from the pull down list for the select text.

Aligning and indenting text in word: Aligning and indentation comes under paragraph formatting. These are used to give well defined structure to the selected document. It gives professional look to the document. Following steps may be adopted to align or indent the document.

- Select paragraph to be aligned or indented.
- Select button on the formatting tool bar to align or indent the paragraph. The meaning of few buttons available on aligning or indenting paragraphs are given below:-

Table 5.3

Command	Description
Left Align	Left align selected text or paragraph.
Right Align	Right align selected text or paragraph.
Centre Align	Centre aligns selected text or paragraph.
Justify	Justify selected text or paragraph.
Decrease indent	Decrease the indent of the select paragraph.
Increase indent	Increase the indent of the select paragraph.

A paragraph can also be formatted using the paragraph dialogue box. Follow steps may be followed:-

- Select paragraph to be formatted.
- Select paragraph from the Format menu to display the paragraph dialogue box.
- The alignment or indentation can be specified in the dialogue box.
- Formatting can be viewed from the preview at the bottom of the box.

5.5 Formatting Style

Style is a set of formatting specifications in MS-Word. It can reduce the time to format the document. Following steps may be used to change style:-

- Put cursor on the paragraph where style is to be applied.
- Click the Style drop-down box and select a style by clicking on it.

Format Painter: It is a handy feature of documentation package for formatting. Following steps can be used for format painter:-

- Select text for formatting which you wish to copy.
- Click (once) on format painter button to copy formatting to a single location in the standard toolbar. Double click it to copy it on multiple locations.
- Click and drag the mouse to select the matter you want to format, release the mouse.
- If the format painter is copied by double click press escape key to come out of painter.

Cut, Copy and Paste: Cut, copy and paste are most frequently used commands. Following sequence may be used for cut, copy and paste:-

Select the Text You Wish to Change:

- If you want to move the text, select cut from edit menu, for copying select copy from the edit menu.
- Click the mouse on the place in the document where you want to insert the text.
- Chose paste from the edit menu, or click the paste button on the standard tool bar.

Finding and replacing Text: Following command sequence may be followed to find an replace text:-

- Select find from the edit menu. It will open dialogue box.
- Click on the find tab if you want to find a text or replace tab if you want to replace text by another one.
- Type text you want to find.
- Click on Find next to find the first occurrence of the word. Also type text by which you want to replace.
- Select replace button to replace each occurrence. Select replace all to replace all word with the searched one.
- Keep on pressing the find button until you reach the end.
- To close the dialogue box click yje cancel button or press escape key.

Undo and redo: These commands are used to undo or redo previous actions. To undo the last action, click on the undo button on the standard tool bar or select undo from standard tool bar. You can also select undo from edit menu. Redo command can be used to reverse the undo.

Bullet and numbering: Bullets and numbering can be applied by selecting bullet and numbering option available in format menu. This will display bullet and numbering dialogue box.

5.6 Header and Footer

Header is the text appears on the top of the every page of the document. Footer appeared at the bottom every page of the document. Every word document has header and footer area. You may adopt following sequence to insert header and footer in the document:-

Select header and footer from the view menu or double click header part of the document.

- It will display header and footer toolbar at the top of the page.
- Type the text in header or footer box.
- Use appropriate option from the header/ footer toolbar.
- Click on close button after completing the task.

Table 5.4: Header and Footer Toolbar

Command	Description
Insert page number	To insert page number in the document
Insert number of pages	To point total number of active pages in the document.
Format Page number	Format the page number in the current section.
Insert date	Insert current date. It automatically updates.
Insert time	Insert current time. It automatically updates.
Switch between header and footer	To move insertion point between header and footer for easy working.

Tables: Tables are very useful tool in a documentation package. Following command sequence may be used to deal with tables:-

- Select insert from table menu.
- Select table from the pop-up menu. Insert table dialogue box will appear.
- Specify row and columns.
- Other way to create table is insert table button from the toolbar.

5.7 Tables and Borders Tool bar

It allow us to use border styles, shading, text effect, alignment, and other options.

Table 5.5

Commands	Description
Draw table	To insert a table by dragging on the document.
Eraser	To remove line from the tale. It is also used to merge cells.
Line style	To define style and thickness of line in a table.
Line Width	To Define width of table border.
Border Colour	To Define colour of border of a table.
Outside Border	To define settings of outside border like: style, line weight, border colour etc.
Shading colour	To open pallet of colour.
Insert Table	To display the insert table dialogue box.
Merge cells	To combine (dissolve) cells in one.
Split cells	To separate cells
Align top left	To arrange by left side
Distribute row evenly	---
Distribute column evenly	--
Table auto format	--
Change text direction	To change direction of text
Sort ascending	Arrange alphabetically a to z
Sort descending	Arrange alphabetically in revrese z to a
Auto sum	To find out summation of values

Table properties:

Editing (Adding and Deleting) Rows in a Table: Number of row or columns can be edited (added or deleted) in a table by following command sequence:-

- Press right click button of the mouse.
- Select insert
- Use appropriate option

Moving and Resizing Table: A table can be resized by placing mouse over the four sided of the table. The Pointer will change to the parallel lines shapes and then you can drag the mouse.

Using Auto-correct: Autocorrect option is available in the word. This option is very useful for auto correction of words. Autocorrect option is available in the tool menu.

Checking Spelling and Grammar: Word has got good facility to check the language. It can also help you to broaden your vocabulary. It is available in review command. Word provides visual clues about the spellings in active document.

Synonyms and Thesaurus: Sometimes you may require synonyms or antonyms of many words in the document. There is a tool which helped you to enrich you document. You may use following steps to use thesaurus:-

Put Cursor in the Word Which is to Be Looked Up: In the tool box select language and then select thesaurus to display it's dialogue box.

Inserting Graphic in a document: Graphics add up value in a document. Word has two types of graphic applications. 1) Pictures 2) drawing objects. Pictures can be inserted from the memory in bitmap, scanned picture, photograph, clip art. Files are available in .BMP, .JPG, .GIF and .WMF.

Inserting Picture: Picture or images from other locations can be inserted in the document.

- Select insert in the command bar.
- Select picture.
- Specify location.
- Press insert.

Editing picture: Once picture is inserted, it can be eduited by using mouse. Picture tool bar options are given below:-

Table: 5.6

Command	Description
insert picture	Display the image selection window and allows user to change the image.
Image control	To make image in grey scale, black & white or watermark.
More/less contrast	To change contrast.
More/less brightness	To change brightness.
Crop	To delete out portion of the image.
Line style	To add borders.
Text wrapping	To modify text wrapping around the image.
Format picture	To display all image properties.
Set transparent colour	To set transparent colour on the object.
Reset picture	To delete all modifications.

Drawing Objects: Words has many useful tools like drawing objects. In drawing objects, we can draw lines, curve, and word art. It includes 1) Auto Shapes and 2) Word Art.

Auto Shape: Word has readymade shapes e.g. line, stars, banners and callouts.

Word Art: In Word Art, you will find interesting ways to display words in MS-Word. you can of find it suitable for cover page of project reports.

Printing Document: To print a document select print button on standard tool bar.

Print Preview: It permits you to see the documents before printing in actual like mode.

5.8 Summary

Word processing is a basic job in any office. There are many softwares sued for word processing. MS-Office is widely used by professionals. It is designed by Micro Soft. Ms-Word has many useful functions for e.g. file management, formatting, view etc.

5.9 Self Assessment Questions

1. Explain the following briefly:
   a. MS-Word
2. Write short notes on the following:
   a. Table
   b. Indentation
3. Write any 05 commands of MS-Word?
4. What are Header and footers? How you will insert header and footer in a document.
5. How you will format a text.

5.10 Reference Books

- Brian.K.Williams & Stacey C.Sawyer (2005) 'Using Information Technology' ; Tata McGraw Hill Publication company limited, Delhi.
- Henry.C.Lucas,Jr. (2001) ' Information Technology'; Tata McGraw Hill Publication company Limited, New Delhi.
- D.P.Sharma (2008); 'Information Technology' ; College Book Centre , 2008, Jaipur.
- P.K.Sinha, Priti Sinha,(2007) 'Computer Fundamentals' ; BPB Publication, New Delhi.

Unit - 6 : MS - Excel

Structure of Unit:

6.0 Objectives
6.1 Introduction
6.2 To Start MS-Excel
6.3 Command in MS-Excel
6.4 To Enter Data in A Worksheet
6.5 Referencing
6.6 Summary
6.7 Self Assessment Questions
6.8 Reference Books

6.0 Objectives

After completing this unit, you would be able to:

- Understand electronic spreadsheet.
- Understand concept of worksheet, work book tables and chart.
- Know about various applications of MS-Excel
- Understand use of commands in MS-Excel.

6.1 Introduction

Spreadsheet is a useful tool to manage with figures. It deals with formulation, calculation and estimation of formulas. Electronic spreadsheet is an arrangement of rows and columns designated by numbers and letters respectively. It gives flexibility to the users. It permits selection of options to create and maintain worksheets.

6.2 To Start MS-Excel

1. You may adopt following steps to start MS-Excel:-

   a. Double click on MS-Excel icon to start it.

   b. Click start, go to all programmes, select MS-Excel.

2. After opening MS-Excel, main sheet will appear. The appearance of the window remains same at that of MS word or any other window application. In the main sheet, you will find following functions:-

   A. Title Bar: It is located on the top of the window. It display name of the application and active worksheet.

   B. Menu Bar: Below title Bar is menu bar. It has different commands like: file, edit, view, insert, format, tools, data, windows and help. It has submenus.

   C. File: File is used to open a new or existing file.

   D. Toolbar: Toolbar is positioned just below the menu bar.

   E. Name Box and Formula Bar: Name box and formula bar are located below the tool bar. Name box show the name of currently active cell. And formula bar displays content of selected cell. It has text, number, formula, and functions.

F. Sheet Tabs and Scrolling Buttons: It is located at the bottom of the excel sheet. It shows sheet numbers. It is also useful for movement between spreadsheets. Scroll button available on the left helps to move quickly between spreadsheets. One could resume the worksheet by right clicking on the sheet and selecting rename.

G. Status Bar: It is located at the bottom of the sheet. It shows selected command. It also displays operation in progress e.g. Caps lock etc.

H. Worksheet and Workbook: The work area of a sheet is know

6.3 Command in Ms-Excel

MS-Excel is used to maintain financial information in the form of a worksheet. It helps in accounts, balance sheet, charts preparation and used by business people for analysis purposes. Major commands of MS-EXCEL are:-

1. Cell
2. Worksheet
3. Workbook
4. Formula Bar
5. Referencing
6. Address
7. Function
8. Relative Address
9. Absolute Address
10. Chart Type
11. Alignment
12. Cell Width
13. Pivot Table
14. Macro
15. Goal Seek
16. Scenario
17. Principle Analysis
18. Survey Analysis
19. Customer Database

Table 6.1 : Command in MS - Excel

Commands	Sub-commands
File	New, Open, Save, Save as, page setup, print area, exit
Edit	Cut, copy, paste, select all, find, replace, fill clear, delete, delete sheet, go to
View	Normal, tool bar, tool bar, zoom, formula bar, status
Insert	Row, column, worksheet, chart, function, name, picture, hyperlink,
Format	Cell. Row, column, sheet, auto format, conditional formatting, style
Tools	Spelling, share work book, protection, customize, option, goal seek, scenario, macro, add in
Data	Sort, filter, sub total, validation, text to column, pivote table
Window	New Window, arrange, hide, split, freeze pans
Help	About MS-Excel, what is this?

Working With MS-Excel Workbook: We will learn functions related to workbook e.g. creating a new workbook, opening an existing work book, saving and making backup of a workbook and closing it.

Creating an Excel Workbook: Whenever you opens MS-Excel, you find a blank work book. If you are already using excel, you may click on new button to create a workbook. New workbook can also be opened by selecting new from the file menu, by selecting workbook from general tab and pressing OK button.

Opening Existing Workbook: Existing workbook can be opened by selecting open command in file menu. It can also be opened by clinking on open button on the standard toolbar.

Saving Workbook: Once workbook is created, you can fill up entries in the workbook. You can use save or save as command to save a workbook. Save as command is used for first time saving of the workbook.

Closing a Workbook: You can close a workbook by selecting close command in file menu. It can also be closed by close windows icon.

Working with the Worksheet: Worksheet is a part of workbook. A workbook consist many worksheets. Worksheet is a group of rows and columns. Intersection point of row and column is known as cell.

6.4 To Enter Data in A Worksheet

You can make three types of entries in the worksheet i.e. text or labels, values or number, formulae or function. By default, labels are assigned left and value, time dates are assigned right. Label includes both the cases i.e. upper and lower case. Formulae are used to do calculation. While using value avoid comma and dollar sign.

First select cell and then type data. Data is placed in the cell when entre key is pressed. Data can also enter in the formulae bar. If you enter more data, package will truncate it and displays ##### sign. This happened due to less width of the cell. You may change width of the cell, to see full content. Cell width can be changed by moving pointer at the border or by pressing double click on the cell's right border to automatically adjust the column width according to the number.

Navigating Through Cell: You may use arrow keys or mouse to navigate through cells in a worksheet. Commands used for navigation are given in the following tables:-

Table: 6.2

Keys	**Function**
Up arrow key	One cell up
Down arrow key	Move down by one cell
Left arrow key	Move one cell by left
Right arrow key or tab key	Move one cell right
Ctrl+right arrow key	Move to end of the row
Ctrl+ left arrow key	Move to begging of the row
Ctrl+up arrow key	First row of the worksheet
Ctrl+down arroa key	Move to bottom of the rows of the worksheet
Ctrl+home	Moves to the top of the worksheet
Ctrl+end	Moves to the end of the worksheet
Page up	Moves active cell up by one screen at one time
Page down	Moves active cell down by one screen at one time

Naming Range of the Cells: A group of adjacent cells in a worksheet are called range of cells. It adds up clarity in operations. It also helps to work faster. You may select cell or range of cells then click inside the name box to highlight existing range and finally type the name of range of cells and press enter.

Editing a Worksheet: While working in a worksheet, you have to add, delete copy or paste cells. To select group of cells, select one cell hold down the mouse button and drag it across the cells you want to select. You may also select range of cells by pressing shift key and clicking on the range. Excel 2000 allows multiple selections. More than one range may be selected at the same time. Select the first range. While holding down the ctrl button select the second the second range.

Inserting Cells, Rows and Columns: To insert cell, row or column, select the cell, right click on the cell and select insert and choose appropriate option in the dialogue box options appear in the dialogue box are given below:-

Table: 6.3

Option	Function
Shift cell right	Move the selected cell (active cell) to right
Shift cell down	Move the selected cell (active cell) down
Entire row	Move the selected cell (active cell) down and insert one new row
Entire column	Move the selected cell (active cell) right and insert one new column

Deleting cell, row or column: To delete row or column, you may select the cell and then select delete from the edit menu. Right click on the cell and select delete. Following options will appear in the dialogue box.

Table: 6.4

Option	Function
Shift cell left	Delete the selected cell (active cell) and moves all the remaining cells to left.
Shift cell up	Delete the selected cell (active cell) and moves all the remaining cells up.
Entire row	Delete the entire row
Entire column	Delete the entire column.

Editing Cell Content: Adopt following sequence to edit cell content.

1. Press single click or retype content.
2. Press F2 or press double click to modify content.
3. Select the cell by using arrow key and edit the content.

Deleting Cell Content: Select the cell and than select 'clear' to delete the content or choose content option in menu or delete key.

Formatting Cells: Formatting feature is used to change appearance of cells in MS-Excel sheet. Select cell to be formatted and then use formatting buttons on the tool bar. Purpose of formatting buttons is given in the following table:-

Cells can also be formatted through format cell dialogue box in excel. Sequence is:-

1. Select cell.
2. Press right click.
3. Select format cell from the short cut menu to display format cells dialogue box.

Number Tab: Number formats permit numbers to be represented in different ways or different kind of scenarios. Commonly used formats are given in the following table:-

Table 6.5

Format	**To format a sheet**
General	--
Number	To allow numbers only
Currency	To allow currency values
Accounting	--
percentage	To accept as percentage valus
Fraction	To accept as fraction value.

Alignment Tab: It is used to change position (alignment) of data in cell(s). Data can be aligned in any four sides of the cell. There are various options available e.f. left align, right align, centre align, fill ad centre across selection.

Font tab: This tab allows you to change the font e.g. font style and effects.

Border and pattern tab: This tab initiates border, shading, and background colour related functions.

Protection tab: This tab is used to protect the tab. This function could be initiated by selecting protection from the tool by choosing protect sheet.

Using Auto format: It permits to use predefined functions e.g. layout to select tables in the worksheet. These layout change colour background etc. without changing the data or content of worksheet. This may be implemented by using following command sequence:-

1. Select auto format from the format menu to display the auto format dialogue box.
2. Choose appropriate option and click OK.
3. To revert back to the original format select undo auto format.

Using Cut, Copy and Paste Commands: While working in excel you need to edit data frequently using cut, copy and paste. Following command sequence may be followed to use cut, copy and paste:-

1. Select cell or range of cells to be worked upon for cut.
2. Choose cut from the edit menu or click on cut button of standard tool bar or use ctrl+ x.
3. Click the mouse on the place where you want to put it. Choose paste from edit menu, or click the paste button on the standard toolbar or use ctrl+V in the keyboard.

Copying cells: Fill handle gives easy mode of copying cell content in a column or row. For copying group of cells or range select the range in worksheet. Following command sequence may be followed to use cut, copy and paste:-

1. Select cell or range of cells to be worked upon for copy.
2. Choose copy from the edit menu or click on copy button of standard tool bar or use ctrl+c.
3. Click the mouse on the place where you want to put it. Choose paste from edit menu, or click the paste button on the standard toolbar or use ctrl+V in the keyboard.

Dragging Cells: Cells may also be moved to another place in the worksheet by using drag and drop process. Command sequence for drag and drop is given below:-

MS-Excel aligns textual data towards left and numeric data or number data towards right by default. It centres logical and error values.

1. Select range of cells.
2. Point at the border around the selection to change mouse pointer to a left pointing arrow.
3. Drag the border of cell to new cell location.
4. Release the mouse click button.

To drag chosen cells you may hold ALT key in the keyboard.

Finding and Replacing Cells: Find and replace function are used to select a particular data (content) from cell and replace by desired content. It helps by searching the desired data. Following command sequence may be followed to use find and replace:-

1. Select find from the edit menu in excel. Find dialogue box will be opened.
2. Type data in the given box (find what box) to find it and click. Clink on find next button to find data.
3. Keeping on clicking find next till end of process.
4. Press escape to close it.

To replace data you may use following steps:-

1. Select replace from the edit menu in excel. Find dialogue box will be opened.
2. Type data in the given box (find what box) to find it and click. Clink on find next button to find data.
3. Type replaces data in the replace with box.
4. Keeping on clicking find next till end of process.
5. Press escape to close it.

Un Do and Re Do: Package remembers the functions predefined on a workbook. If you have deleted any portion on the sheet and you want to revert back, you may choose undo or re do function. Undo function is used to deactivate latest function. Redo function is used to repeat the last function.

Select undo in the standard tool bar in edit menu or Click on undo button in the standard tool bar. To select a number of actins at the same time click on down arrow to display list of actions.

Select redo in the standard tool bar in edit menu or Click on redo button in the standard tool bar. To select a number of actions at the same time click on down arrow to display list of actions.

Formulas and Functions

Excel has facility to implement user defined formulas and functions. You may include built in functions. Both formulas and functions are used for advance computing.

Functions: Functions can be used to perform simple and complex functions. Specific values used to perform functions are known as arguments. Parenthesis used to separate different parts of a formula. You can type desired function in function wizard, formula bar or directly in cell. Following command sequence may be followed for functions:

1. Click on the cell in which function is to be used.
2. Choose function from insert menu or click paste function button on the standard tool bar to display the paste function dialogue box.
3. Click on the function category, which has a list of various functions. Different function categories are given below in the table.
4. After this, you will find syntax windows to create a function. Click on the collapse button (marked with red arrow) to the right of the box marked number 1 or value1 (depend on the selected function).
5. Drag the mouse to choose cell range.
6. To insert additional arguments into the function.
7. Drag the mouse to choose cell range.
8. Click ok.

Table 6.7 Functions and Categories Used in Excel

Categories	Functions
MATHEMATIAL	Sum(num1,num2...); round; sqrt; abs; truc
Statistical	Max, min, average
Date and time	Date(year, month, day),time(hour, minute, second), now()
Logical functions	And, not, or
Text functions	Concatenate(text1,text2...), len(text), lower(text), proper(text), upper(text), trim(text)

Using auto sum: Auto sum function is used most frequently. Following command sequence may be followed for auto sum:-

1. Select the desired cell.
2. Click on auto sum button on standard tool bar.
3. Cells get converted into dotted line. It is known as marquee.
4. Press entre key (if range is correct)
5. If not, type or select the correct range.

Formulas: Formulas are mathematical expressions in excel used to perform calculations. It always begins with equal to (=) sign. If formula is wrong, it will display error in formula massage. Following command sequence may be followed for auto sum:-

1. Choose the desired cell for formula.
2. Type equal to sign followed by operation.
3. Type cell names.
4. Press entre key.

6.5 Referencing

Referring Cells is known as referencing. References used to address cell range. Relative referencing: Referring cells by row and column number is known as relative referencing.

Absolute Referencing: $ is used to refer absolutely. For example e3 will fix to cell C3 for all calculation.

Mixed Referencing: When relative and absolute references are used combinely, it is known relative referencing.

Editing and Deleting Formula

A formula can be edited or deleted when it is required. Click on the cell consists formula and press the deleted key. If you want to change formula use following command steps:

1. Click on the cell contains formula.
2. Click of edit formula bottom appears in formula bar.

Operator in Formula: Operators specify type of calculation we are using in formula. Package has basically four kinds of operators: arithmetic, text, comparison and reference.

Table 6.8 : Operators Used in Formula

operator	Meaning
*	Multiplication
/	Division
+	Addition
-	Subtraction
%	Percent
^	Caret
=	Equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to
<>	Not equal to
&	To concatenate or combine two values to produce on econtinuos values
:	Range operator. To produce
,	

6 Error Values

Error may occur in excel sheet when intended function is not carried out. Error messages are displayed in the sheet. Different error messages have different meanings. Few error messages are given in the table.

Table 6.9 : Error Messages in Excel

Error	Message	Correction
#####	Number (content) is too long to fit in the cell.	Change width of column
#div/0!	Excel can not recognise name given in the formula	Select appropriate name from name box.
#ref!	Invalid cell reference	Enter the formula again
#value!	Wrong operand used in the formula.	Check and correct operand or argument

Inserting Charts: Charts give more visual clarity and meaning to data. It is easier to understand things explained by charts. There are many types of charts available in MS-Excel. Charts are linked to the values given in the worksheet. Charts may be placed in two ways in excel 1) embedded charts 2) chart sheets. Charts are explained in the following table.

Table 6.10 : Types of Chart in Excel

Chart type	Description
Area chart	Used to put emphasis on change over time.
3D surface	Implicates 3d changes.
Bar chart	Compare values
Radar	Each category of information radiate form centre.
Column	Looks like bar chart. Bars are aligned vertically.
Bubble	Displays three sets of variables. Represents two axes and bubble size.
Line	To compare trend
Scatter	To compare set of values with the average or predicted values.
Pie	Compare set of figures
Doughnut	Display more than one figure. Looks like pie chart.

Creating charts: Charts can be created by using chart wizard in excel. You may also adopt following sequence to create charts.

1. Entre data in the excel sheet.
2. Select chart from the insert menu or chose chart wizard available in the standard tool bar.
3. Select chart type according to the values
4. Choose data range.
5. Click on next
6. Entre name of the chart and other related values e.g. x and axis, grid lines, legends, data table etc.
7. Click next
8. Select location of the chart on the same sheet or new sheet.
9. Press finish button

Resizing and Moving Charts: charts can be resized or moved to other places by using mouse on the border of the chart.

Use of Chart Tool Bar: You can click right button on the menu and select chart. Buttons available on the chart tool bar are explained below:-

Table 6.11 Chart Tool Bar Buttons

Command	Meaning
Chart object	To select different objects n the chart
Format chart area	To edit the chart area
Chart type	To select different types of charts
legend	To display of hide chart legend
Data table	To display data table instead of chart
By row	To show data by rows
By column	To show data by column
Angle text downward	To angle text in downward direction
Angle text upward	To angle text in upward direction

Saving a Chart: To save a chart, you may use following command sequence.

1. Select chart and chose chart type.
2. N custom type, select user defined- click addà you will find the chart type dialogue box.
3. Type name of the chart à fill up description.
4. Set as default chart à click yes
5. Click ok to save the chart

Printing in Excel: A worksheet can be printed by using print command in the menu.

Set Page Layout: Click on the page tab to edit page layout. You may make changes to the given options.

Table 6.12 : Page layouts

Options	meaning
orientation	You may choose portrait or landscape
Page numbering	To select page number.
Paper size	To choose paper size.
scaling	To resize the page.
Print quality	To select quality requested. It also depends on the type of printer.

Margin Tabs: Margin tabs are used to specify left, right, up or down margins.

Header and Footer: There are customised as well as standard options are available to define header and footer in excel.

Sheet Tab: You may edit or change print range and elements to be printed e.g. headings, gridlines and comments.

Print Preview: Print previews shows us the actual print like copy on the monitor.

Printing a Worksheet: To print a worksheet, click on the print button on the standard tool bar.

6.6 Summary

There are many software available in the market to create and maintain a spreadsheet. MS-Excel widely used in industry.

In this section, we discussed various commands of MS- Excel. Commands are divided in to categorised like: file related commands, formatting commands, view commands etc. There is help section in MS-Word for user friendly help.

6.7 Self Assessment Questions

1. Write commands available in excel?
2. What do you understand by pivot table?
3. Differentiate workbook and worksheet?
4. What is range? Write stepwise process to define range.

5. Fill in the blanks:
    1. One worksheet contains ..... rows and ..... columns.
    2. Addressing is of ..... types.
    3. Print command used to .....

6.8 Reference Books

- Brian.K.Williams & Stacey C.Sawyer (2005) 'Using Information Technology' ; Tata McGraw Hill Publication company limited, Delhi.
- Henry.C.Lucas,Jr. (2001) ' Information Technology'; Tata McGraw Hill Publication company Limited, New Delhi.
- D.P.Sharma (2008); 'Information Technology' ; College Book Centre , 2008, Jaipur.
- P.K.Sinha, Priti Sinha,(2007) 'Computer Fundamentals' ; BPB Publication, New Delhi.

Unit - 7 : MS - Power Point

Structure of Unit:

7.0 Objectives
7.1 Introduction
7.2 About Power Point
7.3 Toolbars
7.4 Creating a Simple Presentation
7.5 Additional Features in PowerPoint
7.6 Creating Slide Show
7.7 Printing a Presentation
7.8 Help and Support
7.9 Summary
7.10 Self Assessment Questions
7.11 Reference Books

7.0 Objectives

After studying this unit, you will be able to

- Understand the PowerPoint as a presentation tool,
- Identify the different parts of a PowerPoint window,
- Understand the various functions of toolbars
- Create a simple presentation (PPT) by using various slide formats available,
- Insert Pictures, Movies, Audio clips and animations to make the presentation effective
- Create Slideshows with custom settings, and Print the saved presentations.

7.1 Introduction

Microsoft PowerPoint is a part of MS OFFICE suite. It is a presentation package that allows a user to create presentations, OHP transparencies, Posters and WebPages. It allows a user to manipulate texts and graphical elements such as pictures, charts, audio-visuals with greater flexibility than that of MS WORD. Typically a presentation or a slide show comprises individual slides arranged in a sequential manner. Normally, one slide covers a brief topic. PowerPoint also allows user to choose any predefined templates

7.2 About Power Point

Microsoft PowerPoint allows the user to incorporate images, video, and colorful backdrops to the information on screen. The prepared presentation you can deliver to a small team or a large audience. It creates great audio-visuals shows and with this tool it is easier to communicate the ideas effectively. Due to its simplicity, MS PowerPoint has become an indispensable tool to most of the corporate meetings and board rooms since it gives the management staff enough flexibility to present ideas and data more intelligently.

MS-Power Point not only handles picture, group, photos but also uses movies, audio, clips, TV recording to make presentation effective. Since PowerPoint is a member of the Office family of programs that look and work alike, once you learn one program, you can work on any one of them with ease. The next page shows the layout of a PowerPoint screen. It is important to familiarize yourself with the various toolbars available with PowerPoint and get an understanding of how to create and run a simple presentation. All these are presented in subsequent pages of this unit.

Starting Microsoft PowerPoint

Microsoft PowerPoint can be started in one of the two ways:

(a) By double clicking on the Microsoft PowerPoint icon on the desktop.

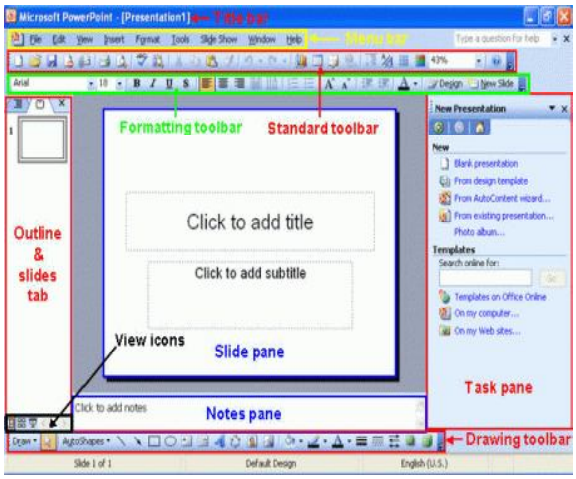


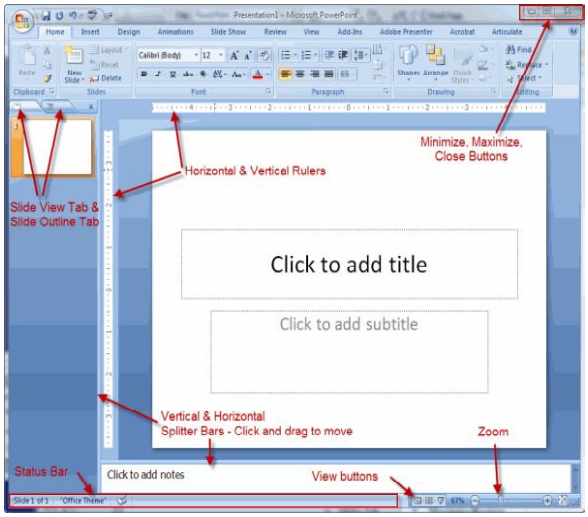
(b) Select Start -> All Programs -> Microsoft PowerPoint as shown below.



Power Point Screen Layout

There are subtle differences between MS PowerPoint 2007 and 2003 but both versions share same way of handling commands.





MS POWERPOINT 2007 **MS POWERPOINT 2003**

7.3 Toolbars

An active PowerPoint window has:

Title Bar

It displays which application package is running and name of the PowerPoint file currently open.

Menu Bar: It is the conventional Windows style drop down menu. If you click on any of the options available on the Menu bar, it displays the commands available under that menu. Alternatively, this menu can also be activated by pressing the access keys from the keyboard e.g. Alt + F to activate the File menu, Alt + E to activate the Edit menu, Alt + V to activate the View menu, and so on. This represents that these commands have further sub-commands. (Please note that Adobe PDF menu shown below will only come if you have already installed Adobe Reader Professional)



Standard Toolbar: It contains buttons and other controls that help you to execute a variety of PowerPoint commands, without having to go through the menus. The standard toolbar contains icons for basic functions like opening a new or existing file, saving a file, printing a file, cut-copy-paste, etc.



Formatting Toolbar: It contains icons to change the way your text looks also known as 'formatting' your text. Changing fonts such as Arial, Times New Romans etc., text size, colour, style, alignment etc. can be done using icons contained in this toolbar.



Drawing Toolbar: It allows, you to enhance your presentation by adding shapes and pictures, also allowing you to change the size, colour etc. of these. The drawing toolbar, as the name suggests, contains icons to add drawings and pictures to your presentation.



Scroll Tools: It helps you to move within your presentation. You can move up and down, left and right in your presentation in two ways: using the horizontal and vertical scrollbars with the help of a mouse; or by using the keyboard PgUp, PgDn, Home, End, and arrow keys.

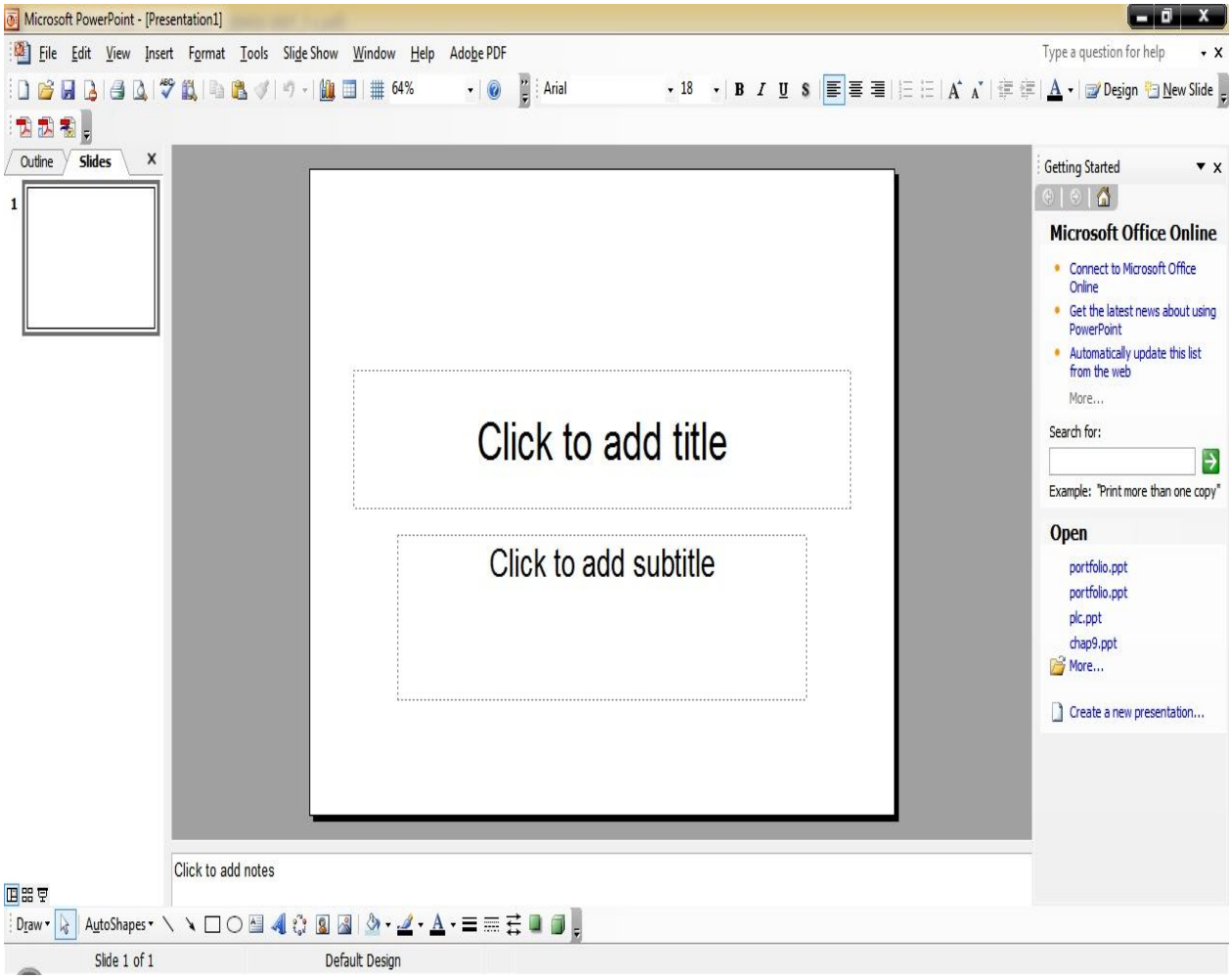
Status Bar: Normally, it is the last line on the screen and displays the current slide number, and the design template being used. (Template is a predefined outline that will be applicable across all the slides, unless changed. This outline includes features like colour scheme, fonts, default title etc.)

7.4 Creating a Simple Presentation

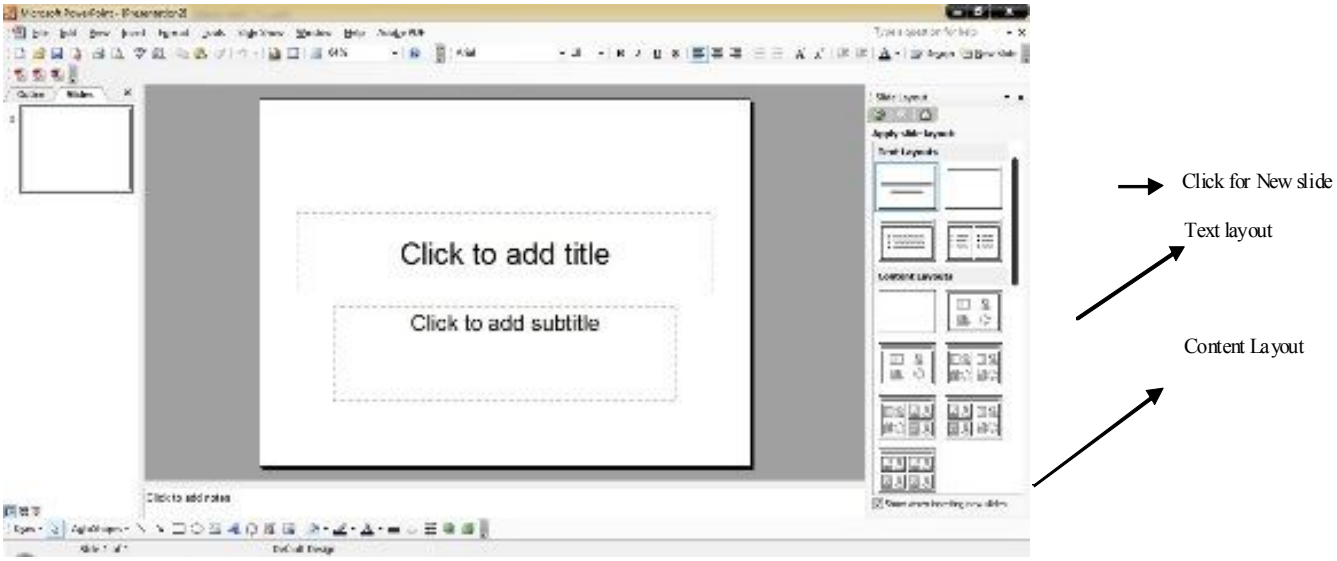
Select start, programs, and click on PowerPoint

1. Creating a New Slide

(1) Choose Blank Presentation from the right panel. (Or choose File -> Menu from the menu)



(2) Now you will see following window

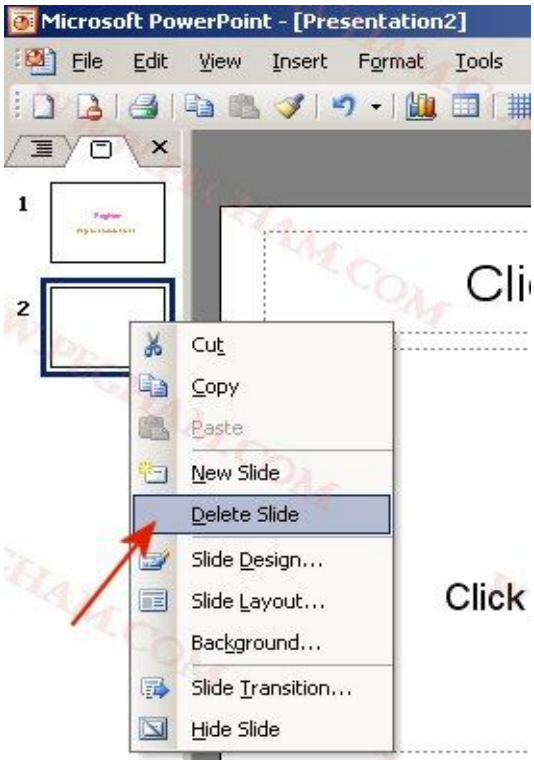


Click on "click to add title", you can also type on "click to add subtitle" to add subtitle such as your name, your organization/ college/ and your email address or phone number.

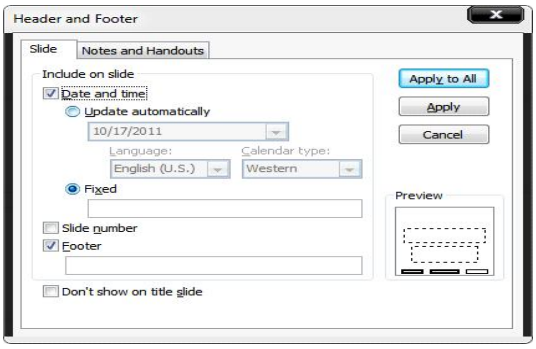
You can add new slide by clicking as shown above by arrow. Otherwise you can also go to menu bar and click on Insert and click on Add new slide option.

You can change the formatting option of your slides as per your desire and requirement by clicking on text layout and content layout. These two layouts give enough flexibility to user.

A user can easily copy by Menu> Insert> Duplicate slide and if a user wants to delete the slide he can go to main view and then right click on the desired slide and clicking on "Delete Slide" option as shown below



A user can also add numbers in the slide. The handling procedure is slightly different in PowerPoint 2003 and 2007 which is shown below.





Slide Numbering in MS PowerPoint 2003

Slide Numbering in MS PowerPoint 2007

In PowerPoint 2003

(1) Select View > "Header Footer" from the menu. This displays a dialogue box for selecting options for slides in terms of Date and Time, Slide Numbers, and Footer (if required).

(2) Click on the Slide Number check box.

(3) Click on the Apply to All button to apply this to all the slides. In case you click on the Apply button only, the numbering will apply only to the current slide.

(4) You could optionally click on the Date and Time check box to have a date and time displayed on each slide.

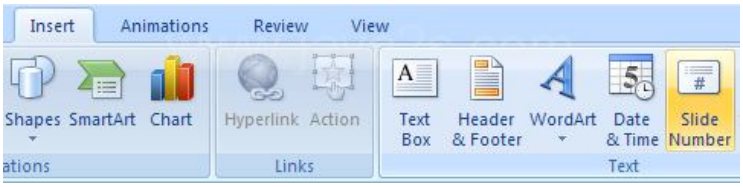
In PowerPoint 2007

(1) Click the View tab, and then click the Slide Master Button.

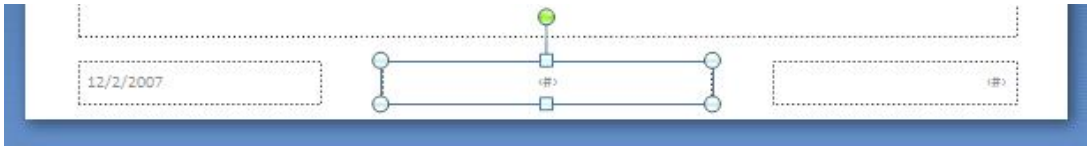


(2) Select the slide master or slide layout in the left pane. Click to place the insertion point in the text object.

(3) Click the Insert tab. Click the Insert Slide Number button.



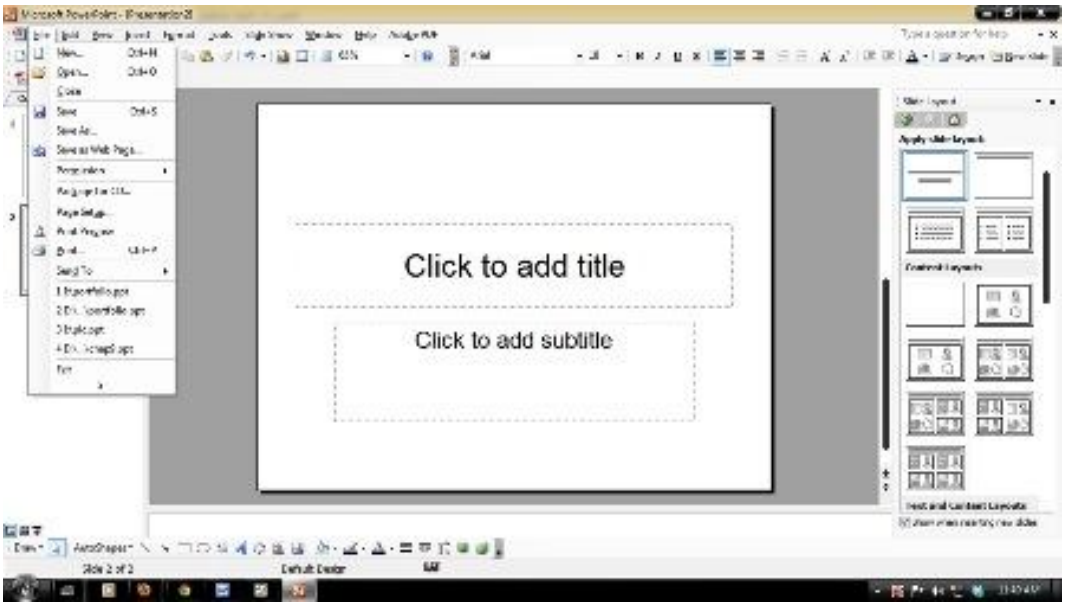
(4) The # symbol appears in the text. As shown below in the diagram. Write the Slide Number here.



Click the Slide Master tab, and then click Close Master View button on the Ribbon.

2. Saving a Presentation

In PowerPoint 2003 user may go to > File -> Save from the menu. Optionally, user can click on the save icon in the standard toolbar.



In PowerPoint 2007 user may go to office button and there on can save the file in various formats.



There are multiple formats that the presentation can be saved as.

PowerPoint Presentation

This is the default format; the presentation will be saved as a PowerPoint 2007 file.

Power Point Show

In this format when the PowerPoint file is launched the presentation will automatically start.

PowerPoint 97-2003 Presentation

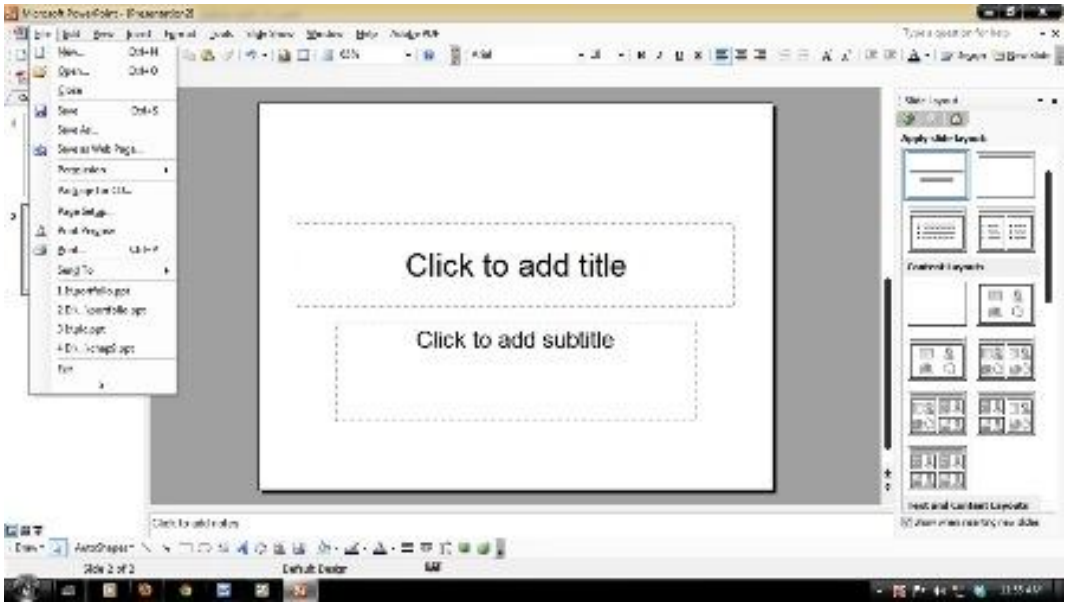
This means that the file will be saved in an older format, increasing the presentations compatibility with older version of PowerPoint.

PDF or XPS

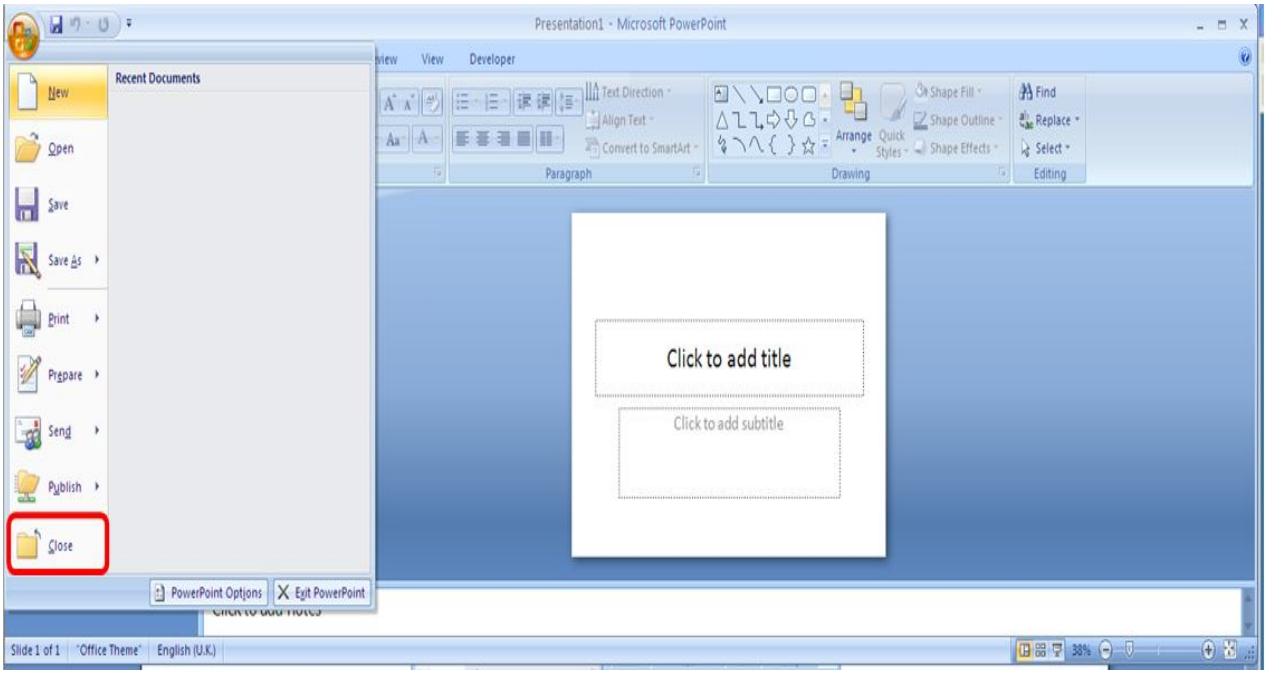
This format is entirely different from PowerPoint meaning that when the save file is launched; it will be launched in a PDF/XPS viewer. The reason for saving the presentation in this format, is to ensure your printed or viewed file keeps the original formatting

3. Closing a Presentation

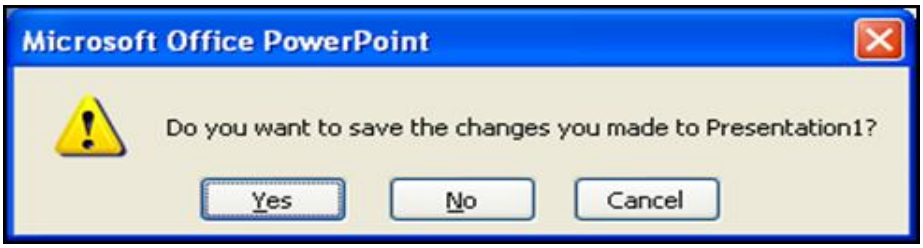
When you have finished working with your presentation it is always important to close it properly. The user can close the presentation by clicking on File>close in 2003



In PowerPoint 2007 when you have finished with your presentation if you go into the file menu which is accessed by clicking the circle with the Windows Logo in the top left corner of the software, there is an option saying close (circled below).



If you have made any changes to the presentation PowerPoint will bring up a message asking if you wish to save your presentation.



Be careful, if you click No any changes you've made to the presentation will be lost and you'll have to re-do them if you want to keep them. If you click Yes, any changes you've made will be saved and the presentation will be closed. Finally if you click Cancel you will be returned to your presentation and nothing else will happen.

4. Opening an Existing Presentation

If you have a presentation that you have already been working on, you can open it from PowerPoint.

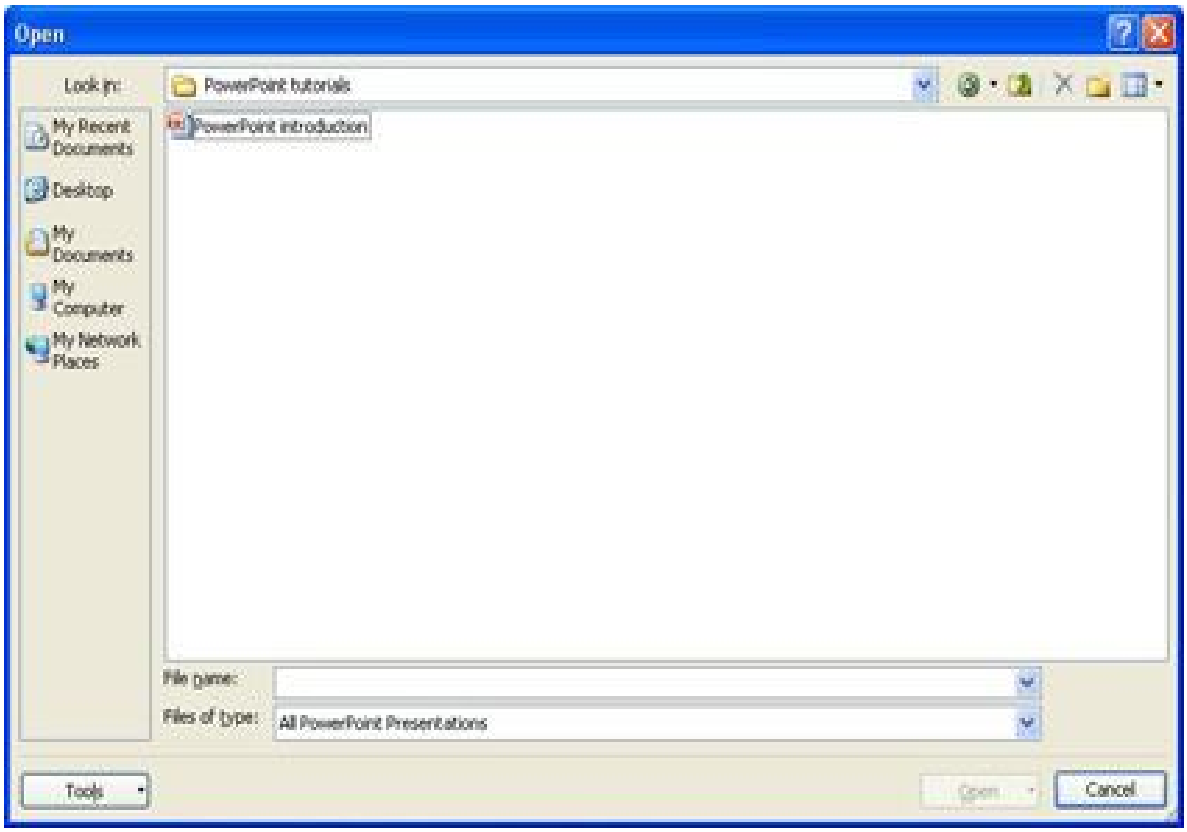
You can do so in three ways;

1 Click Office Button > Open Select File -> (in PowerPoint 2003 >Open from the menu)

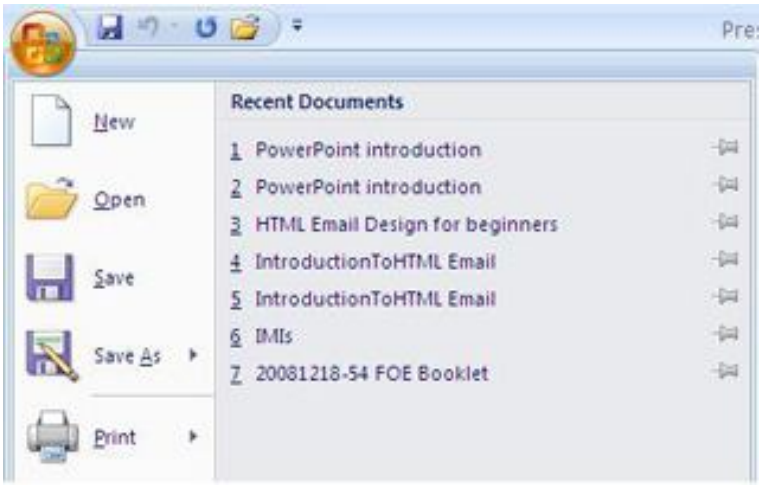
Click the Open button (if it has been added to the Quick Access Toolbar) Open button

2 Press Ctrl + O

The Open dialogue box will appear. Navigate to the location of the saved presentation using either the Look in list at the top or the shortcuts on the left, select the presentation and click Open. The requested file is then opened.



3 If the presentation you are looking for was used recently, it can be opened by clicking the Office Button and selecting it from the list of recent documents.



If the opened presentation was saved as a 97-2003 presentation, [Compatibility Mode] will appear in the Title Bar. Although using PowerPoint 2007, compatibility mode tells you that not all the new PowerPoint 2007 features are available for use, unless the presentation is saved under the new file format.

7.5 Additional Features in PowerPoint

As discussed in the introduction paragraph, MS PowerPoint has additional abilities to insert photos, pictures, picture albums, videos and audio clips. In this section we will acquaint the user to further enhance his presentations by adding above features.

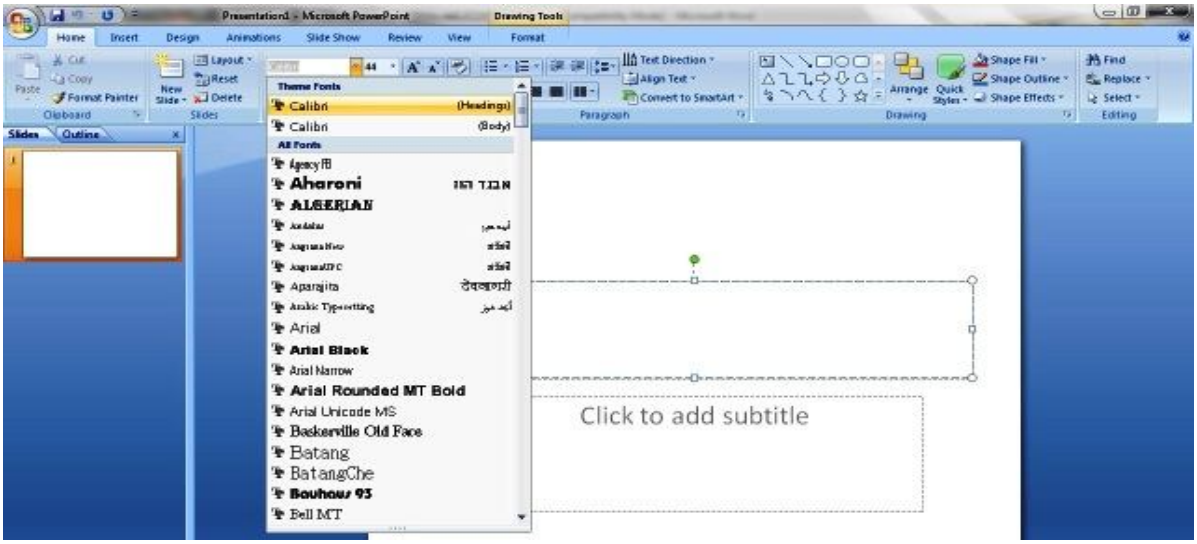
These features not only make the presentation attractive but also help the user to make the presentation lot more simple and effortless.

1. Changing Fonts

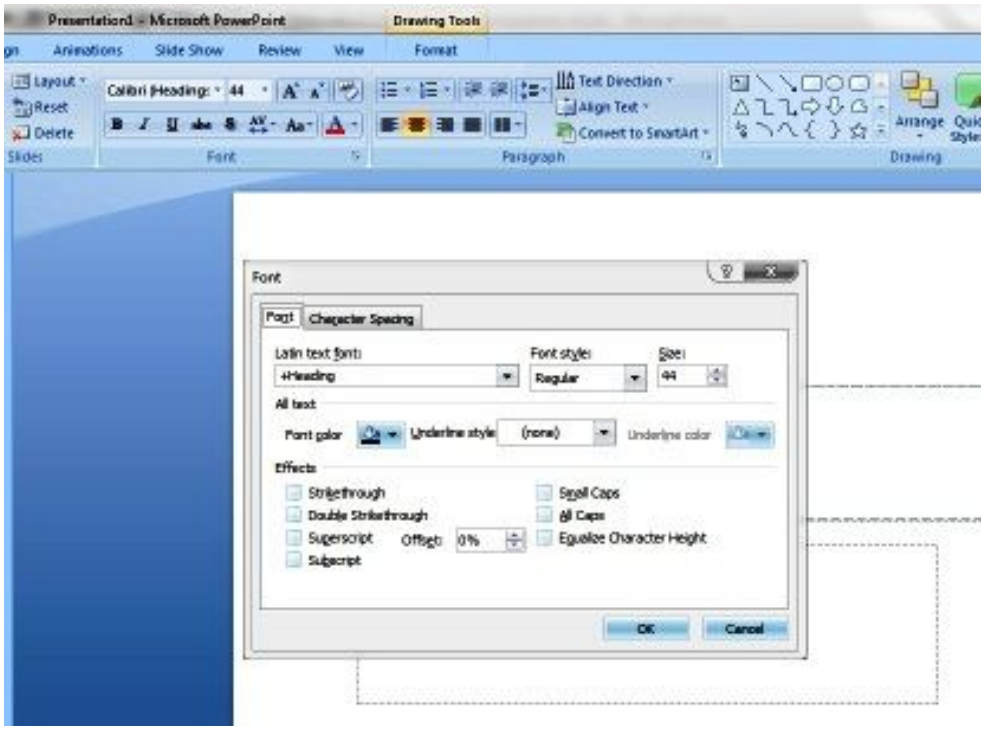
User can do many things with his /her presentation. In PowerPoint 2007 changing the fonts is now lots more easier than that in 2003. For that, user has to click on any text in his slide, and then go to following drawing tools and then clicking the cursor on the Font style.



User can change and select the appropriate font there on easily.



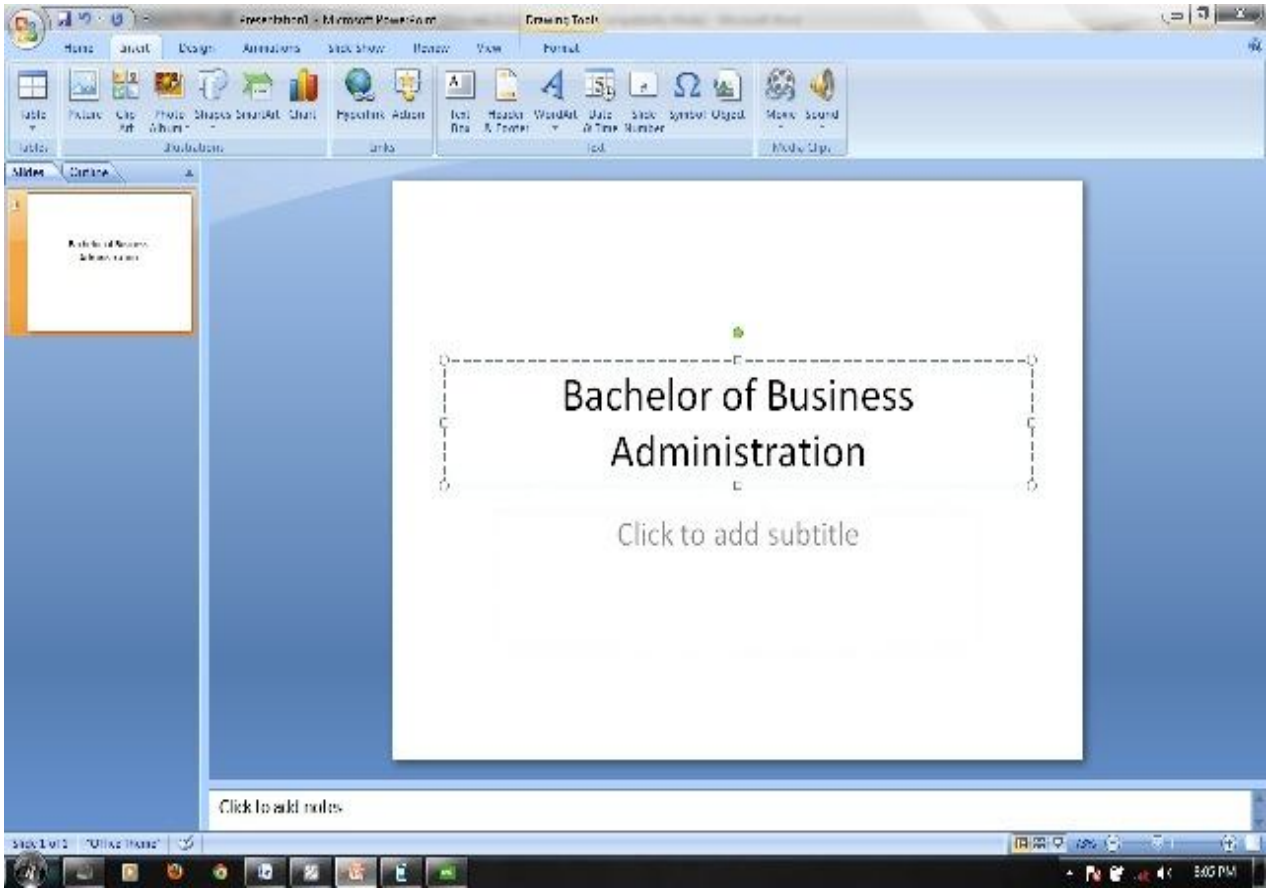
By clicking on the small arrow in font tab, a popup will come out as shown in following



Click Here

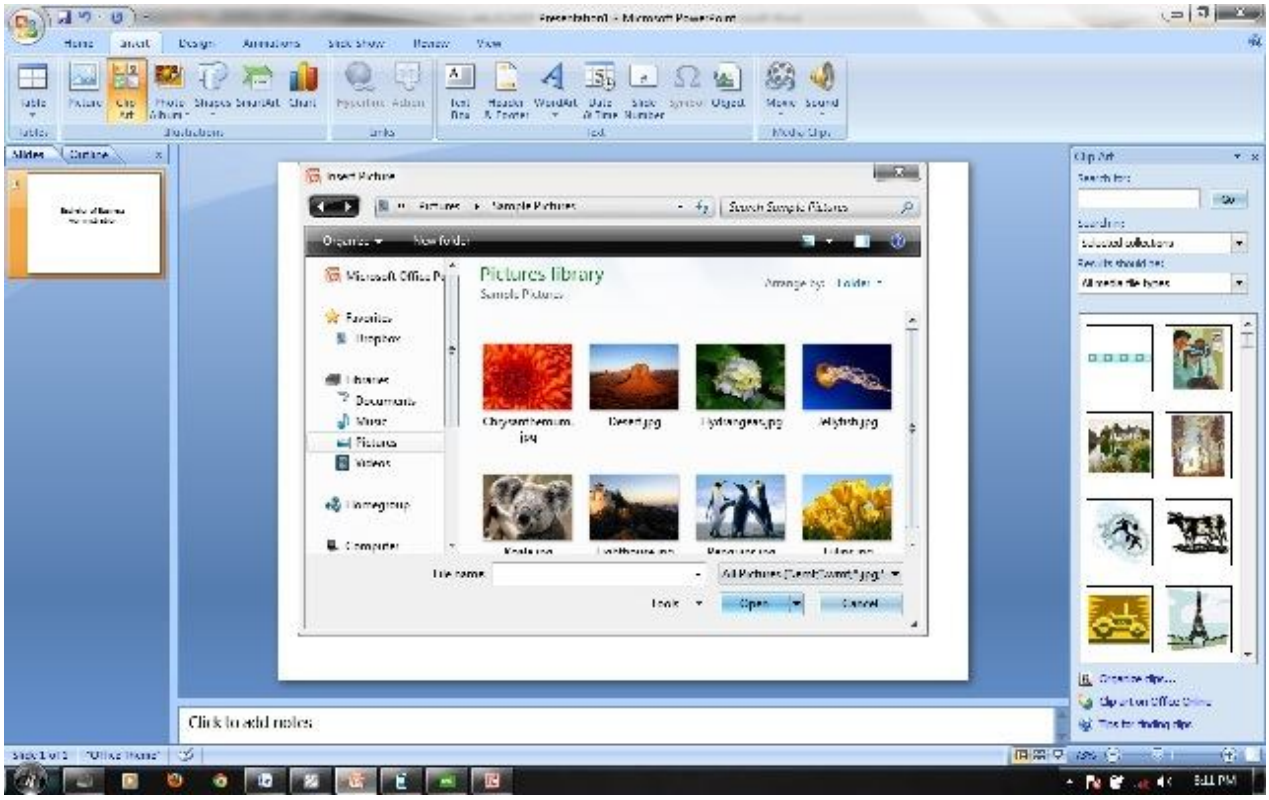
It enables the user to change font, character spacing, and even change the desired effects.

2. Insert Audio/Visual Contents



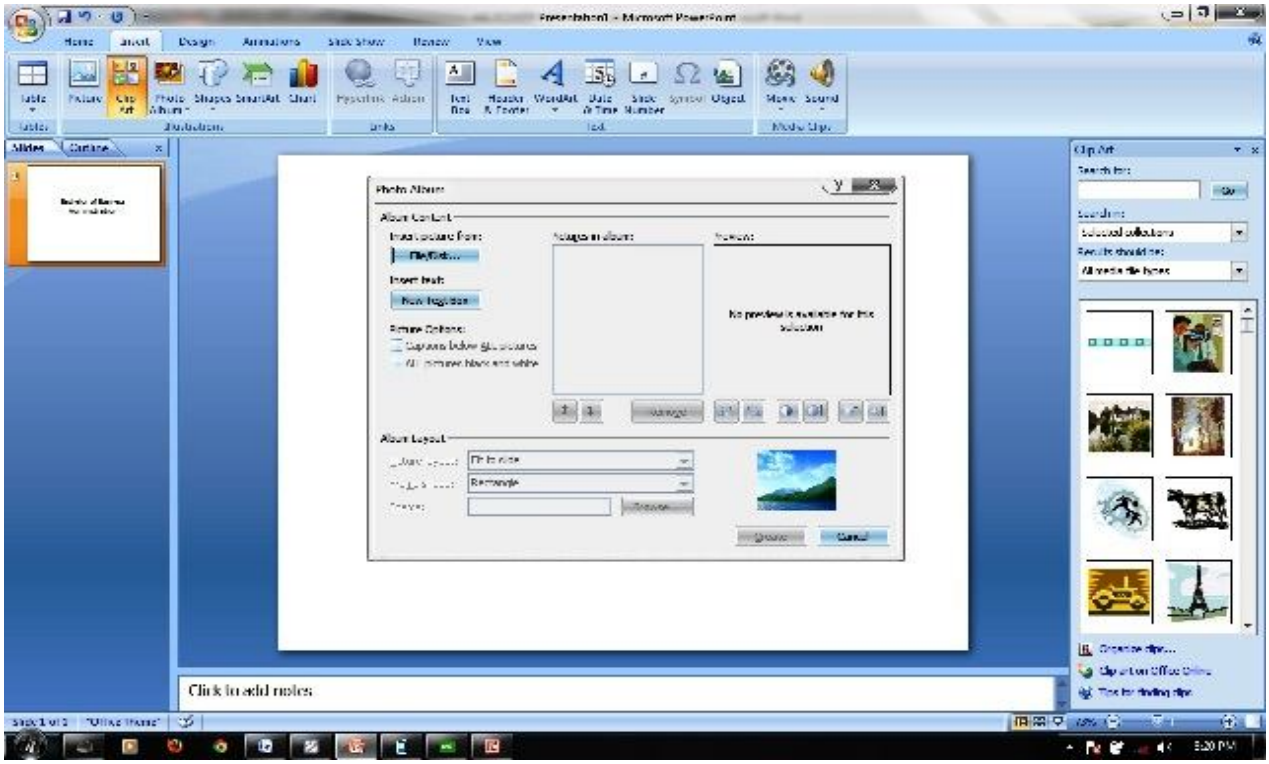
MS PowerPoint is one of the most versatile tools as far as customization is concerned; it allows the user to insert tables, pictures, clipart, even photo albums, smart art and chart. User has to click in Insert tab in MS PowerPoint 2007 version as shown above. In MS PowerPoint 2003 versions insert tab is same.

3. Inserting Pictures and Clip Art



A user can insert the picture by clicking on insert picture, by doing so a popup window will open which will show the pictures already stored in User>My Documents> My Picture folder. User can change the path easily and can navigate freely in any place in the computer according to his desire and need. User can also insert Clipart by clicking on Clipart tab on PowerPoint window.

4. Inserting Photo Albums



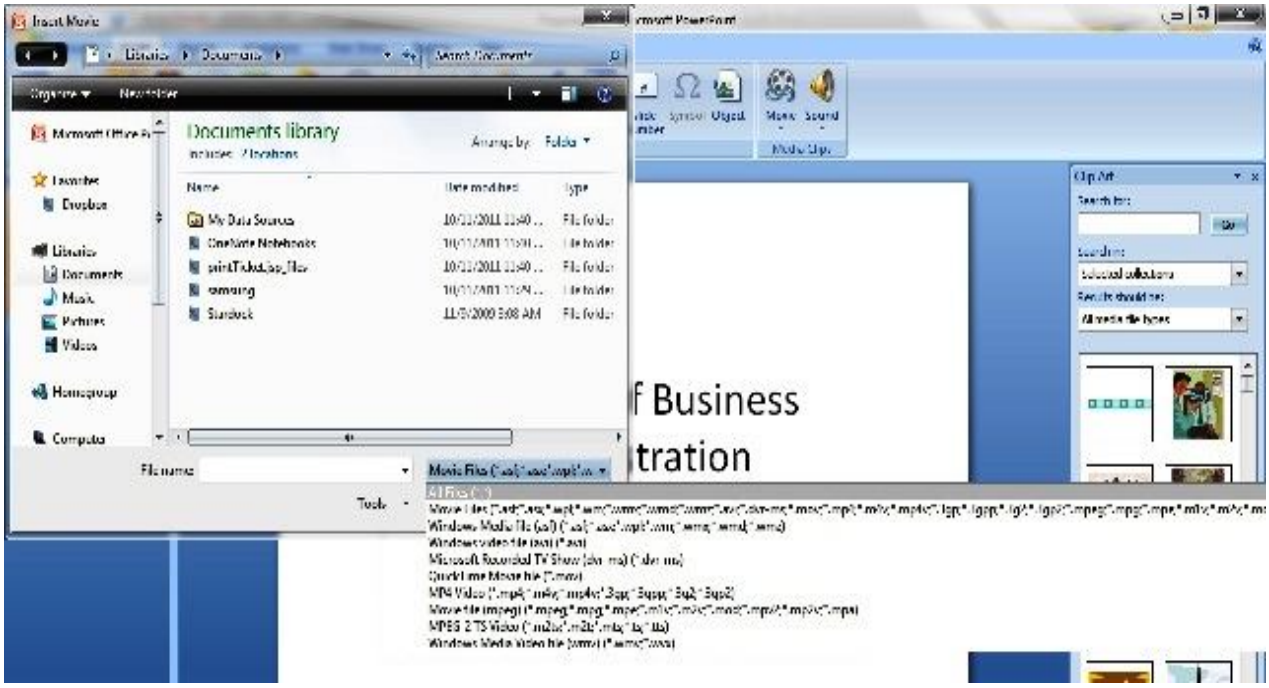
A user can click in Photo album tab also and insert entire album to his discretion. The album option is especially helpful for displaying various pictures without compromising the simplicity.

5. Inserting Movie

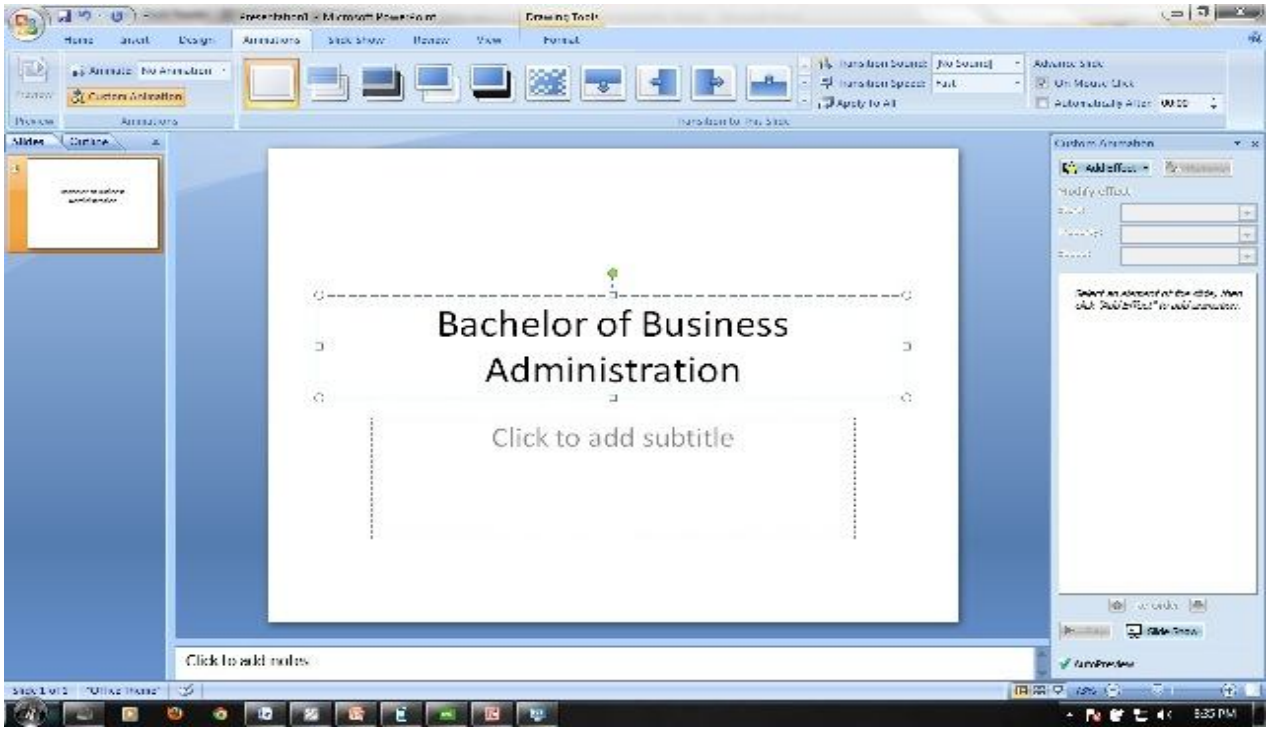
PowerPoint 2007 and 2003 both gives the user to insert either entire movie or clips from the movie. Or even multiple clips from different movies. This feature is especially good for persons who want to show video clips to create significant impact of their presentation.

When a user clicks on movie tab, following popup will come out, showing the user document library from where he can select the movie. MS PowerPoint accepts a really wide range of audio and video formats.

Almost all type of Window Media Files, Real Media Player files, Quick Time Files, MPEG files MP4 videos, Microsoft Recorded TV show Files are supported. The following slide, shows the formats which are supported. The user can also add audio clips in the similar manner.



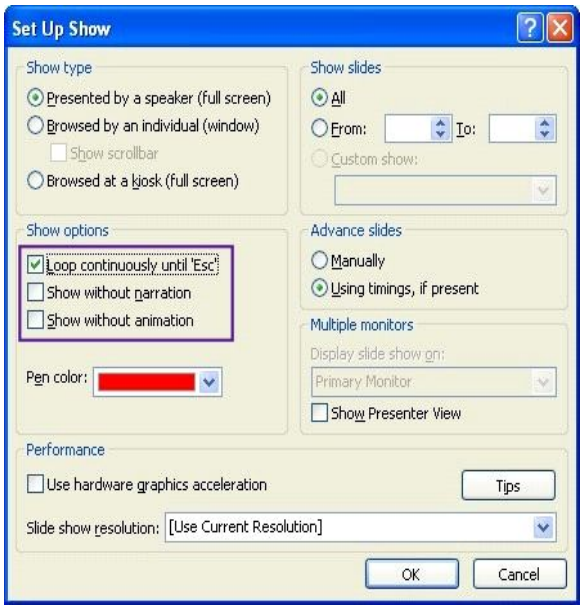
Adding Animation



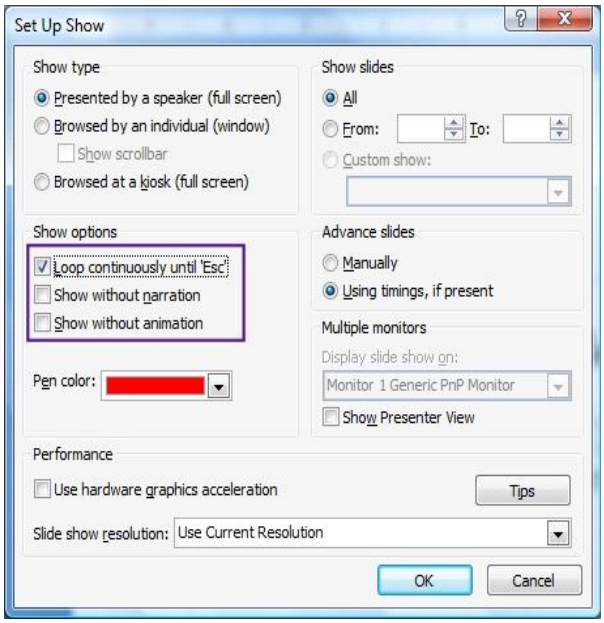
7.6 Creating Slide Show

Once a user has created his presentation, he can create slide shows from it. A slide show is a set of slides which appear automatically or manually one by one thus creates a story board or show.

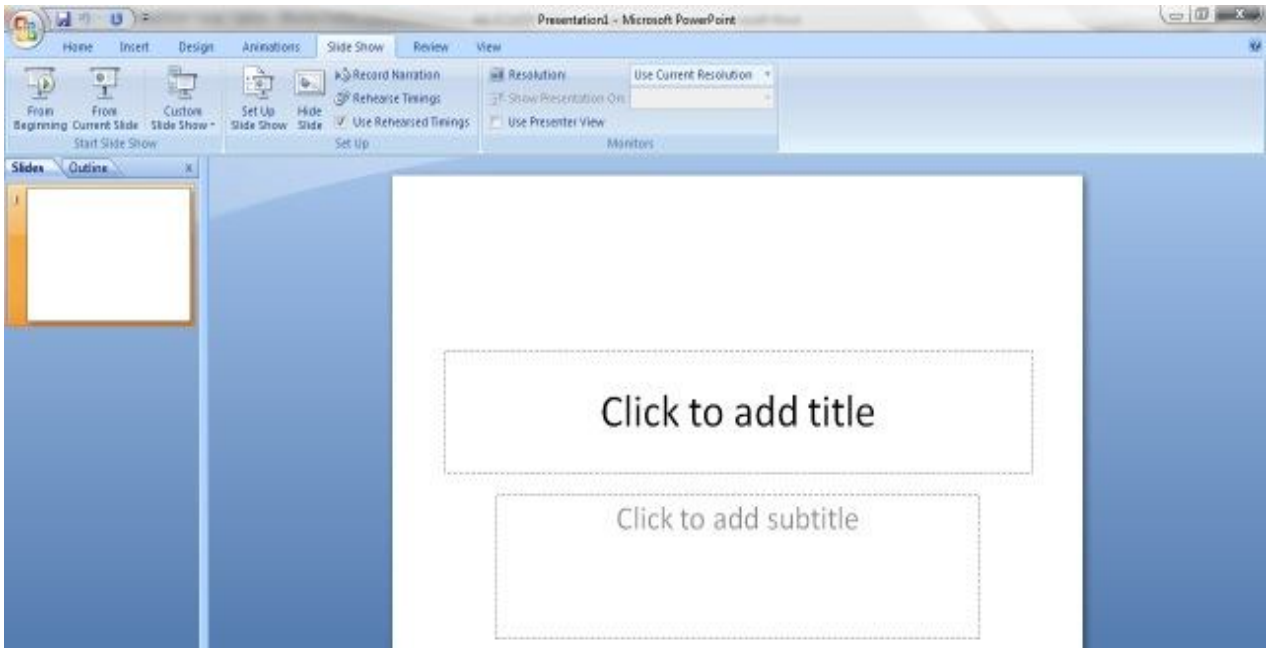
In both PowerPoint versions, user has to click on slideshow tab. Once there, he has to specify the options which he wants in the show.



Slide Show in PowerPoint 2003



Slide Show in PowerPoint 2007



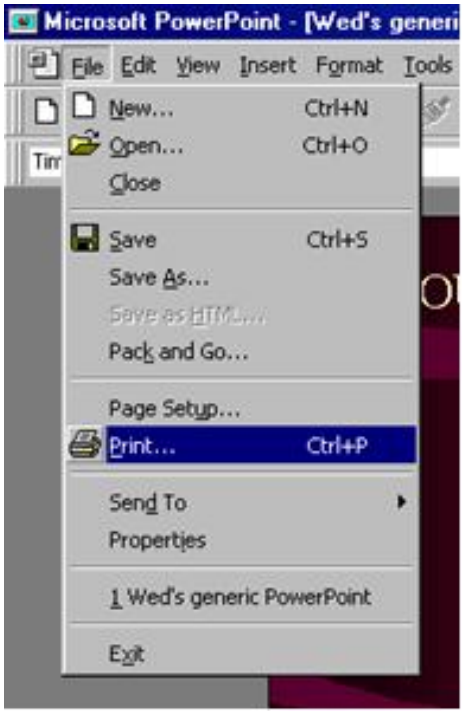
Slide Show Options in PowerPoint

User can also create voice recording which will accompany the slide show as shown above.

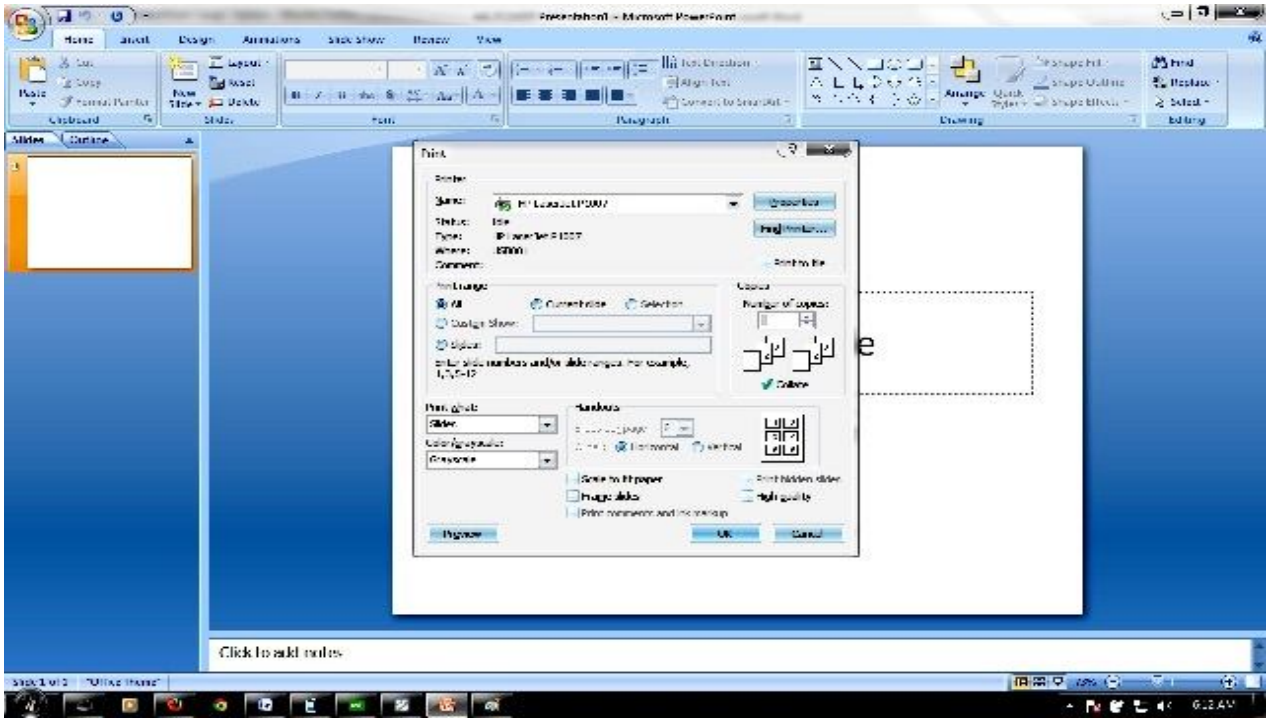
In either version of PowerPoint, check the first checkbox under the "Show options" section that says Loop continuously until 'Esc'. This will force PowerPoint to keep the user's presentation displayed until the user presses the ESCAPE ('Esc') key. If the user reaches the end of the presentation and click to the next slide, the first slide appears or LOOPs back to the beginning.

7.7 Printing a Presentation

If the user wants to print his presentation, he can go to Office Button in PowerPoint 2007 or select File > Print in PowerPoint 2003.



Print Option in PowerPoint 2003



Print Option in PowerPoint 2007

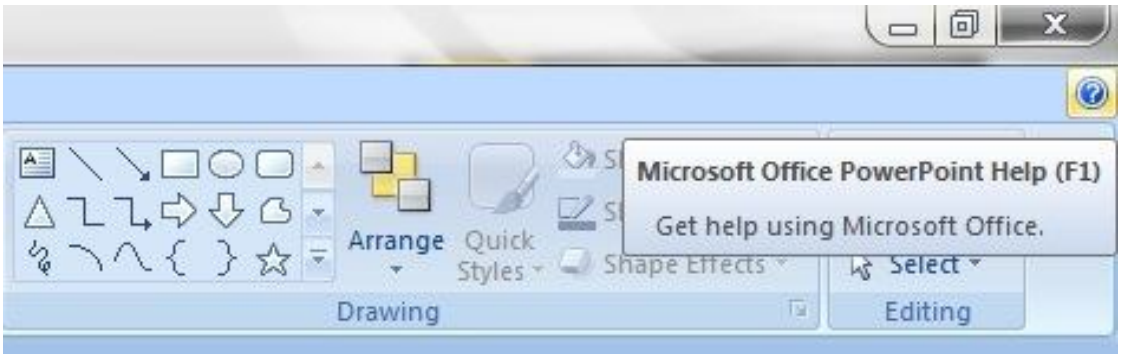
When printing a presentation, it may be a good idea to select the Audience Handout option, since this lets the user to choose how many slides to display on the same printed page. Another advantage is that it gives the user a space to write his notes in. for this user has to select Handouts and choose the number of slides per printed page he wants (3 are normally good) as shown in above diagram.

7.8 Help and Support

Since PowerPoint is an MS Office suit package, it has an integrated customer support system. In PowerPoint 2003 user can avail of help by clicking on Menu>Help



Help and Support in PowerPoint 2003



Help and Support in PowerPoint 2007

In PowerPoint 2007 user can go to question mark symbol and ask for the help online. In both versions internet connectivity is recommended since the program will then try to connect to the Microsoft server for the help. Alternatively user can click on F1 key which will bring the popup menu which is contextual in nature.

7.9 Summary

In this unit, we have studied that a PowerPoint presentation consists of individual slides arranged in a sequential manner. New slides can be inserted, existing slides can be deleted, and slides can be re-ordered within a presentation.

Not only that, a user can but also adds pictures, albums and audio-visual item as per the need and requirements. A user can also print the entire slides or certain slides and handouts through print commands.

In any case, if a user wishes to acquire Microsoft services he can avail of this services through built in "help" feature.

7.10 Self Assessment Questions

1. What is MS PowerPoint? How you can create Slides in it
2. How a user can add or delete slides in PowerPoint 2007 and 2003.
3. How a user can add video clips in PowerPoint Presentation?
4. What are various view of power Point.
5. How will you create a slide show.
6 What do you mean by slide transition.

7.11 Reference Books

- IGNOU Study Material for MS PowerPoint
- Muir, & Nancy. (2011), *MICROSOFT® POWERPOINT® 2010 PLAIN & SIMPLE*. New Delhi: PHI.
- Saxena, S. (2009), *MS PowePoint,* New Delhi: Vikas Publication.
- Stevenson. N, (2008), Using Microsoft Power Point 2007: The Most Complete Reference: PHI

Online Reference Material:-

- 12 Tips for Creating Better PowerPoint Presentations
- http://www.microsoft.com/atwork/getworkdone/presentations.mspx
- Microsoft Office Official site for PowerPoint Presentation
- http://office.microsoft.com/en-us/templates/CT010117272.aspx
- Creating with PowerPoint: 10 Do's and Don'ts
- http:// tinyurl.com/5se42r

Unit - 8 : MS - Access

Structure of Unit:

8.0 Objectives
8.1 Introduction
8.2 Definition
8.3 Starting and Quitting Microsoft Access
8.4 Creating a Microsoft Access Database
8.5 Creating Tables
8.6 Creating Queries
8.7 Importing Excel Data to Access
8.8 Use Reports to Present Data
8.9 Preview, Print and Save Report
8.10 Summary
8.11 Self Assessment Questions
8.12 Reference Books

8.0 Objectives

After completing this unit, you will be able to:

- Launch Access and identify the parts of the screen.
- Define fields and field properties constructing table structures.
- Enter and edit records in a table.
- Find, sort data.
- Design custom queries to display data.
- Import and export data between Excel and Access.

8.1 Introduction

Microsoft Access is a powerful, yet easy to learn, relational database application for Microsoft Windows. This tutorial is designed for users who are new or only have little experience using Access 2003 or Access 2007. It introduces fundamental database concepts and operations and illustrates how they are performed in Microsoft Access. This unit emphasis as on basic and frequently-used features of MS Access such as the creation of tables and queries, or importing spreadsheet into Access.

8.2 Definition

Relational Database: in relational databases such as Access, data is stored in tables made up of one or more fields (Access calls a column a field). The data stored in each column must be of a single data type such as Character, Number or Date. A collection of values from each column of a table is called a record or a row in the table.

Different tables can have the same column in common. This feature is used to explicitly specify a relationship between two tables. Values appearing in column A in one table are shared with another table.

Table: tables are the main units of data storage in a database. A table is a collection of data about a specific topic; it is made up of one of more fields.

Field: a field is a column in a table and defines a data type for a set of values in a table. For example, a mailing list table might include fields for first name, last name, address, city, state, zip code, and telephone number.

Record: a record is a row in a table and is a set of values defined by fields. In a mailing list table, each record would contain the data for one person as specified by the intersecting fields columns.

Data Type: data types are the properties of each field. A field only has one data type, such as Character, Number or Date.

Primary Key: a primary key is a value that can be used to identify a record uniquely in a table.

Design View: it provides the tools for creating fields in a table.

Datasheet View: it allows you to update, edit, and delete information from a table.

What is a Database?

One of the technology terms that most people have become accustomed to hearing either at work or while surfing the Internet is the database. The database used to be an extremely technical term, however with the rise of computer systems and information technology throughout our culture, the database has become a household term.

Employee records in a file cabinet, a student records in a library or a guest record in a hotel are some of the examples of a database. Thus a database is a structured collection of records or data that is stored in a computer system.

In order for a database to be truly functional, it must not only store large amounts of records well, but be accessed easily. In addition, new information and changes should also be fairly easy to input. Besides these features, all databases that are created should be built with high data integrity and the ability to recover data if hardware fails.

Database, typically consists of a heading that describes the type of information it contains, and each row contains some information. In database terminology, the columns are called fields and the rows are called records. This kind of organization in a database is called a table.

In order to have a highly efficient database system, a program that manages the queries and information stored on the system must be incorporated. This is usually referred to as DBMS or a Database Management System.

A database management system (DBMS) is a system that stores and retrieves information in a database. Data management involves creating, modifying, deleting and adding data in files and using this data to generate reports or answer adhoc queries. Hence the software that allows us to perform these functions easily is called a DBMS.

What is Microsoft Access Database?

Microsoft Access is a computer application used to create and manage computer-based databases on desktop computers and/or on connected computers (a network).

Microsoft Access is a relational database management system (RDBMS). Microsoft Access is also a database like any other database. There are certain key benefits of using MS Access like

- Fairly complex databases can be setup and running in 1/2 the time and cost of other large database systems (the simpler the database the greater the cost advantage).

- Microsoft Access integrates well with the other members of the Microsoft Office suite of products (Excel, Word, Outlook, etc.).
- Other software manufacturers are more likely to provide interfaces to MS Access than any other desktop database system.
- When designed correctly, Access databases can be ported (usually with some difficulty) to SQL Server or Oracle. This is important if you want to start small or develop a pilot database system and then migrate to the larger database management systems.
- A Microsoft Access system can be placed on a website for access for remote users. Simple screens can be developed within Access, Data Access Pages. Or full control and functionality can be implemented using Active Server Page (ASP) programming. Note that you still have the same simultaneous connection limitations described above.

8.3 Starting and Quitting Microsoft Access

You can start and exit Microsoft Access in the same way as you do other windows based Applications.

To Start Microsoft Access Open the program group that contains the Microsoft Access icon.

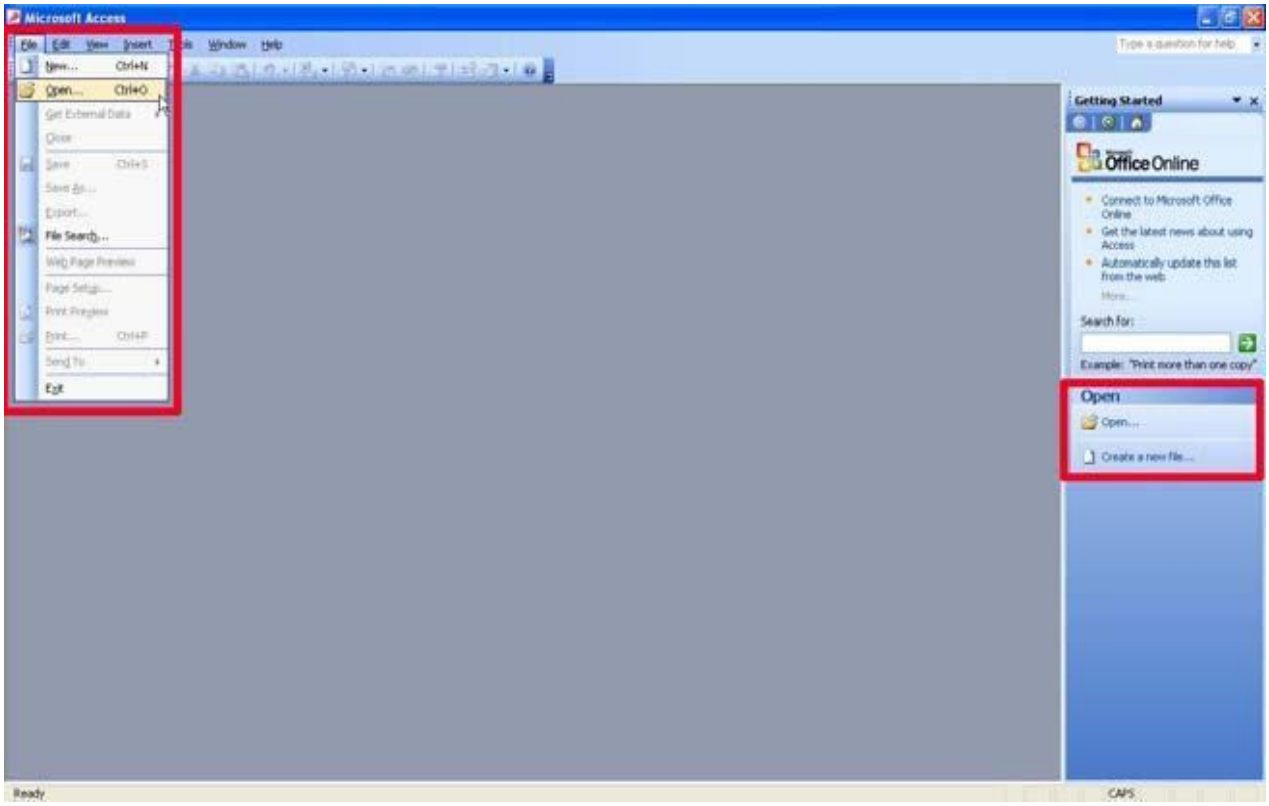


Double click the Microsoft Access icon. Microsoft Access starts and displays Microsoft Access window, where you can create or open a database or you may click on the START button on your computer and position your cursor over the PROGRAMS menu to view a list of installed programs. Once you see the list, position the cursor over Microsoft Office and then click on Microsoft Access.

Depending on your version of MS Access, the layout will be different as shown below



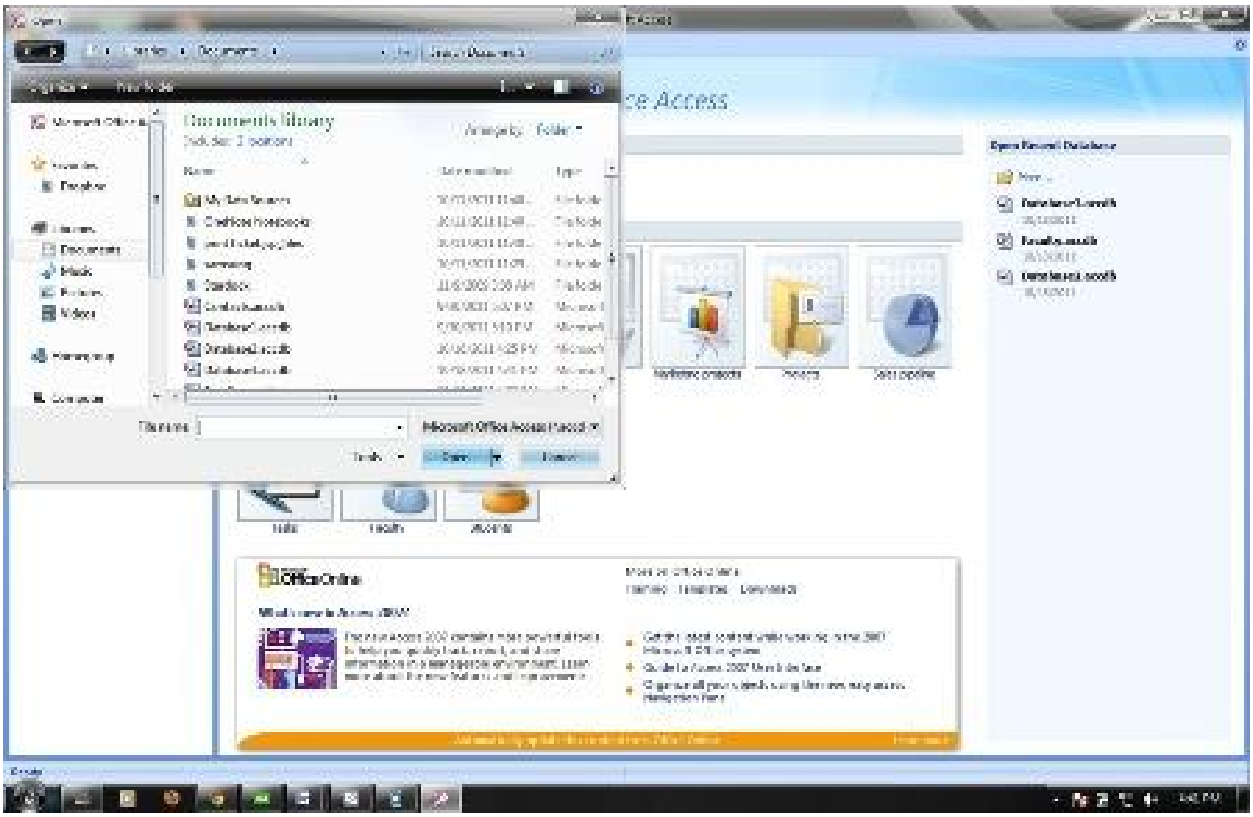
Initial layout in MS Access 2007



Initial Layout in MS Access 2003

To Quit Microsoft Access you may choose Exit from File menu.

8.3.1 Opening a Database

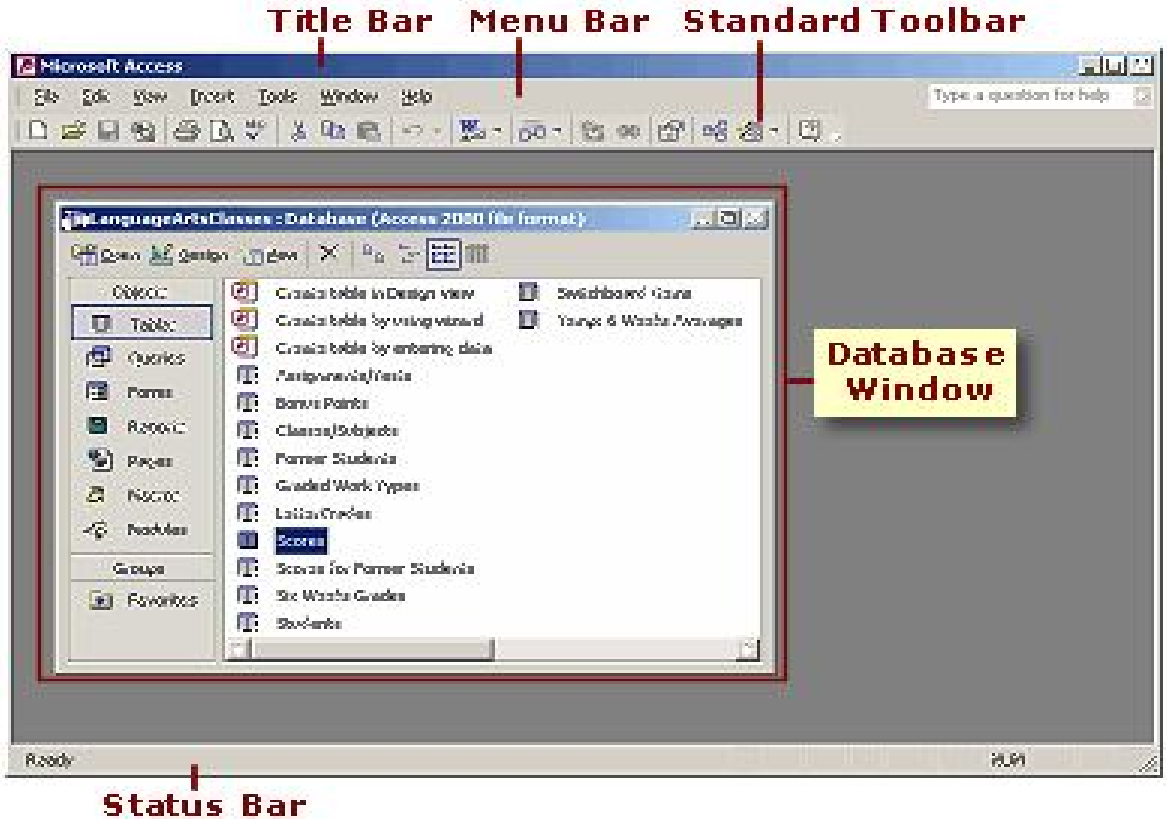


To open a data base select Open Database from the File menu. The above figure shows the popup window which will list the already available data base files in the document library. Please note that the file will have .accdb as suffix or any other compatible version such as .xls or .xlsx. MS Access 2007 saves database with .mdb extension.

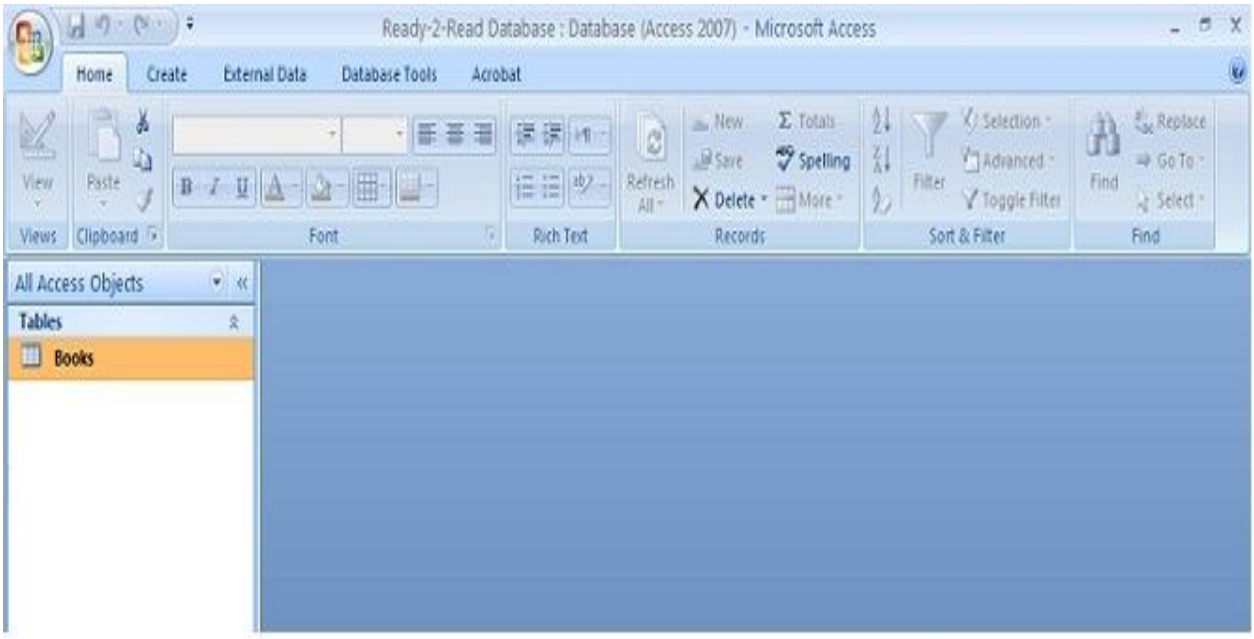
In office 2003 the process is more cumbersome where user has to click multiple time, but essentially the difference between 2003 and 2007 versions are more graphic user interface (GUI) related rather than that of technical in nature.

8.3.2 The Database Window

Once a database has been selected, the user will face the database window as shown below in the figure



The database window in MS Access 2003



The database window in MS Access 2007

Title bar which is located at the top of the screen, displays the name of the program.

Menu bar which is located below the title bar, lists the options.

Tool Bars generally located below the menu bar, provides quick access to most frequently used commands and utilities. User can drag the toolbars and place to the position of his convenience.

Status Bar is a horizontal bar at the bottom of the screen that displays information about commands, toolbar buttons and other options.

8.3.3 Components of the Access Database

An Access database consists of several different components. Each component listed is called an *object*.

Listed below are the names and descriptions of the different objects you can use in Access. This tutorial will focus on the first two objects: tables and queries.

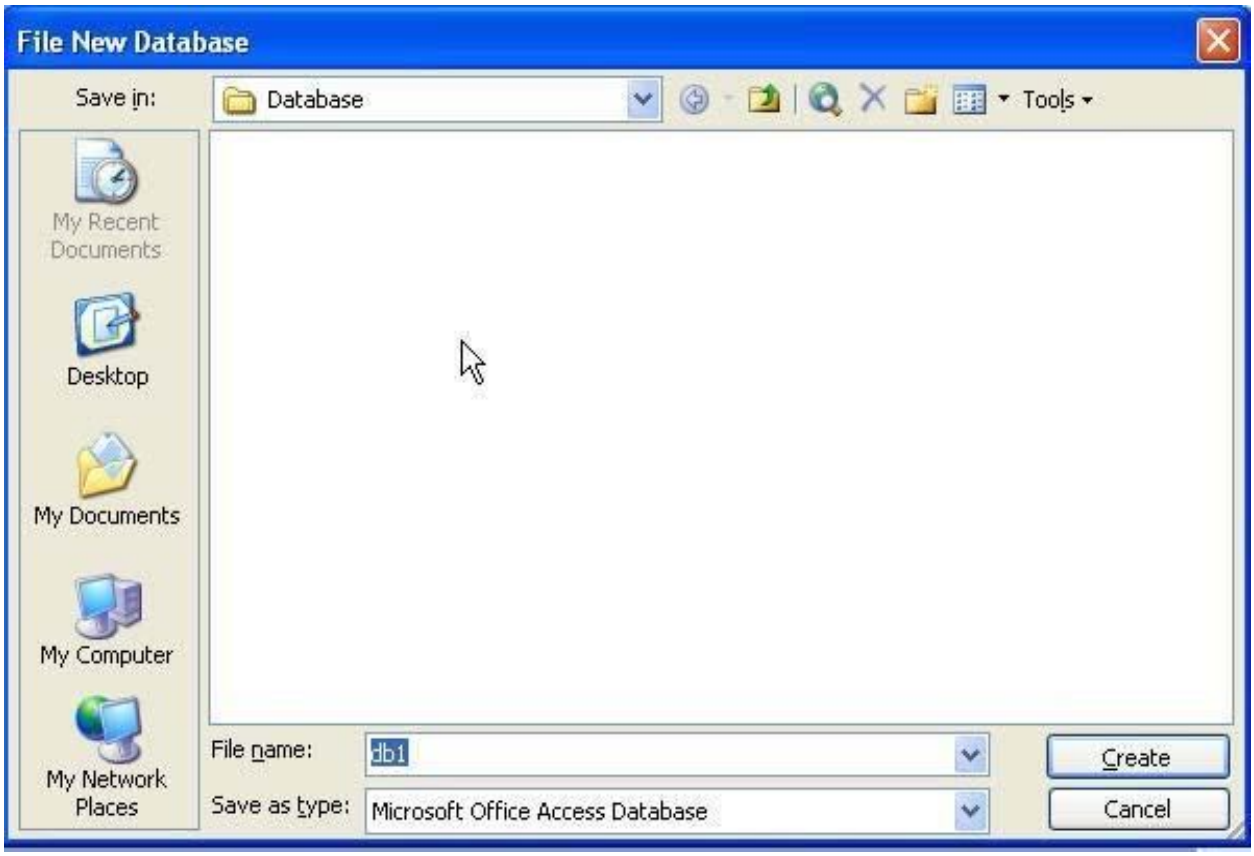
Tables: Tables are where the actual data is defined and entered. Tables consist of records (rows) and fields (columns).

Queries: Queries are basically questions about the data in a database. A query consists of specifications indicating which fields, records, and summaries you want to see from a database. Queries allow you to extract data based on the criteria you define.

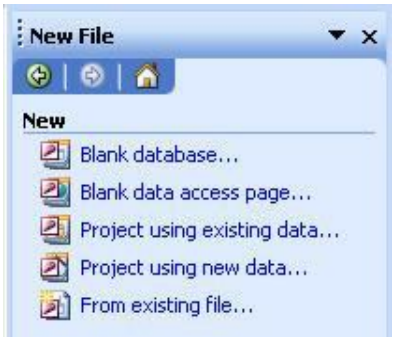
Forms: Forms are designed to ease the data entry process. For example, you can create a data entry form that looks exactly like a paper form. People generally prefer to enter data into a well-designed form, rather than a table.

8.4 Creating a Microsoft Access Database

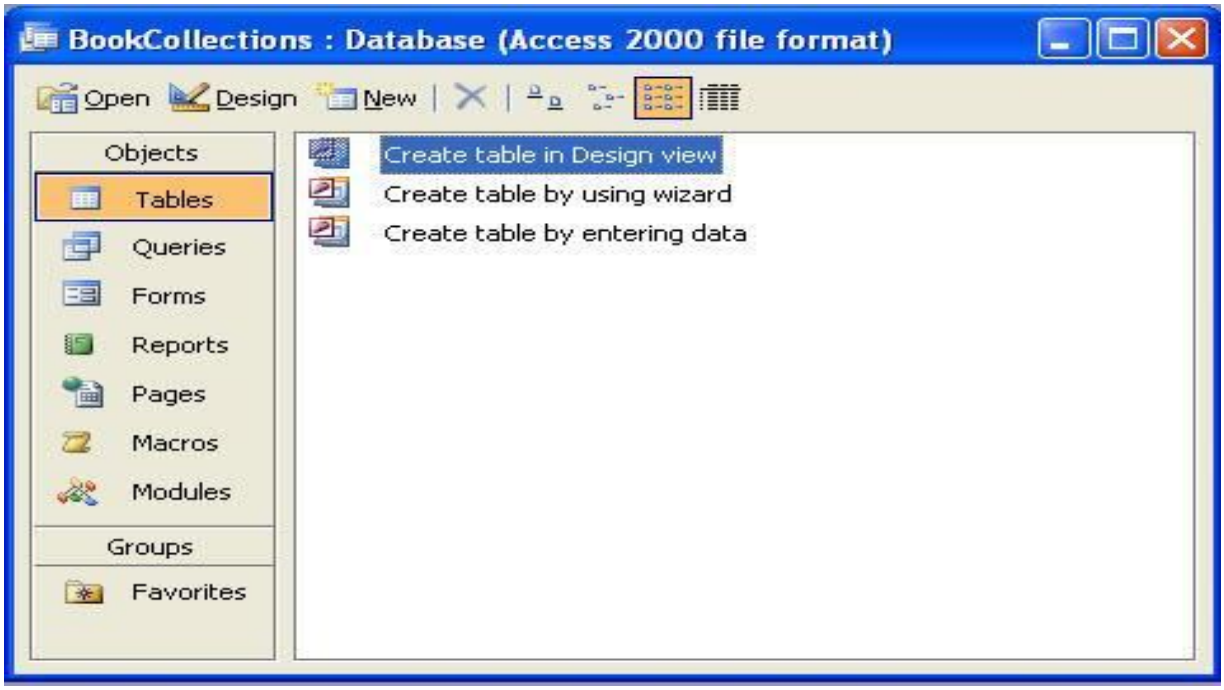
If you are creating a new database, you can also either go to File—New, or move your cursor to the lower right-hand side to click on Create a new file. You will be presented with five options on the right side menu as shown in Figure.



Unlike Word documents, Excel spreadsheets, and Power Point presentations, you must save an Access database before you start working on it. After selecting "Blank database", you will first be prompted to specify a location and name for the database. In the New Database dialog box, type in a name for the database and a location and click on Create as shown in Figure.



Now a new database is created as shown in Figure



8.4.1 Creating Objects

In the previous sessions we have studied, that a database contains different types of objects or components. Now we know how to create a database, the next step is to know, the creation of those objects. Creating tables is the first step to build a database. It depends on your data and your need as to how many tables you ought to create. After you have created tables, you can create queries, forms, reports and other objects to get desired information from the database. You can create or modify an object of any type from the Database window.

To Create a Microsoft Access Object

1 Select the object type to create, from the database window.
2 Click the New button.

To modify the data

1 Select the object type to modify from the Database window.
2 Select the object name from the list, to modify
3 Click the Design button to display object window in design view

When you create a new table, query, form, or report, Microsoft Access displays a dialog box to ask, you want to build object yourself or use access wizard to build it. An access wizard is like a database expert who prompts you with questions about the object and then builds the objects based on your answers.

8.4.2 Set Toolbars to Your Working Style

Microsoft Access provides a wide variety of graphical tools you can use to create and modify objects in your database. When you start Microsoft Access, it displays tools for opening a database and creating a database only.

After you open a database, some new toolbars get added to the existing ones. The toolbars get or lose focus as and when you open any object (forms, tables, queries etc.) in Design, Open, or New view.

Initially, the toolbar appears at the top of the Microsoft Access window and tools are arranged in a single row. However you can pull the toolbar into vertical side of window, bottom of the window and middle of window and change its shape.

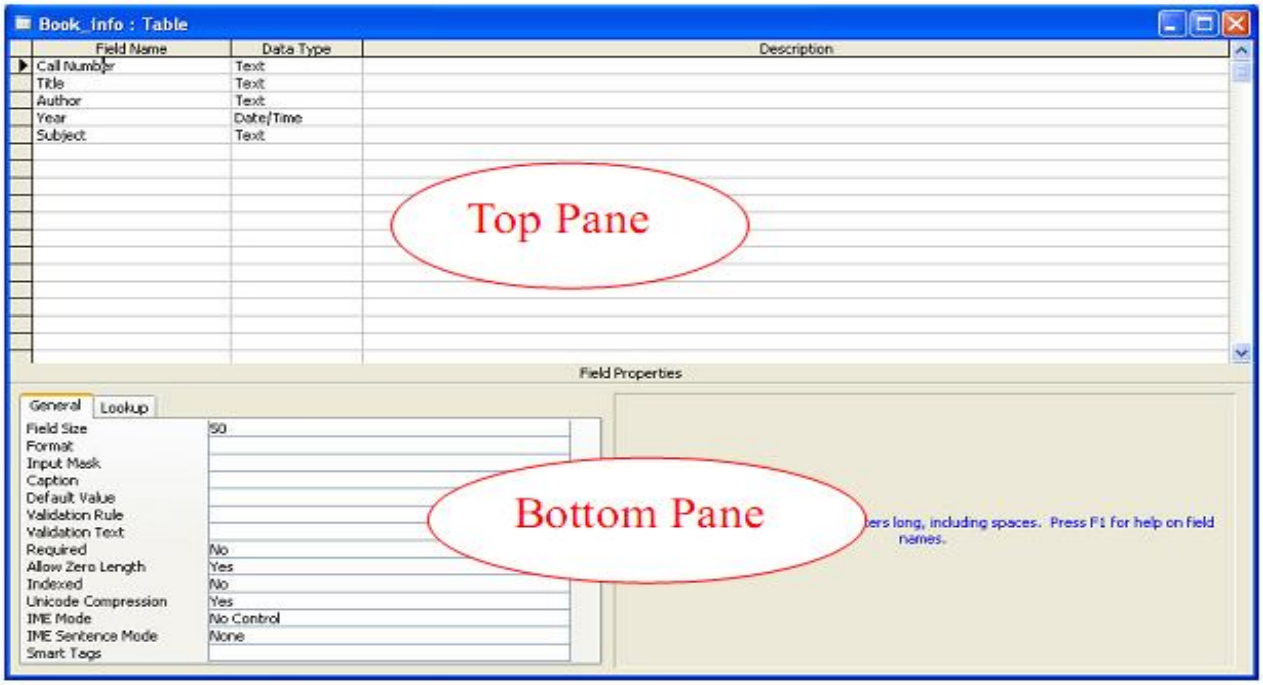
8.5 Creating Tables

This section describes how to create data tables, enter and edit data, sort records, and find records that meet certain conditions.

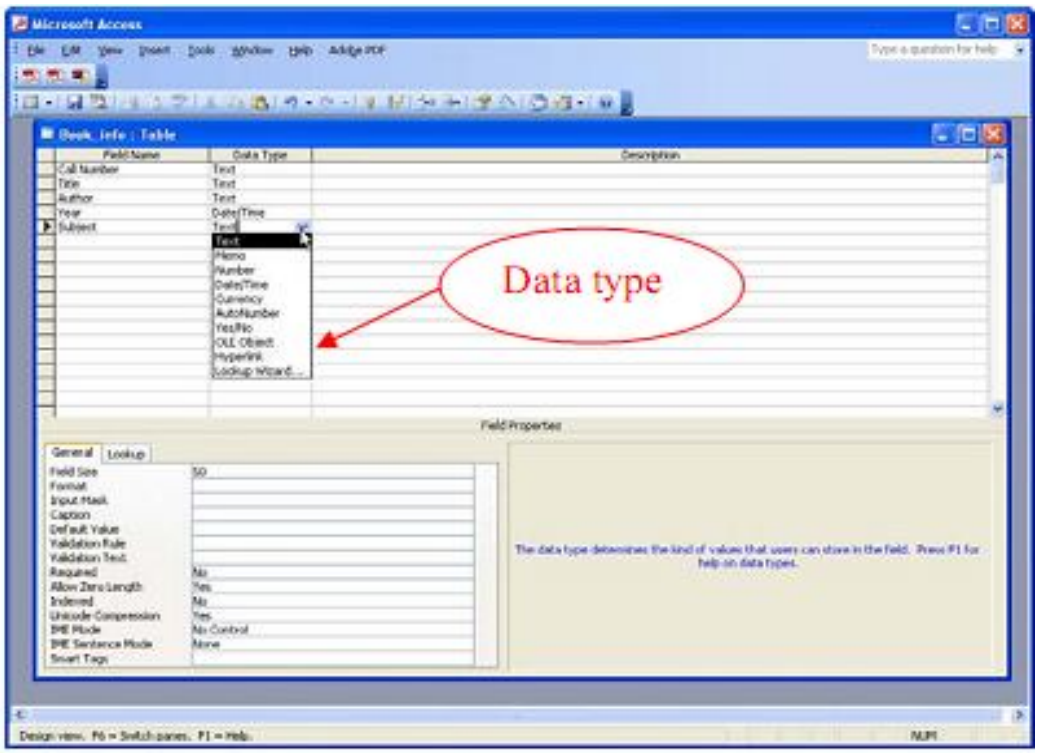
Creating Tables in Design View

1. By clicking the Table tab on the left hand side, you will find Access provides three ways to create a table for which there are icons in the Database window.
   - Create Table in Design view will allow you to create the fields of the table. It allows you to define the fields in the table before adding any data to the datasheet. This is the most common way of creating a table and is explained in detail below.
   - Create table by using wizard will step you through the creation of a table.
   - Create table by entering data will give you a blank datasheet with unlabelled columns that looks much like an Excel worksheet.

2. Double clicking on Create table in Design view displays the Table Design screen where you define fields for your table. The screen is divided into two parts: a top pane for entering the field name, data type, and an option description of the field and a bottom pane for specifying field properties.



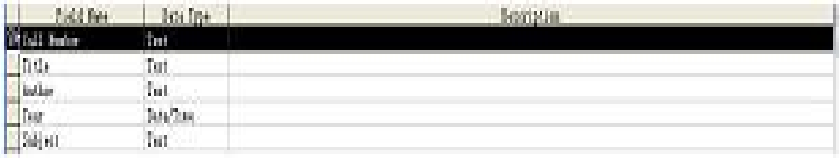
3. Every table consists of fields. For each field, specify the name of the field, the type of data, and any description needed to determine what data the field contains. Pressing the Tab key moves the cursor from one column to the next in the Table Design screen. You can select the data type from the drop-down list in the Data Type column as shown in figure.



4. Each table in your database should have a "primary key." A primary key is a field that uniquely identifies each record in the database. In a database of book collection, there might be two books with the same author so author is not a good primary key. However, every book has a unique "ISBN number", so "ISBN number" would be a good choice for a primary key. To set the primary key for your table, highlight the key field and choose Primary Key from the Edit menu.



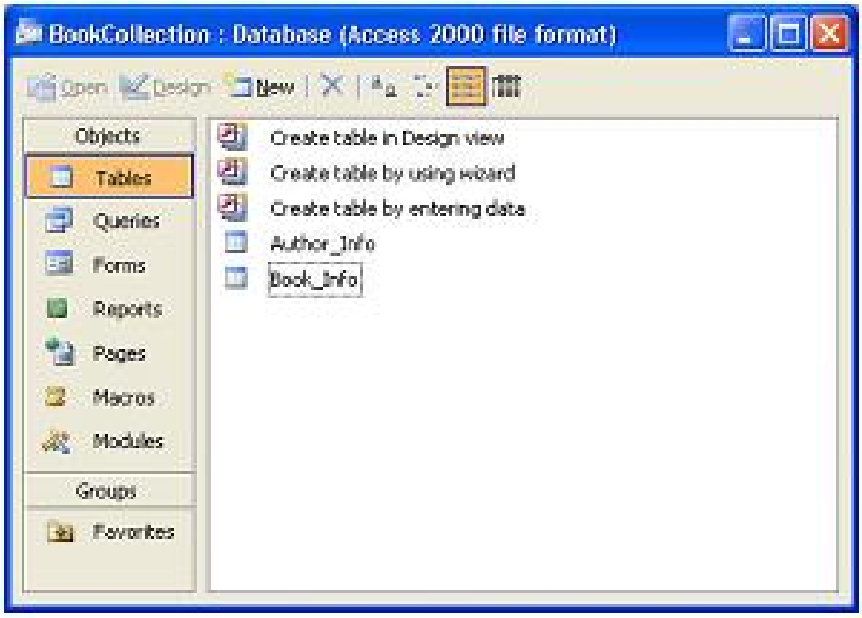
5. When the primary key is set, you should find a little key icon next to the field name on the left side. Note: To remove a primary key, simply repeat this procedure to toggle the primary key off.



6. As a final step, the table must be saved. Pull down the File Menu to choose Save. A dialogue box will pop up where the name of the new table should be specified. Access gives a default name such as "Table1" or "Table2." Simply type over this default name with the name of the table. For this example, name the table "Book Info", then click OK.



7. At this point, the new table has been created and saved. Switch back to the Access main screen by pulling down the File menu and choosing Close. This will close the Design View for the table and display the Access main screen. Notice that the new Book Info table appears below the Table tab.



8.5.1 Adding and Deleting Fields to Tables

Even the best planned database will sometimes require you to add or delete a field in the Design View. To add a new field, select the row you want to insert above and choose "Row" from the Insert menu. If you need to delete a field, select the row containing the field and choose "Delete Row" from the Edit menu.

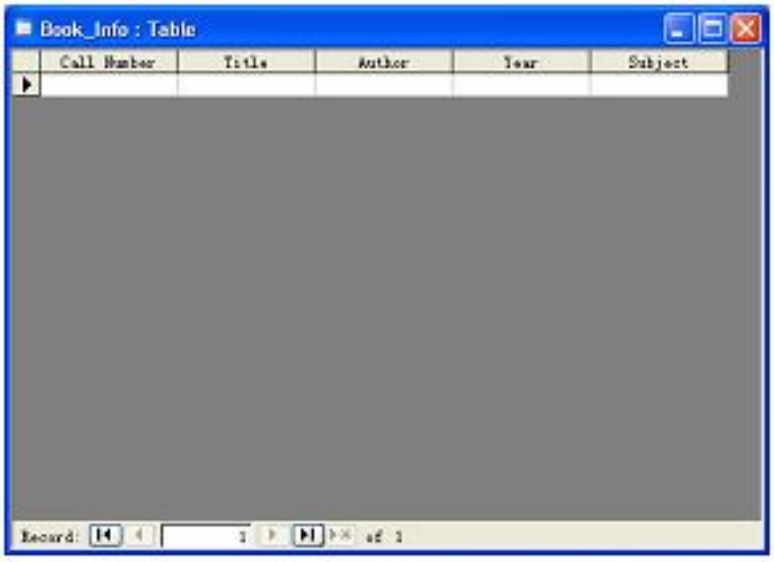
You can also move fields in the table design. Select the field you want to move by clicking on its row. A black triangle will appear to indicate the field is selected. Then, drag the field to the new location.

Cautions in Modifying your Table Design Structure

- Backup your table before you make any modifications to it.
- Deleting a field will delete the records in the field.
- If you delete a field and that field is used in any of your forms, queries or reports you must also delete that field from these other documents.
- Renaming a field will have the same effect on a table as deleting the field.
- Resizing a field (making it smaller) may truncate the data in your forms or reports.

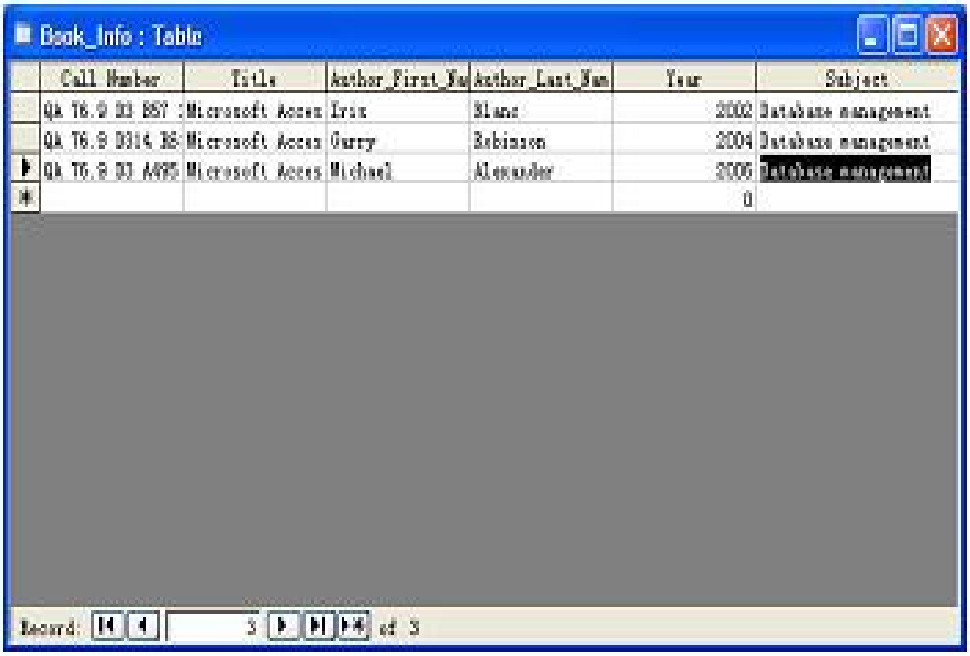
Entering and Editing Data

1. After you have defined fields in the table, you can enter data. Highlight the table, choose Open from the database window menu bar. This displays a grid with field names across the top and a row for each record of the database as shown in Figure.



2. To enter data, simply click the mouse in the field you want to enter and type a value. Press the Tab key to move from field to field. When you are in the last field of a record, pressing the Tab key automatically creates a new record for you.

3. The table in Figure 12 is shown in Datasheet View. Use the Datasheet View to add, delete, and move records.



4. To save the new data, pull down the File menu and choose Save.
5. To navigate to other records in the table, use the navigation bar at the bottom of the screen:



Sorting and Finding Records

Two of the most common database tasks are sorting records and searching for records that meet a particular condition. Fortunately, both of these operations are easy to perform while viewing the table datasheet.



Sorting Records

To sort records by a particular field, select the field you want to sort. From the Records menu select Quick Sort then choose either Ascending or Descending order. Access quickly sorts the records by the selected field.



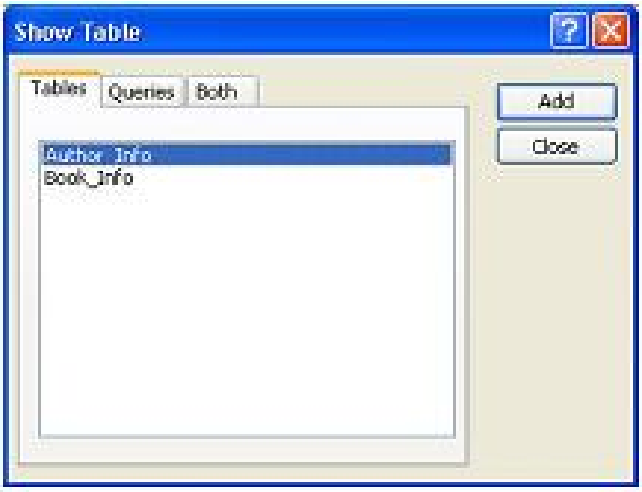
Finding Records

If you want to locate a record that contains a certain name or date use the Find command on the Edit menu. Type the search string in the Find What box and click Find First. Access will highlight the first record that contains the search string.

8.5.2 Table Relationships

To prevent the duplication of information in a database by repeating fields in more than one table, table relationships can be established to link fields of tables together. Follow the steps below to set up a relational database:

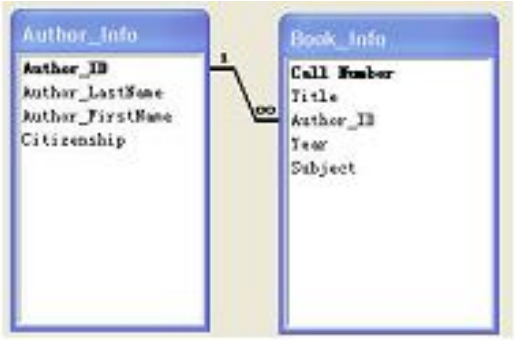
1. Click the Relationships button on the toolbar:
2. From the Show Table window (click the Show Table button on the toolbar to make it appear), double click on the names of the tables you would like to include in the relationships. When you have finished adding tables, click Close.



3. To link fields in two different tables, click and drag a field from one table to the corresponding field on the other table and release the mouse button. The Edit Relationships window will appear as shown in Figure. From this window, select different fields if necessary and select an option from Enforce Referential Integrity if necessary. These options give Access permission to automatically make changes to referential tables if key records in one of the tables are deleted. Check the Enforce Referential Integrity box to ensure that the relationships are valid and that the data is not accidentally deleted when data is added, edited, or deleted. Click Create to create the link.



4. A line now connects the two fields in the Relationships window as shown in the above figure. Note the symbols "1" (indicating the "One" side) and the infinity symbol (indicating the "Many" side) on the relationship. Close the relationships screen and select Yes to save the changes to the Relationships layout.



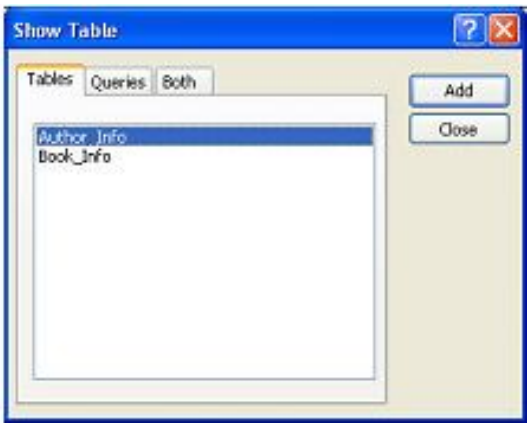
8.6 Creating Queries

A query is simply a question you ask a database. How many books are written by a certain author? Who wrote a book in a certain year? Queries select records from one or more tables in a database that match the criteria you set, they can be viewed, analyzed, and sorted on a common datasheet. The resulting collection of records, called a dynaset (short for dynamic subset), is saved as a database object and can therefore be easily used in the future. The query will be updated whenever the original tables are updated.

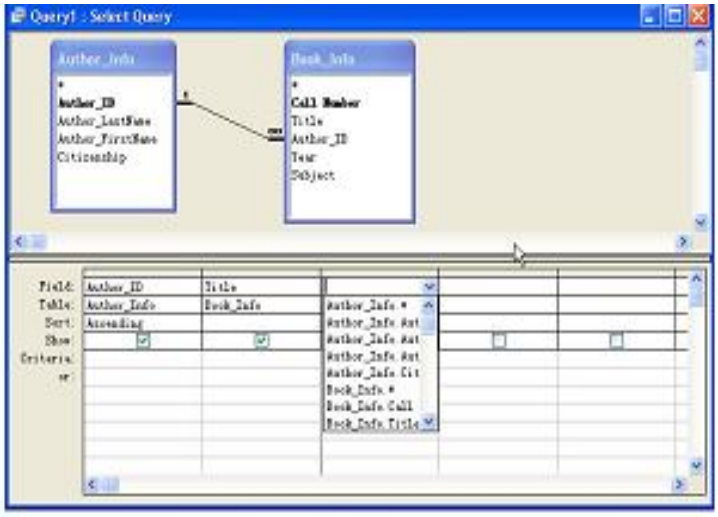
1. To construct a query, Click on the new button in the database window as shown in Figure below. Choose Design View, click OK.



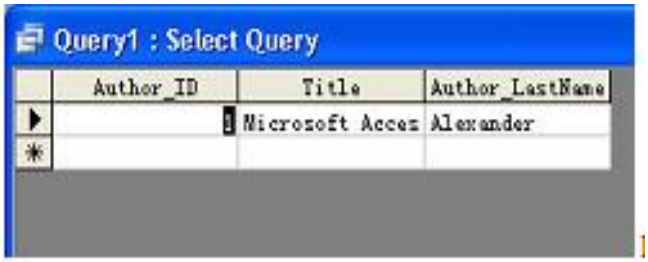
2. In the Show Table dialog box as shown in Figure below, you will be asked to choose a table or tables for the query. Select the tables you want to query and click "Add".



3. Add fields from the tables to the new query by double-clicking the field name in the table boxes or selecting the field from the Field and Table drop-down menus on the query form as shown in Figure below. Specify sort orders if necessary.



4. Enter the criteria for the query in the Criteria field. The Expression Builder can also be used to assist in writing the expressions in the Criteria field.
5. After you have selected all of the fields and tables, click the Run button on the toolbar to execute the query. Figure below shows the query result, records that match the criteria you set.



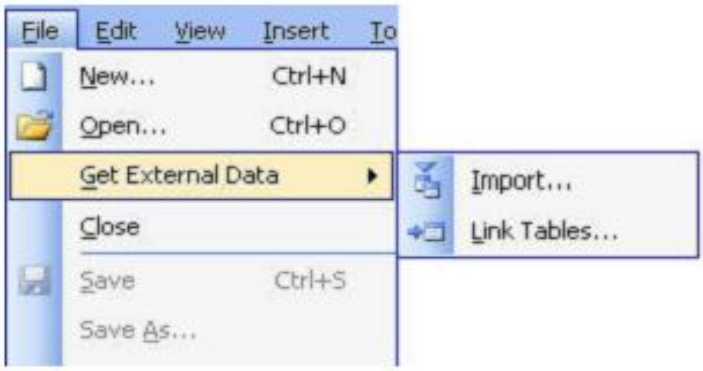
6. Choose Save from the File menu to save a query for later execution.

8.7 Importing Excel Data to Access

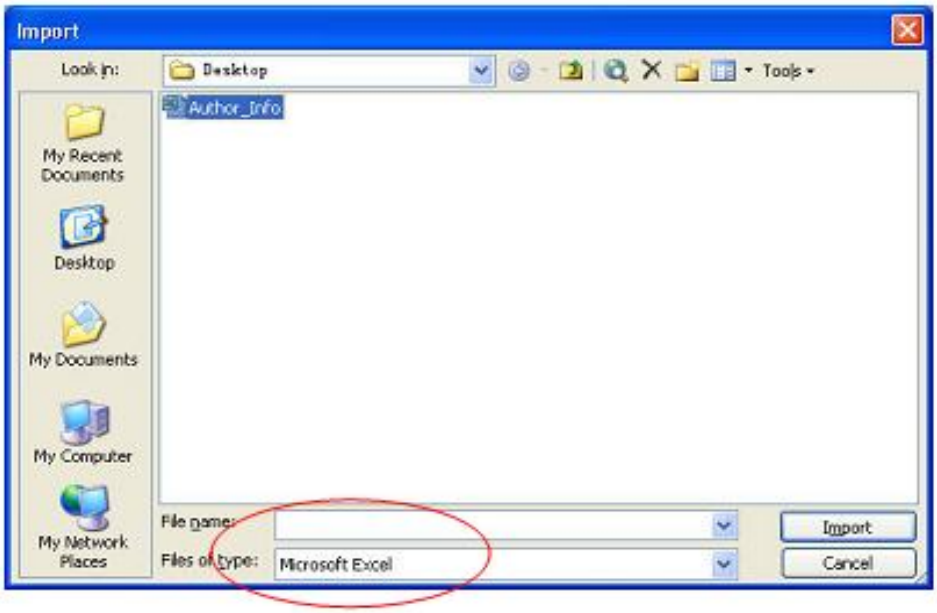
1. To format data in an Excel spreadsheet, you need to make sure the data is list format. This means that each column has a label in the first row and contains similar facts, and there are no blank rows or columns within the list. Then, close the Excel workbook that contains the data you want to use in Access

2. In Access, open the database (if you already have one) or create a new database where you want to copy the Excel data.

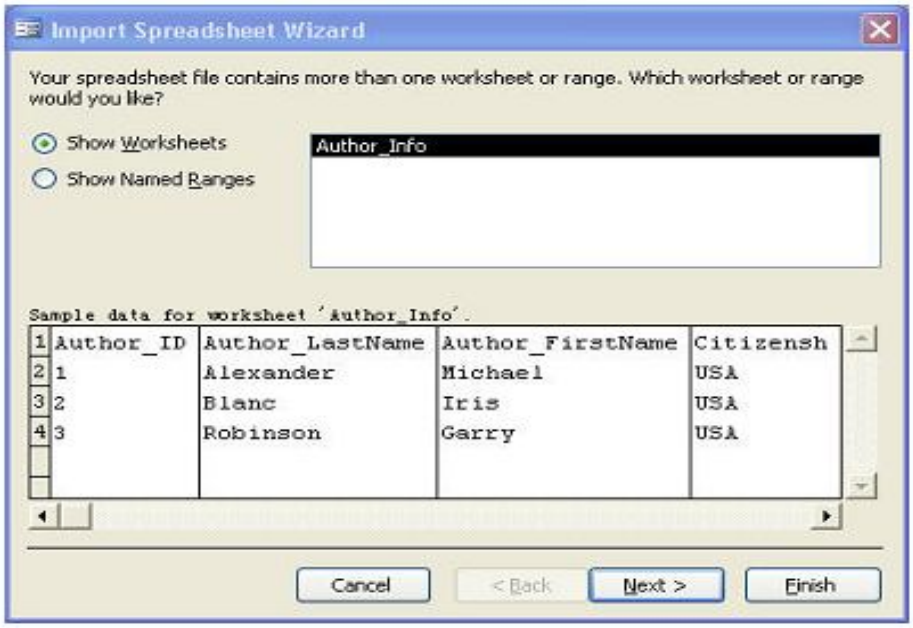
3. On the Access File menu, point to Get External Data, and then click Import.



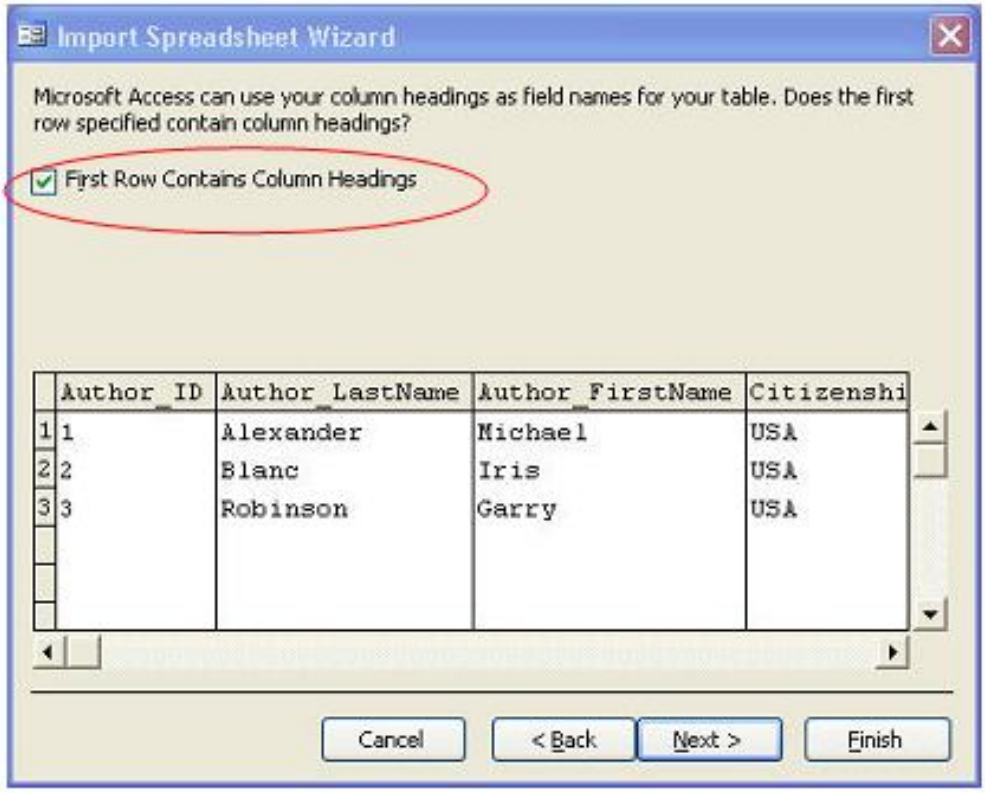
4. In the Import dialog box, click Microsoft Excel in the Files of type box. Then locate the file you want to import, and then double-click the file.



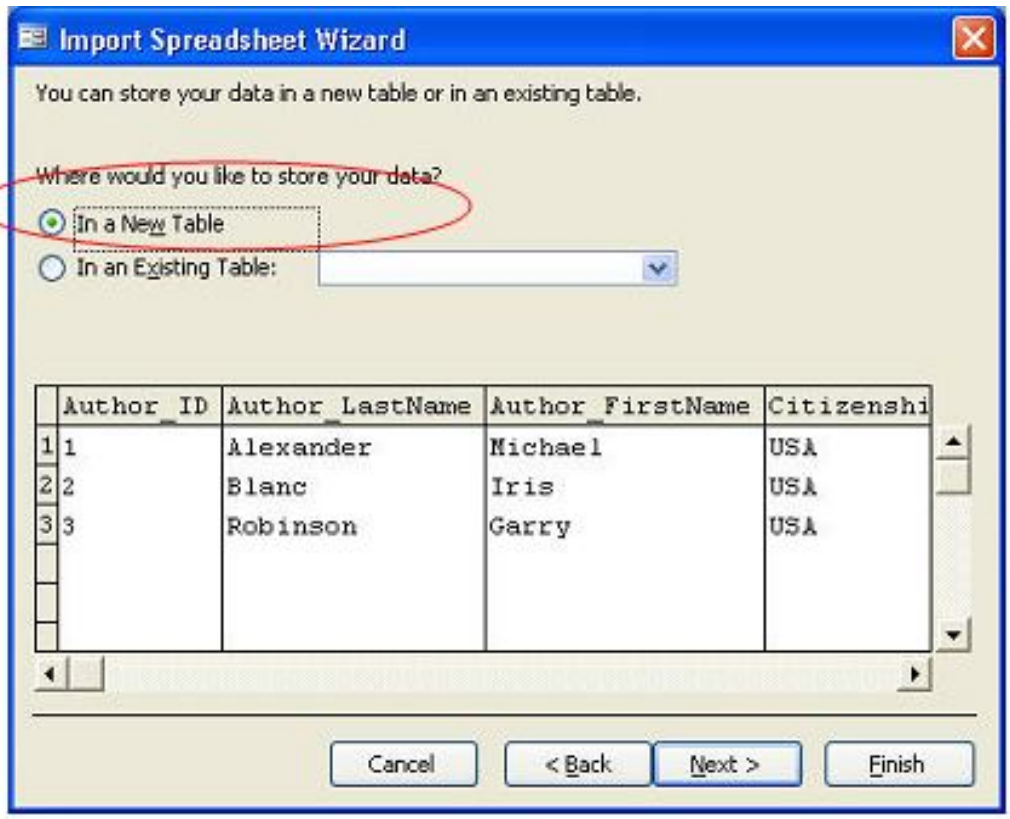
5. After you select the spreadsheet to import, you'll be presented with a new screen asking you to select the Worksheet or Named Range that you wish to import. In the example here, there is only one worksheet. Select the worksheet and click "Next".



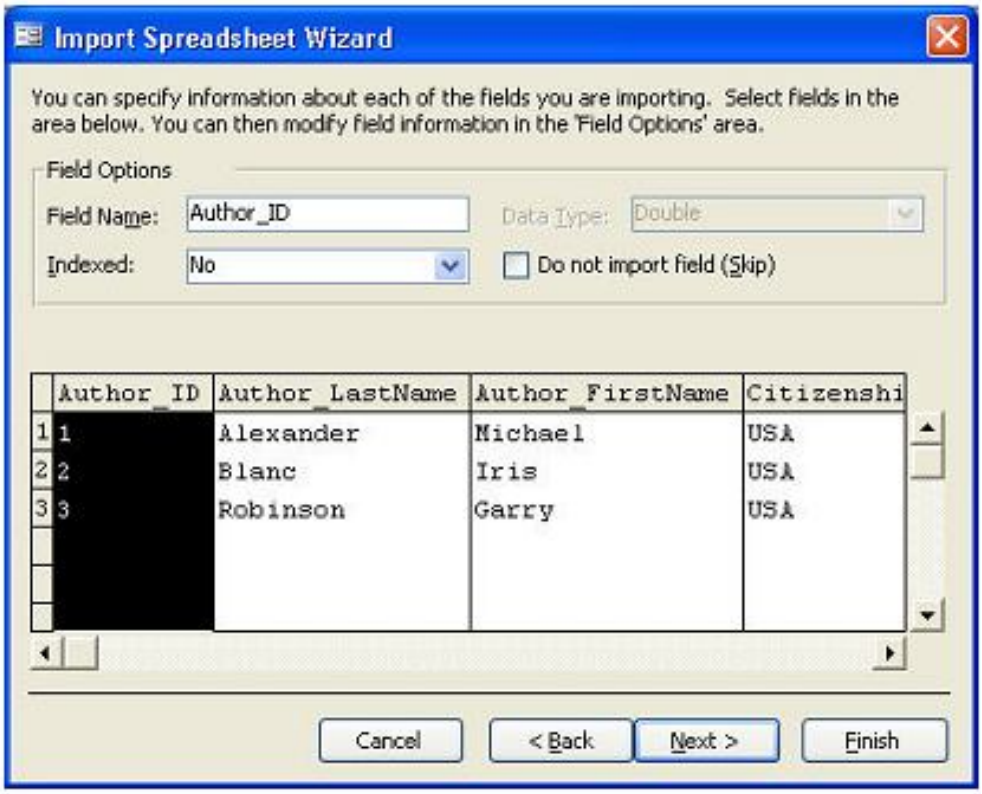
6. Specify whether column headings are present. Often, Excel users utilize the first row of their spread sheet to provide column names for their data. In our example file, we did this to identify Author_ID, etc. In the window shown below, ensure that the First Row Contains Column Headings box is checked. This will tell Access to treat the first row as names, rather than actual data to be stored in the list. Click the Next button to continue.



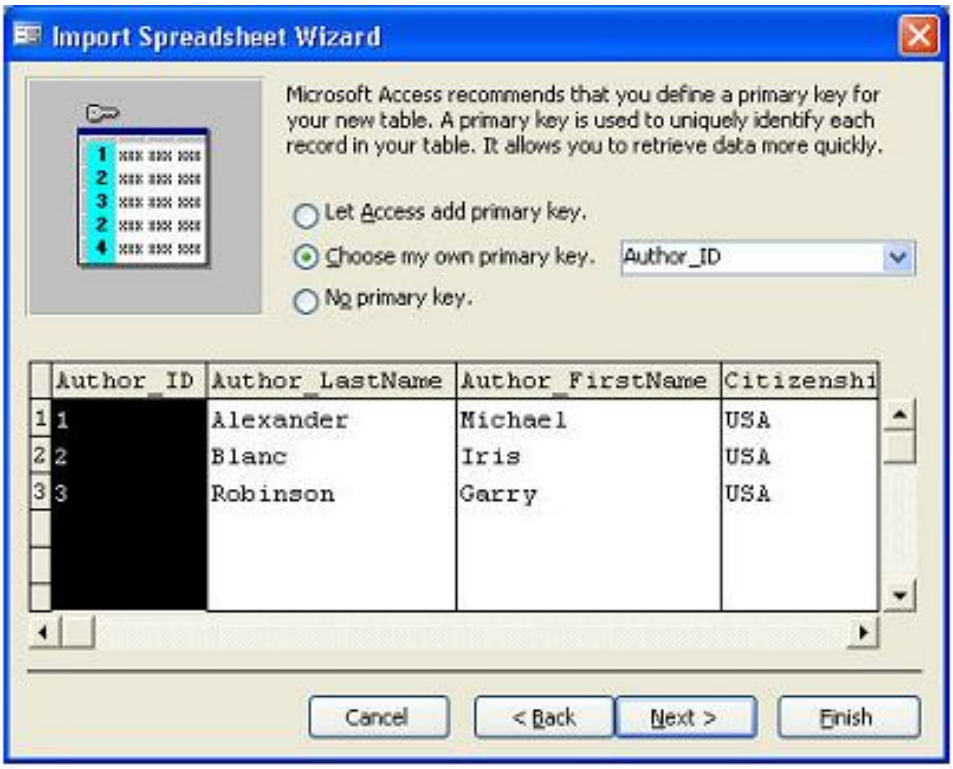
7. Choose a destination type. If you're working with a brand-new database, you'll want to check the in a "New Table" radio box. If you are importing data into an existing database, you could specify the destination table here. Click the Next button to continue.



8. Create any desired indices. Database indices are an internal mechanism that can be used to increase the speed at which Access can find information in your database. You can apply an index to one or more of your database columns at this step. Simply click the Indexed pull-down menu and select the appropriate option.



9. Select a primary key. You can either let Access generate a primary key for you, or you can define one of the fields in your worksheet as primary key.

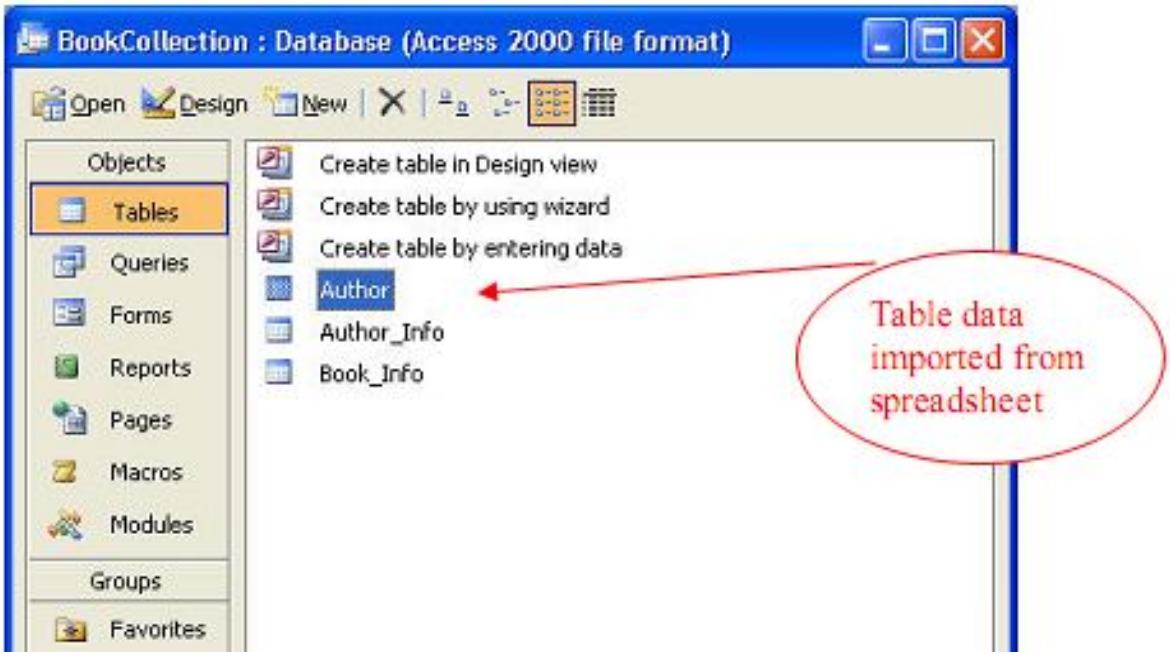


10. The last step is to name your table and click Finish. A dialogue box will appear to inform you that your spreadsheet has been imported successfully.





11. Return to the database window, you will find the new table a part of your database now.



8.8 Use Reports to Present Data

A Report is information you have organized and formatted to fit your specifications. A report gives you a way to retrieve and present data as meaningful information that you can use and distribute.

Examples of reports are mailing labels, Invoices and sales summaries. With Microsoft Access, you can design reports that present information the way you want. You can use many different design elements, such as text, data, pictures, lines, boxes and graphs to create the report.

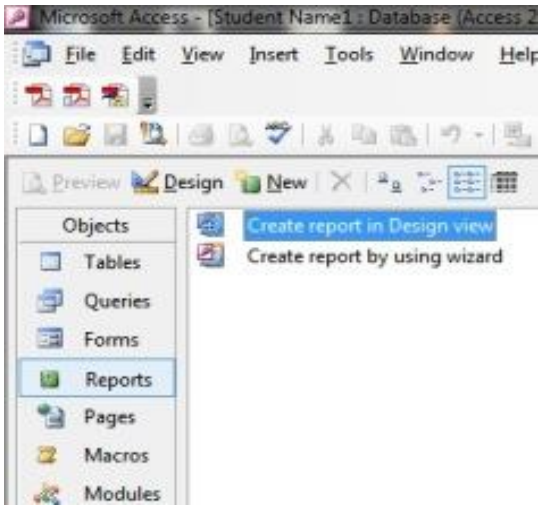
Reports are also an efficient way to print information that you use regularly. You can create a design for a report and then save it, so that you can use it over and over again. Once you save the report design, it stays the same, but you get current data each time you print the report. If your reporting needs change, you can adjust the report design or create a similar report based on the original report.

You can create reports that:

- Organize and present data in groups.
- Calculate running totals, group totals, grand totals and percentages of totals.
- Include sub reports and graphs.
- Present your data in an attractive format with pictures, lines and special fonts.

8.8.1 Create Report

1. Click the Report button in the Database window.



2. Click the New button to displays the New Report dialog box as shown above
3. Select the tables and queries from the list.
4. Click the Report wizard's button to displays the first report wizard dialog box

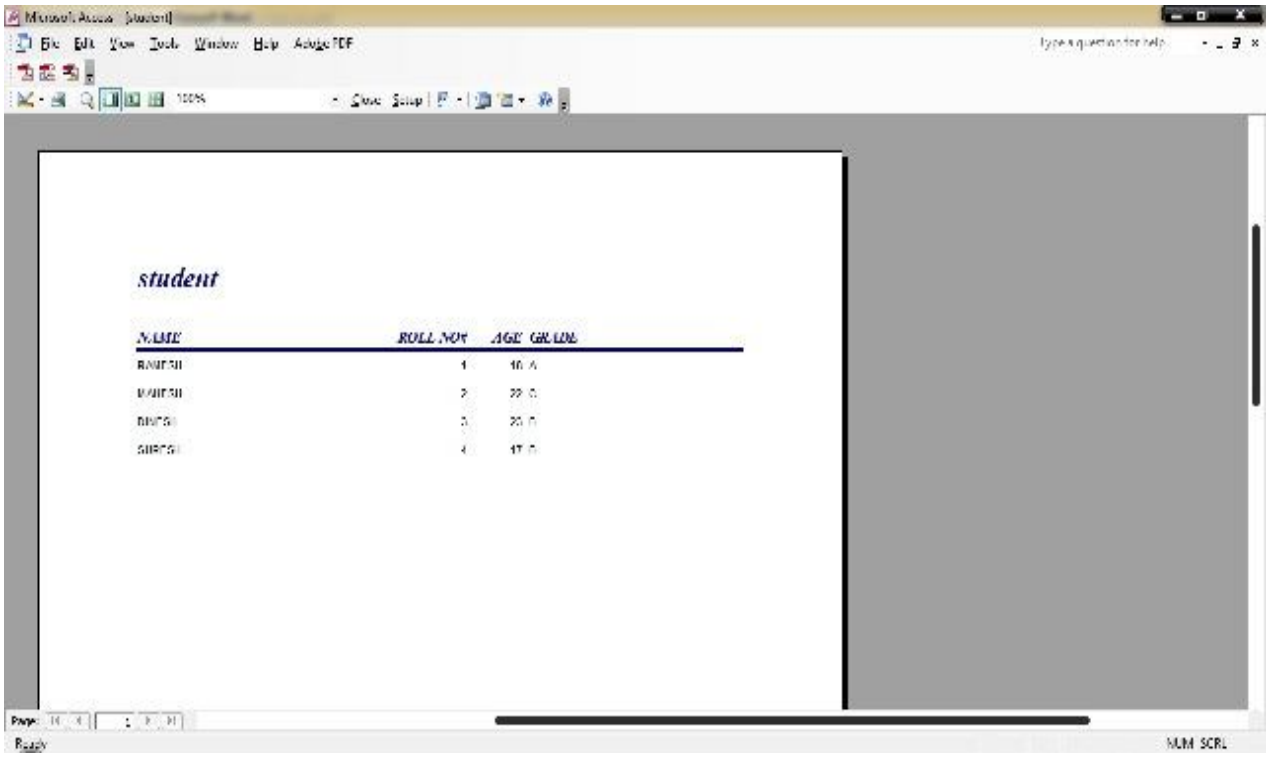


5. Make these choices as you go through the dialog boxes

- Select the Groups/Totals wizard.
- Add all the fields from the query to the report.
- Group records by the Item-code field.
- Sort records on the Trans-Type field.
- Select the Executive style for your report.
- Give the title to your report.
- Click the Finish button to create and opens the report in Print Preview.

8.8.2 Final Screen

The final screen will be as shown below.



8.9 Preview, Print and Save Report

After the Report wizard creates your report, Microsoft Access displays your report as it would appear in print.

Preview Report

To see a whole page in report

1. Position the pointer over the report in Print preview. The pointer becomes a magnifying glass.
2. Click the report to displays a view of the whole page.
3. Click the report again to zoom back and view data.

To scroll in one page and through pages

- Click the horizontal and vertical scroll bars to scroll in a page.
- Click the page buttons to scroll in other pages.

Print the Report

To print a report

1. Select Print from the File menu.
2. It will show the Print Dialog Box
3. Select OK to print.

Save the Report

To save a report

1. Select save from the File menu to displays Save As dialog box.
2. Type the name in the Report Name box.
3. Click Ok to saves the report.

8.10 Summary

MS Access is a Database program from Microsoft incorporation. A user can open an existing database by selecting Open from the File menu to display a dialog box, and select the database file name. The file extension .mdb designates the file as an Access database. The database window provides access to any tables, queries, forms or other objects that you create. To create a new database, select New from the File menu to display a dialog box, which asks you for the name of the new database and where you want the file to be stored. To create a table, click on new button and then click on new table to display table in Design view, where you enter field name, field data types and set field properties. A new query can be created by clicking on the Query button in the database window. A report provides a way to retrieve and present data as meaningful information that you can use and distribute. User can also print the report in the desired format.

8.11 Self Assessment Questions

1. What is MS Access? How it is different from other database Software?
2. How a user can create New Database in MS Access?
3. What is a Query? How a query can be generated by the user?
4. How reports are generated in MS Access.
5. Can we use excel file in Access, if yes then how?

8.12 Reference Books

- Saxena, S. (2009). *Microsoft Office Xp for Everyone* . New Delhi: Vikas Publication.
- Peter, R., Elie S. (2010). *Databases Design, Development, & Deployment using Microsoft Access*, New Delhi: Tata McGraw Hill Publication.
- Mclaren,(2010). *Understanding and Using Microsoft Access:* West Publishing Co.
- IGNOU study material for MS Access

Online Reference Material:

- http://www.katsueydesignworks.com/tutorials_databases.html
- http://www.fgcu.edu/support/office2000/access/.html
- http://cisnet.baruch.cuny.edu/holowczak/classes/2200/access/accessall.html

Unit - 9 : Computer Networks

Structure of Unit:

9.0 Objectives
9.1 Introduction
9.2 Computer Network
9.3 Protocol Architecture
9.4 Types of Network
9.5 Network Topology
9.6 The OSI Reference Model
9.7 The TCP/IP Reference Model
9.8 Summary
9.9 Self Assessment Questions
9.10 Reference Books

9.0 Objective

After completing this unit you, should be able to understand:

- Technology and protocol architecture of the computer network.
- Architecture of the TCP/IP protocol suite.
- Seven layer Open System Interconnection (ISO) model.
- Local, metropolitan and wide area networks.

9.1 Introduction

This unit provides a context for the detailed material of computer networks, their components, protocol architecture and types of networks. We begin this unit by introducing the concept of computer network and their needs with simple diagrams. Next, the chapter introduces the Open Systems Interconnection (OSI) reference model. OSI is a standardized architecture that is often used to describe communication functions but that is now rarely implemented. We then examine the most important protocol architecture, the TCP/IP protocol suite. TCP/IP is an Internet–based concept and is the framework for developing a complete range of computer communication standards.

Computer networks fall into two main types: *client/server* networks and *peer-to-peer* networks. A client/server network uses one or more dedicated machines (the server) to share the files, printers, and applications. A peer-to-peer network allows any user to share files with any other user and doesn't require a central, dedicated server. The most common networks are *Local Area Networks* or *LANs* for short. A LAN connects computers within a single geographical location, such as one office building, office suite, or home. Whereas, *Wide Area Networks* (WANs) span different cities or even countries, using phone lines or satellite links or any other transmission media. Networks are often categorized in other ways, too. We can refer to a network by what sort of circuit boards the computers use to link to each other – *Ethernet* and *Token-Ring* are the most popular choices. You can also refer to a network by how it packages data for transmission across the cable, with terms such as *TCP/IP* (Transmission Control Protocol/Internet Protocol)

9.2 Computer Network

The early computer networks were not commonly computer-to-computer networks such as we see today. Usually, a big organization such as a bank or a government department would have a mainframe computer with a network of terminal equipment. Operators would sit at these terminals and input data while the mainframe computer would process the data and output results to other terminals or printers. A "terminal", in those days, was practically related to a keyboard/screen pair (the familiar old green-on-black display units) and office buildings were interlinked with huge bundles of cables connecting all these peripheral devices to the computer room. In order to take the communications load away from the mainframe, smaller computers were introduced to control and priorities the data traffic. There was a very formal network "protocol" (set of rules) applied to control this traffic flow: in the IBM world this was called Systems Network Architecture (SNA). It was very successful and dominated computer networks for many years (and still operates in places where mainframes are alive and prospering).

Finally, the production of mini-computers and PC's spread to the world of big business and government. The model of the mainframe computer in the centre of the network is replaced by another model: that of small computers with local processing power, connected to others doing similar work. This was a distributed processing model and it soon extended to the desktop where each "terminal" was now a PC and could perform its own tasks. The new model needed new network architecture so, an alternative was just about ready to take centre stage: the **Local Area Network**, or **LAN**.

The term "computer network" is used to mean an interconnected collection of autonomous computers. Two computers are said to be interconnected if they are able to exchange information. The connection needs not to be via a copper wire; fiber optics, microwaves and communication satellite can also be used. By requiring the computers to be autonomous, we wish to exclude from our definition system in which there is a clear master/slave relation. The fundamental purpose of a computer network is the exchange of data and information between two parties (devices).

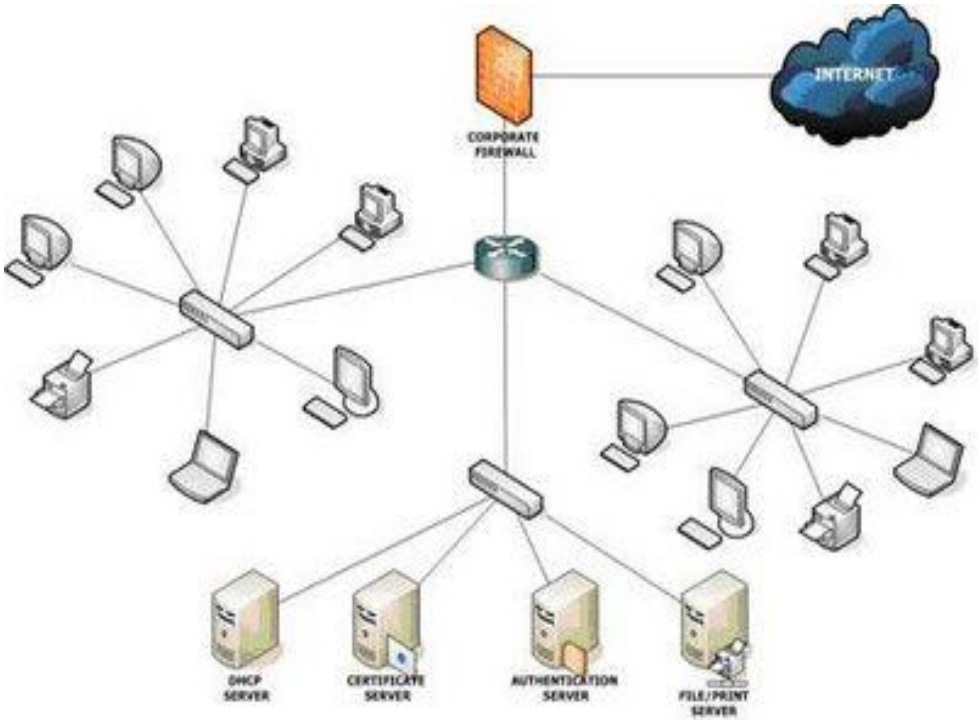


Figure 9.1 : Simple Network

The above diagram shows a LAN inside an organization - a small office LAN, for example - connected to the outside world of the public internet. Between private and public are the two gateway devices: the protective firewall and the ADSL (Asymmetric Digital Subscribe Line) router. The outward facing (ADSL) interface of the router will have a public IP address and the inward facing (Ethernet) interface of the firewall will have a private LAN address. ADSL is the Link layer protocol that runs on the telephone wires from your home. It connects you to the big routers and servers maintained by your Internet Service Provider (ISP).

Network Devices:

Computer network devices also known as communication devices and they comprise a data communication network. These devices are routers, switches, hubs, LAN cards, gateway, modems, hardware firewall, CSU/DSU, ISDN terminals and transceivers. In an Ethernet or WAN network, the data communication cannot be performed without these devices. Being an IT/Business professional or a network administrator, you must have the good understanding of these devices.

Based on your business requirements, you have to select the best devices for your network and before selection, make sure that they are compatible with each other. It is recommended that you select all the devices for your IT infrastructure from the same vendor. The some vendors are Cisco, D-Link, LinkSys, Baynet, RealTek, NetGear, Intel, Nortel, and Lucent etc.

1. LAN Cards

LAN cards or network adapters are the building blocks of a computer network. No computer can communicate without a properly installed and configured LAN card. Every LAN card is provided with a unique IP address, subnet mask, gateway and DNS (if applicable). An UTP/STP cable connects a computer with the hub or switch. Both ends of the cable have the RJ-45 connectors one is inserted into the LAN card and one in the hub/switch. LAN cards are inserted into the expansion slots inside the computer. Different LAN cards support different speed from 10/100 to 10/1000.



Figure 9.2 :LAN Cards

2. Hubs

The central connecting device in a computer network is known as a hub. There are two types of a hub i.e. active hub and passive hub. Every computer is directly connected with the hub. When data packets arrives at hub, it broadcast them to all the LAN cards in a network and the destined recipient picks them and all other computers discard the data packets. Hub has five, eight, sixteen, thirty two and more ports and one port is known as uplink port, which is used to connect with the next hub.

3. Switches

A switch is an intelligent device that maps the IP address with the MAC address of the LAN card. Unlike the hubs, a switch does not broadcast the data to all the computers, it sends the data packets only to the destined computer. These are used in the LAN, MAN and WAN. In an Ethernet network, computers are directly connected with the switch via twisted pair cables. In a network, switches use the three methods to transmit the data i.e. store and forward, cut through and fragment free.

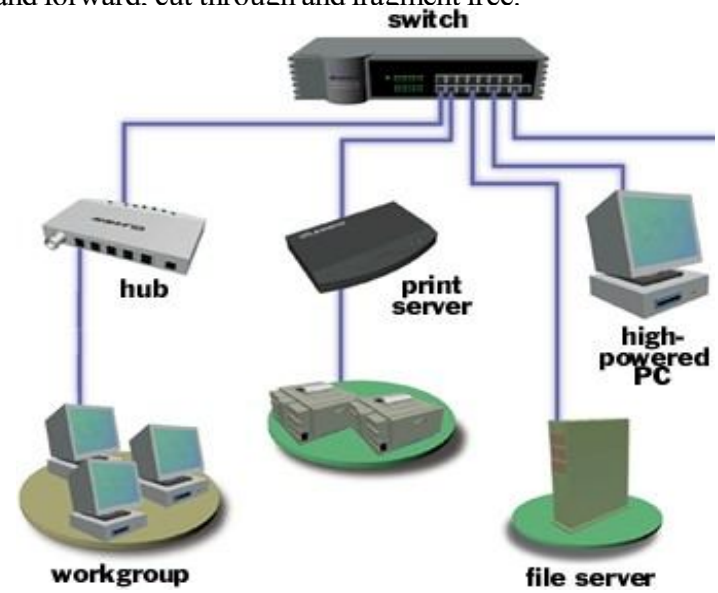


Figure 9.3 : Switch

4. Routers

A router is a communication device that is used to connect two logically and physically different networks, two LANs, two WANs and a LAN with WAN. The main function of the router is to sorting and the distribution of the data packets to their destinations based on their IP addresses. Routers provides the connectivity between the enterprise businesses, ISPs and in the internet infrastructure, router is a main device. Cisco routers are widely used in the world. Every router has routing software, which is known as IOS. Router operates at the network layer of the OSI model. Router does not broadcast the data packets.

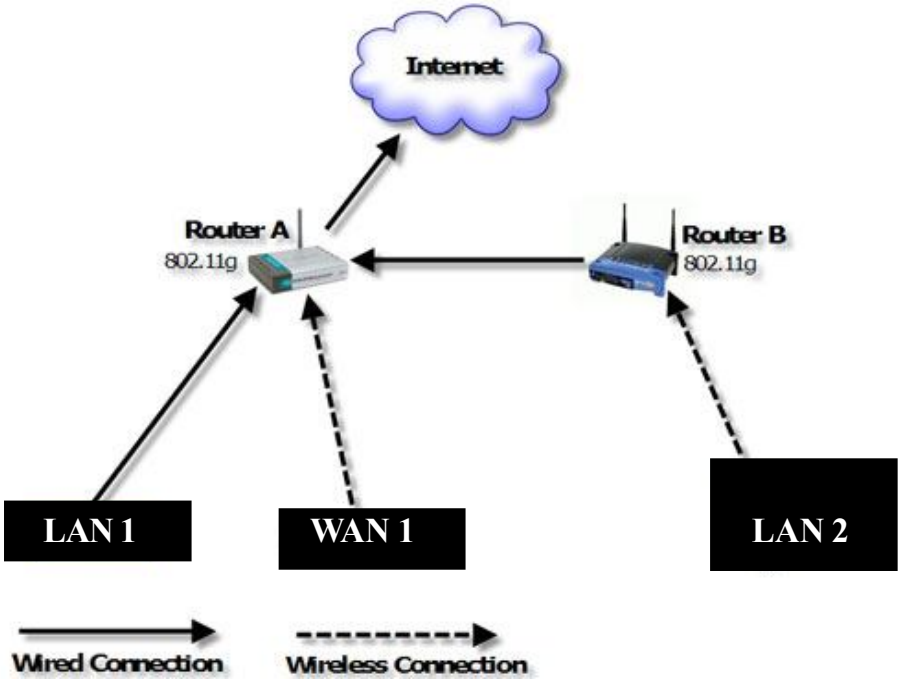


Figure 9.4 : Router

5. Modems

A modem is a communication device that is used to provide the connectivity with the internet. Modem works in two ways i.e. modulation and demodulation. It converts the digital data into the analog and analog to digital.

Modem comes in two shapes: Internal Modem (which is a card, installed in a slot, inside the computer), and External Modem (which is a hardware device, found outside the case of computer).

a. Internal modems

Internal modems are in the form of circuit boards, fitted in expansion slots of the motherboard. An internal modem is a device installed inside desktop or laptop computer, allowing the computer to communicate over a network with other connected computers. There are two types of internal modems: dial-up and Wife (wireless). Dial-up operates over a telephone line and requires a network access phone number and logon ID to make a connection. WIFI connect wirelessly and without identification in certain cases.

b. External modems

External modems are enclosed in separate cases and not inside the system units. The modem is connected to the computer and telephone line by means of two separate cables, as shown in figure.

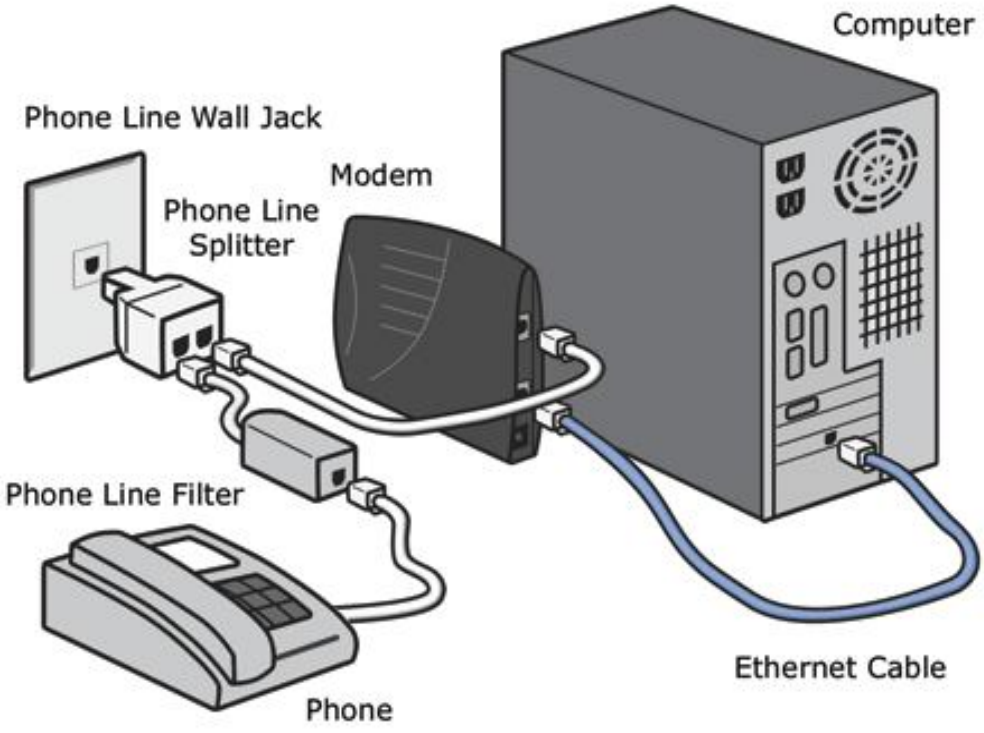


Figure 9.5 : Modem

Why We Need Computer Network:

Computer networks help users on the network to share the resources and in communication. some of the popular application emails, online news papers, blogs, chat and the other services offered by the internet?

The following are the important benefits of a computer network.

File sharing: Networking of computers helps the users to share data files. User can sharing any information via networks.

Hardware sharing: Users can share devices such as printers, scanners, CD-ROM drives, hard drives etc.

Application sharing: Applications can be shared over the network, and this allows implementing client/server applications

User communication: Networks allow users to communicate/ exchange using e-mail, newsgroups, and video conferencing etc.

Network gaming: Lot of games are available, which are supports multi-users.

Benefits of an office network: An office network enables a host of other benefits: Storing data on one central networked server frees up local storage space on individual computers. It also makes backups of your company data easier and simpler as long as everyone is storing their data to the storage server, you have one back up machine. A network also makes printing much less complicated because you don't have to purchase extra printers and connect one to each computer. Just connect your printer to the network, and all machines will be able to print to it.

9.3 Protocol Architecture

In a computer network, there must be a connection between the two computers, terminals and/or other data processing devices to exchange data, information or files. For communication or exchanging data items, the typical tasks to be performed include the following:

(a) The source system must either activate the direct data communication path or inform the communication network of the identity of the desired destination system.

(b) The source system must ascertain that the destination system is prepared to receive data.

(c) The file transfer application on the source system must ascertain that the file management program on the destination system is prepared to accept and store the file for this particular user.

(d) If the file formats used on the two systems are incompatible, one or the other system must perform a format translation function.

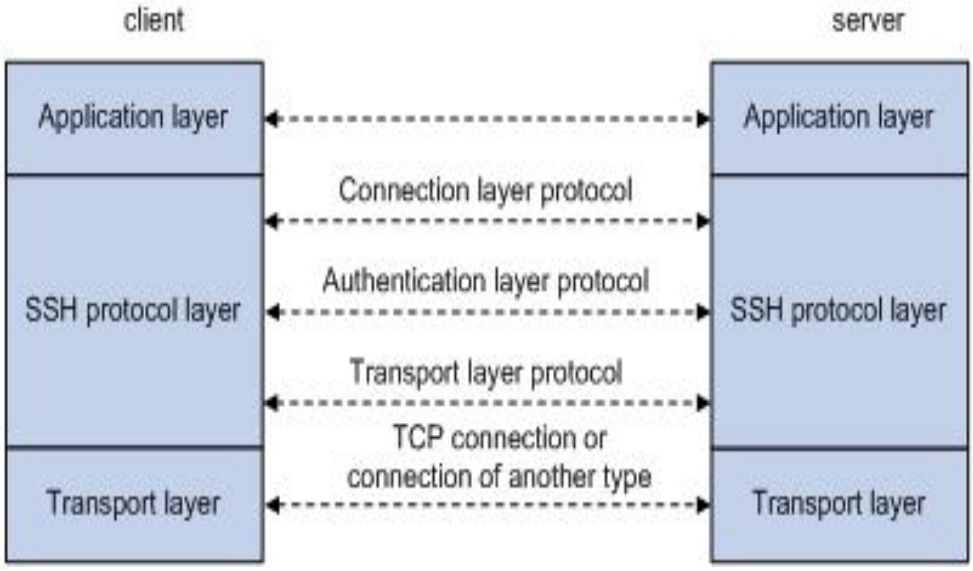


Figure 9.6 : Client- Server Communication Structure

It is clear that there must be a high degree of cooperation between the two computer systems. It takes two to communicate, so the same set of layered functions must exist in two systems. The communication is achieved by having the corresponding or peer, layers in two systems communicate. The peer layers communicate by means of formatted block of data that obey a set of rules or conventions known as a **protocol**.

The key features of protocol are as follows:

- Syntax: Concerns the format of the data blocks.
- Semantics: Includes control information for coordination and error handling.
- Timing: Includes speed matching and sequencing.

Having introduced the concept of a protocol, we can now introduce the concept of protocol architecture. Two protocol architectures have served as the basis for the development of interoperable protocol standards:- the TCP/IP protocol suite and the OSI reference model. TCP/IP is by far the most widely used interoperable architecture. The International Standards Organization (ISO) has defined a standard called the OSI (Open Systems Interconnection) reference model. This is seven layer architecture.

9.4 Types of Network

One way to categorize the different types of computer network designs is by their scope or scale. For historical reasons, the networking industry refers to nearly every type of design as some kind of *area network*. Common examples of area network types are:

(i) Local Area Network (LAN)
(ii) Wide Area Network (WAN)
(iii) Metropolitan Area Network (MAN)

1. Local Area Network (LAN):

LAN is mostly privately owned and links the devices in a single office building or campus. It can be as simple as two PCs and a printer in a person's home office but also can be extended throughout a company that includes audio and video peripherals. LAN is limited to a few kilometers. Most of the time, one of the PCs will be allocated with a large capacity disk drive that acts as the server to the client. This allows software can be shared by the whole group when the software installed in this central server. The size of the LAN may be determined by licensing restrictions on the number of users per copy of software or restrictions on the number of users licensed to access the OS. LAN can be distinguished from other types of networks by their transmission media and topology and usually use one type of transmission medium. The most common topologies are bus, ring and star.

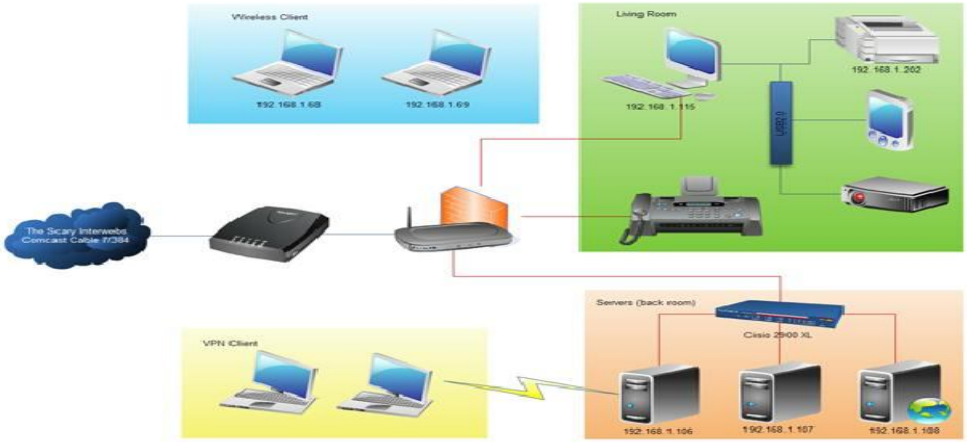


Figure 9.7 : Local Area Network

Advantages

- Each application needs only be installed once and installed applications on the file server can be shared to all workstations.
- Peripheral devices can be networked and shared by any workstation which minimizes the number of peripheral devices required.
- Software management is easier on a LAN.
- Network security can be established by restricting the network users to have access to certain files and applications.
- Centralized backups which allow the data backup done over a network can be centrally managed and scheduled.

Disadvantages

- Some sites will cause the cabling work difficult to be done and also costly especially if large distances are involved.
- Require additional maintenance or additional system administrator as the system grows.
- Area of coverage is limited. If the central server experiences failure, other networked users may not be able to run the application programs.
- Network failure can causes data loss to the networked user.

2. Wide Area Network (WAN):

A WAN is a geographically-dispersed collection of LANs. A network device called a router connects LANs to a WAN. In IP networking, the router maintains both a LAN address and a WAN address.

A wide area network (WAN) provides long-distance transmission of data, image, audio, and video information over large geographic areas that may comprise a country, a continent, or even the whole world. An example of simple WAN is a dial-up line that connects a home computer to the Internet is refer as point-to-point WAN, whereas a complex WAN such as the backbones that connect the Internet is refer as switched WAN.

The differences between switched WAN and point-to-point WAN is switched WAN connects to the end systems that usually involves of a router that connects to another LAN or WAN whereas point-to-point WAN is just a line leased from a telephone or cable TV provider that connects a home PC or a small LAN to an ISP.

Example of a switched WAN is X.25 which is being gradually replaced by a high-speed and more efficient network called Frame Relay. Another example of a switched WAN is the asynchronous transfer mode (ATM) network (network with fixed-size data unit packets called cells).

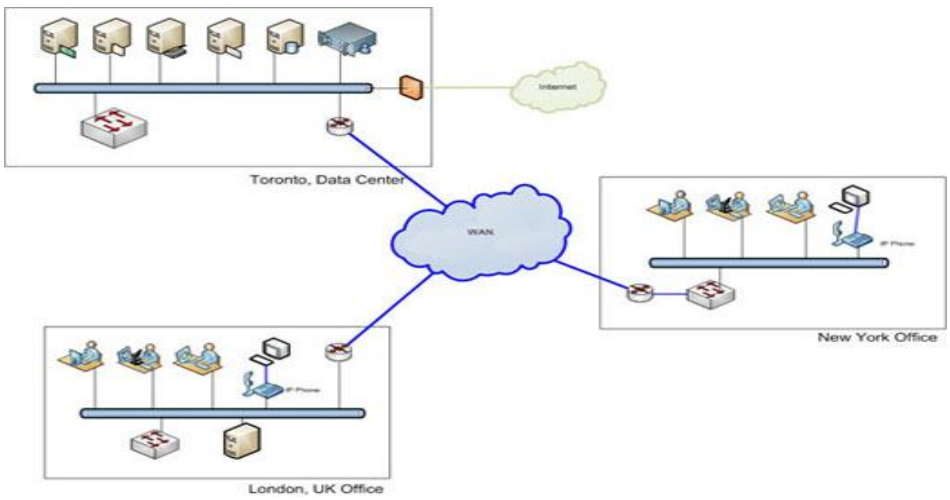


Figure 9.8 : Wide Area Network

Advantages

- Large geographical area coverage.

Disadvantages

- Expensive.
- Complicated setup.
- helpless to hackers.

3. Metropolitan Area Network (MAN):

MAN is a network size between a LAN and a WAN which usually covers the area inside a town or a city. A MAN is typically owned and operated by a single entity such as a government body or large corporation. This network designed for those that need high-speed connectivity, normally to the Internet, and have endpoints spread over a city or part of city. Common examples for MAN is cable TV network that originally was designed for cable TV but now also can be used for high-speed data connection to the Internet. Another example will be the telephone company network that can provide a high-speed DSL line to the customer.

9.5 Network Topology

The physical structure of a network refers to the configuration of cables, computers, and other peripherals called topology. Physical topology should not be confused with logical topology which is the method used to pass information between workstations.

In networking, the term "topology" refers to the layout of connected devices on a network. This article introduces the standard topologies of computer networking.

One can think of a topology as a network's virtual shape or structure. This shape does not necessarily correspond to the actual physical layout of the devices on the network. For example, the computers on a home LAN may be arranged in a circle in a family room, but it would be highly unlikely to find an actual ring topology there.

Network topologies are categorized into the following basic types:

- Star Topology
- Ring Topology
- Bus Topology
- Tree Topology
- Mesh Topology
- Hybrid Topology

1. Star Topology:

Many home networks use the star topology. A star network features a central connection point called a "hub" that may be a hub, switch or router. Devices typically connect to the hub with Unshielded Twisted Pair (UTP) Ethernet. Compared to the bus topology, a star network generally requires more cable, but a failure in any star network cable will only take down one computer's network access and not the entire LAN. (If the hub fails, however, the entire network also fails.) The protocols used with star configurations are usually Ethernet or Local Talk.

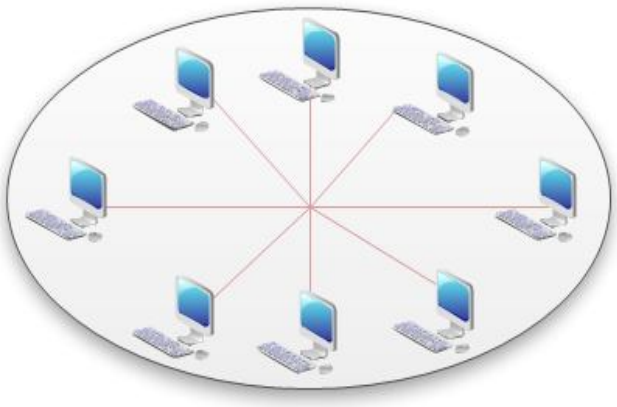


Figure 9.9 : Star Network Topology

Advantages of a Star Topology

- Easy to install and wire.
- No disruptions to the network then connecting or removing devices.
- Easy to detect faults and to remove parts.

Disadvantages of a Star Topology

- Requires more cable length than a linear topology.
- If the hub or concentrator fails, nodes attached are disabled.
- More expensive than linear bus topologies because of the cost of the concentrators.

2. Ring Topology:

In a ring network, every device has exactly two neighbors for communication purposes. All messages travel through a ring in the same direction (either "clockwise" or "counter clock wise"). A failure in any cable or device breaks the loop and can take down the entire network. To implement a ring network, one typically uses FDDI, SONET, or Token Ring technology. Ring topologies are found in some office buildings or school campuses.

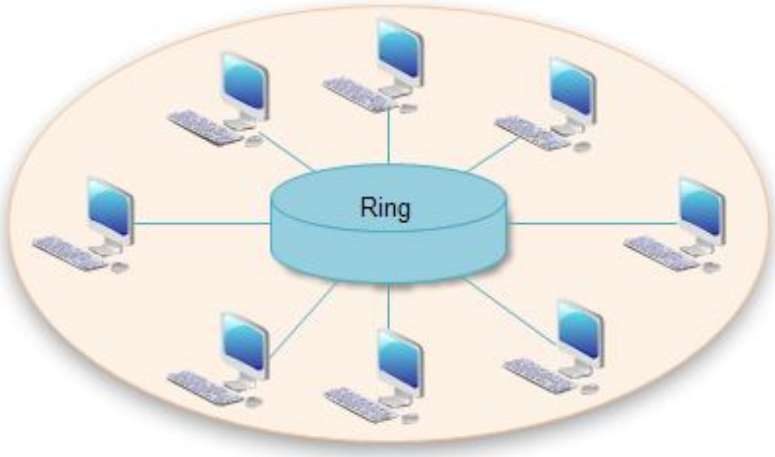


Figure 9.10 : Ring Topology

3. Bus Topology:

Bus networks use a common backbone to connect all devices. A single cable, the backbone functions as a shared communication medium that devices attach with an interface connector. A device wanting to communicate with another device on the network sends a broadcast message onto the wire that all other devices see, but only the intended recipient actually accepts and processes the message.

Ethernet bus topologies are relatively easy to install and don't require much cabling compared to the alternatives. 10Base-2 ("ThinNet") and 10Base-5 ("ThickNet") both were popular Ethernet cabling options many years ago for bus topologies. However, bus networks work best with a limited number of devices. If more than a few dozen computers are added to a network bus, performance problems will likely result. In addition, if the backbone cable fails, the entire network effectively becomes unusable.

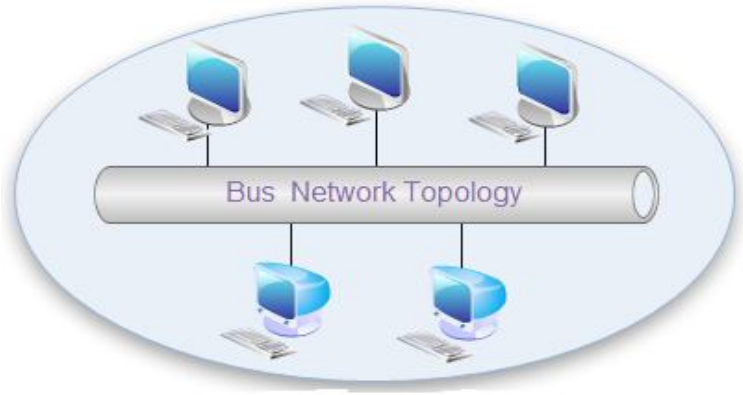


Figure 9.11 : Bus Network Topology

Advantages of a Linear Bus Topology

- Easy to connect a computer or peripheral to a linear bus.
- Requires less cable length than a star topology.

Disadvantages of a Linear Bus Topology

- Entire network shuts down if there is a break in the main cable.
- Terminators are required at both ends of the backbone cable.
- Difficult to identify the problem if the entire network shuts down.
- Not meant to be used as a stand-alone solution in a large building.

4. Tree Topology:

Tree topologies combine multiple star topologies together onto a bus. In its simplest form, only hub devices connect directly to the tree bus and each hub functions as the "root" of a tree of devices. This bus/star hybrid approach supports future expandability of the network much better than a bus (limited in the number of devices due to the broadcast traffic it generates) or a star (limited by the number of hub connection points) alone.

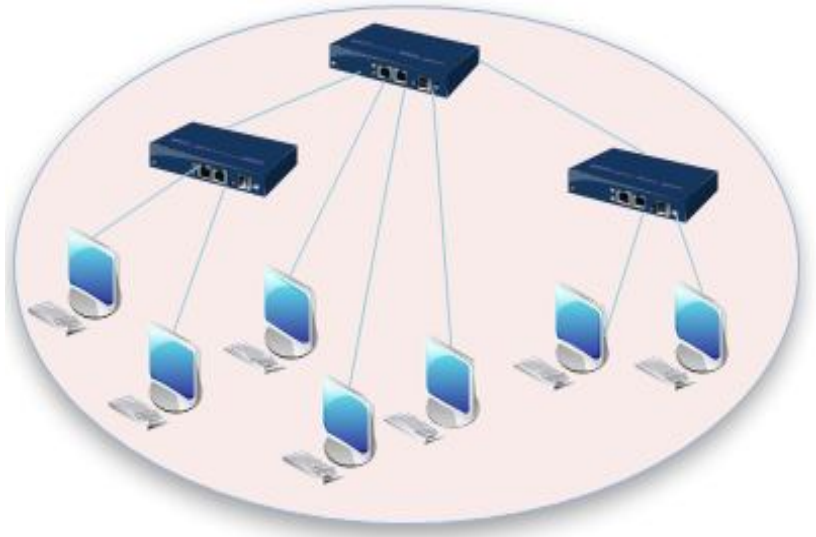


Figure 9.12 : Tree Network Topology

Advantages of a Tree Topology

- Point-to-point wiring for individual segments.
- Supported by several hardware and software vendors.

Disadvantages of a Tree Topology

- Overall length of each segment is limited by the type of cabling used.
- If the backbone line breaks, the entire segment goes down.
- More difficult to configure and wire than other topologies.

5. Mesh Topology:

Mesh topology involve the concept of routes. Unlike each of the previous topologies, messages sent on a mesh network can take any of several possible paths from source to destination. (Recall that even in a ring, although two cable paths exist, messages can only travel in one direction.) Some WANs, most notably the Internet, employ mesh routing. A mesh network in which every device connects to every other is called a full mesh. As shown in the diagram below, partial mesh networks also exist in which some devices connect only indirectly to others.

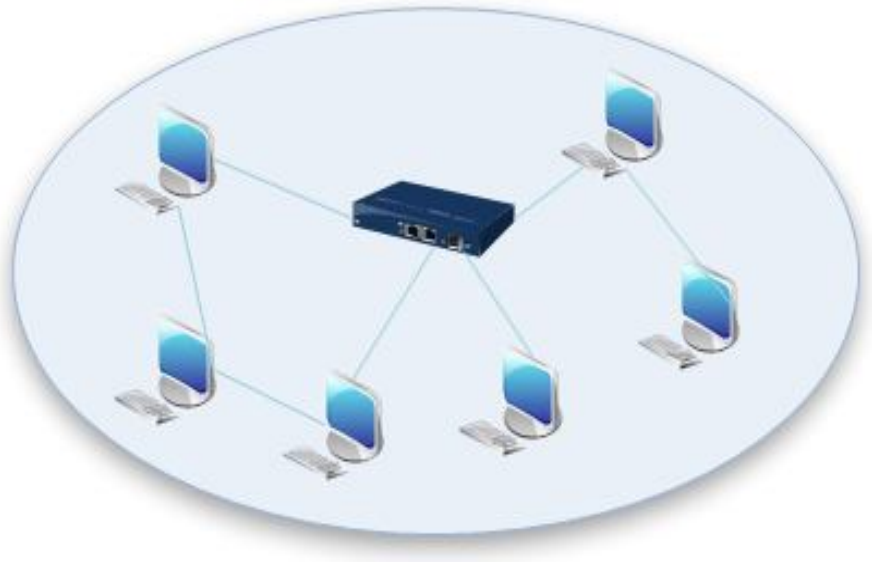


Figure 9.13 : Mesh Network Topology

6. Hybrid Topology:

A combination of any two or more network topologies. Instances can occur where two basic network topologies, when connected together, can still retain the basic network character, and therefore not be a hybrid network. For example, a tree network connected to a tree network is still a tree network. Therefore, a hybrid network accrues only when two basic networks are connected and the resulting network topology fails to meet one of the basic topology definitions. For example, two star networks connected together exhibit hybrid network topologies. A hybrid topology always accrues when two different basic network topologies are connected.

9.6 The OSI Reference Model

The OSI model is based on a proposal developed by International Standards Organization (ISO), as a first step toward international standardization of the protocols used in the various layers. The model is called the ISO OSI (Open Systems Interconnection) reference model, because it deals with connecting open system – that is, systems that are open for communication with other systems.

The principles that were applied to arrive at the seven layers are as follows –

(i) A layer should be created where a different level of abstraction is needed.

(ii) Each layer should perform a well defined function.

(iii) The function of each layer should be chosen with an eye toward defining internationally standardized protocol.

(iv) The layer boundaries should be chosen to minimize the information flow across the interface.

(iv) The number of layers should be large enough that distinct functions need not be thrown together in the same layer out of necessity, and small enough that the architecture does not become unmanageable.

9.4.1 OSI Layers:

The OSI model has following seven layers:

Layer 7 - Application Layer: Consists of application programs that use the network.

Layer 6 - Presentation Layer: Standardizes data presentation to the applications that use the network.

Layer 5 - Session Layer: Manages sessions between applications.

Layer 4 - Transport Layer: Provides end-to-end error detection and correction.

Layer 3 - Network Layer: Manages connections across the network for the Upper Layers.

Layer 2 - Data Link Layer: Provides reliable data delivery across the physical link.

Layer 1 - Physical Layer: Defines the physical characteristics of the network media.

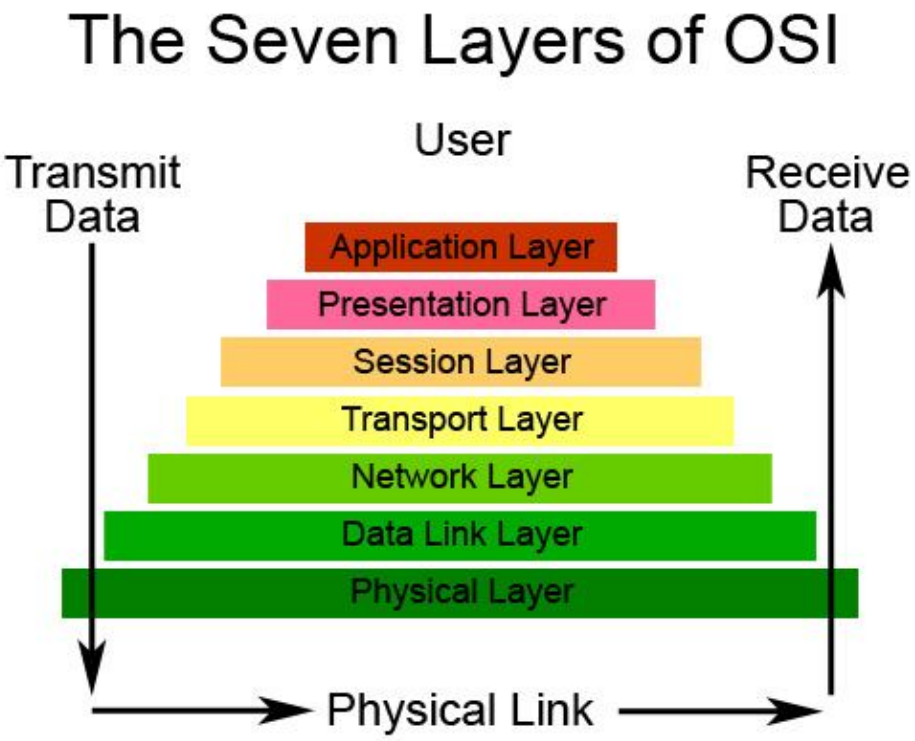


Figure 9.14 : OSI Layers

The principle motivation for the development of the OSI model was to provide a framework for standardization. Within the model, one or more protocol standards can be developed at each layer. The model defines in general terms the functions to be performed at that layer and facilitates the standards-making process in two ways:

- the function of each layer is well defined, standards can be developed independently and simultaneously for each layer. This speeds up the standards-making process.
- the boundaries between layers are well defined, changes in standards in onelayer need not affect already existing software in another layer. This makes it easier to introduce new standards.

We will discuss each layer of the model in detail, starting at the bottom layer. Note that the OSI model itself is not network architecture because it does not specify the exact services and protocols to be used in each layer. It is just theoretical foundation of layers and their functions.

The seven layers of the OSI reference model can be divided into two categories:

The Upper Layers: The Upper Layers of the OSI model deal with application issues and generally are implemented only in software. The highest layer, the application layer, is closest to the end user. Both users and application layer processes interact with software applications that contain a communications component. The term upper layer is sometimes used to refer to any layer above another layer in the OSI model.

The Lower Layers: The Lower Layers of the OSI model handle data transmission issues. The physical layer and the data link layer are implemented in hardware and software. The lowest layer, the physical layer, is closest to the physical network medium (the network cabling, for example) and is responsible for actually placing information on the medium.

1. The Physical Layer: Connects the entity to the transmission media

The physical layer is concerned with transmitting bits over a communication media. The design issues must have to be sure that when one side sends a 1 bit, it is received by the other side as a 1 bit, not as a 0 bit. Typical questions here are how many volts should be used to represent a 1 and how many for a 0, how many microseconds a bit lasts, whether transmission may proceed simultaneously in both direction, how the initial connection is established and how it is turn down when both sides are finished. The design issues here largely deal with mechanical, electrical and procedural interfaces and the physical transmission medium, which presents below the physical layer.

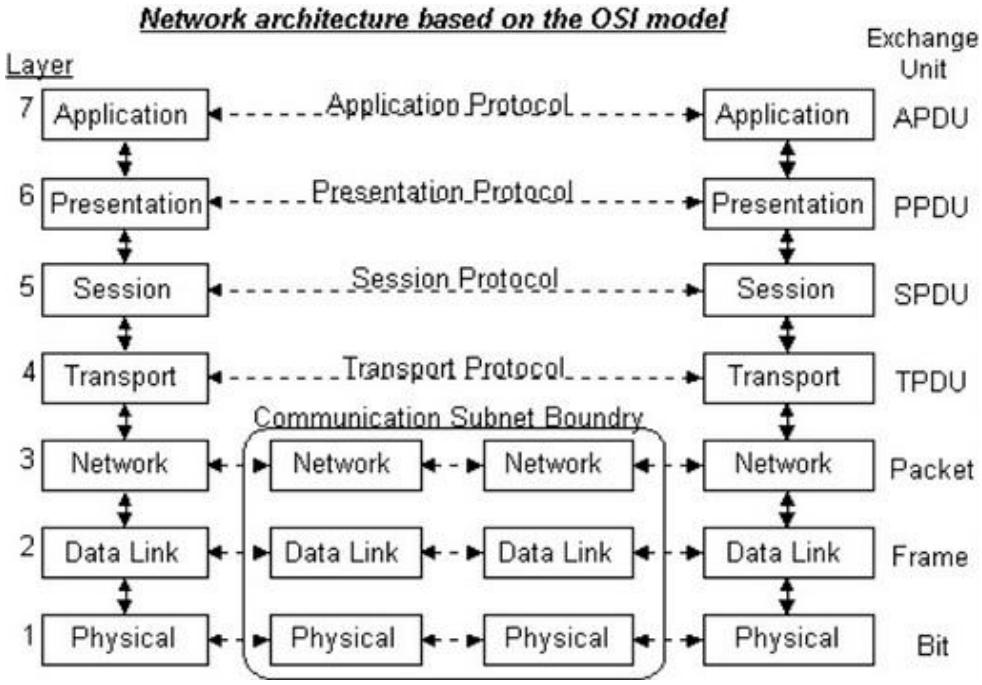


Figure 9.15 : OSI Model Network Architecture

2. The Data Link Layer: Provides error control between adjacent nodes

The main task of the data link layer is to take a transmission facility and transform it into a line that appears free of undetected transmission errors to the network layer. It accomplishes this task by having the sender break the input data up into data frames, transmit the frames sequentially, and process the acknowledgement frame sent back by the receiver. Since the physical layer just accepts and transmits a stream of bits without any regard to meaning or structure, it is up to the data link layer to create and recognize frame boundaries. This can be accomplished by attaching special bit patterns to the beginning and end of the frame. If these bit patterns can accidentally occur in the data, special care must be taken to make sure these patterns are not incorrectly interpreted as frame delimiters.

A noise burst on the line can destroy a frame completely. In this case, the data link layer software on the source machine can transmit the frame. However, multiple transmission of the sane frame introduces the possibility of duplicate frames. A duplicate frame could be sent if the acknowledgement frame from the receiver back to the sender were lost. It is up to this layer to solve the problem by damaged, lost and duplicate frames. The data link layer may offer several different service classes to the network layer, each of different quality and with a different price.

Another issue arise in the data link layer is how to keep a fast transmitter from drawing a slow receiver in data. Some traffic regulation mechanism must be employed to let the transmitter know how much buffer space the receiver has at the moment. Frequently, this flow regulation and the error handling are integrated.

Broadcast networks have an additional issue in the data link layer, how to control access to the shared channel. A special sub layer of the of the data link layer, the medium access sublayer, deals with this problem.

3. The Network Layer:

The network layer concerned with controlling the operation of the subnet. A key design issue is determining how packets are routed from source to destination. Routers can be based on static tables that are wired into the network and rarely changed. They can also be determined at the start of each conversation, for example a terminal session. Finally, they can be highly dynamic, being determined a new for each packet, to reflect the current load.

4. The Transport Layer: Provides end to end communication control

Transport layer subdivides user-buffer into network-buffer sized datagrams and enforces desired transmission control. Two transport protocols, Transmission Control Protocol (TCP) and User Datagram Protocol (UDP), sits at the transport layer. Reliability and speed are the primary difference between these two protocols. TCP establishes connections between two hosts on the network through 'sockets' which are determined by the IP address and port number. TCP keeps track of the packet delivery order and the packets that must be resent. Maintaining this information for each connection makes TCP a protocol. UDP on the other hand provides a low overhead transmission service, but with less error checking. NFS is built on top of UDP because of its speed and statelessness. Statelessness simplifies the crash recovery. The basic function of the transport layer, is to accept data from the session layer, split up it into smaller units if needed, pass these to the network layer, and ensure that the pieces all arrive correctly at the other end. Furthermore, all this must be done efficiently, and in a way that isolates the session layer from the unavoidable changes in the hardware technology.

In addition to multiplexing several message streams onto one channel, the transport layer must take care of

establishing and deleting connections across the network. This requires some kind of naming mechanism, so that process on one machine has a way of describing with whom it wishes to converse. There must also be a mechanism to regulate the flow of information, so that a fast host cannot overrun a slow one. Such a mechanism is called Flow Control and plays a key role in transport layer.

5. The Session Layer: Handles problems which are not communication issues

This layer allows users on different machines to establish sessions between them. A session allows ordinary data transport, as does the transport layer, but it also provides some improved services useful in some applications. A session might be used to allow a user to login into a remote time-sharing system or to transfer a file between two machines. One of the services of the session layer is to manage dialogue control. Sessions can allow traffic to go in both directions at the same time, or in only one direction at a time. If traffic can only go one way at a time, the session layer can help keep track of whose turn it is. A related session service is token management. For some protocols, it is essential that both sides do not attempt the same operation at the same time. To manage these activities, the session layer provides tokens that can be exchanged. Only the side holding the token may perform the critical operation. Another session service is synchronization. Consider the problems that might occur when trying to do a two-hour file transfer between two machines on a network with a 1 hour mean time between crashes. After each transfer was aborted, the whole transfer would have to start over again, and would probably fail again with the next network crash. To eliminate this problem, the session layer provides a way to insert checkpoints into the data stream, so that after a crash, only the data after the last checkpoint has to be repeated.

6. The Presentation Layer: Converts the information

The presentation layer performs certain functions that are requested sufficiently often to warrant finding a general solution for them, rather than letting each user solve the problems. In particular, unlike all the lower layers, which are just interested in moving bits reliably from here to there, This layer is concerned with the syntax and semantics of the information transmitted. A typical example of a presentation service is encoding data in a standard, agreed upon way. Most user programs do not exchange random binary bit strings. They exchange things such as people's names, dates, amounts of money, and invoices. These items are represented as character strings, integers, floating point numbers, and data structures composed of several simpler items. Different computers have different codes for representing character strings, integers and so on.

In order to make it possible for computers with different representation to communicate, the data structures to be exchanged can be defined in an abstract way, along with a standard encoding to be used "on the wire". The job of managing these abstract data structures and converting from the representation used inside the computer to the network standard representation is handled by the presentation layer. The presentation layer is also concerned with other aspects of information representation. For example, data compression can be used here to reduce the number of bits that have to be transmitted and cryptography is frequently required for privacy and authentication.

7. The Application layer:

It provides network services to the end-users. Mail, ftp, telnet, DNS, NIS, NFS are examples of network applications. The application layer contains a variety of protocols that are commonly needed. For example, there are hundreds of incompatible terminal types in the world. Consider the difficulty of a full screen editor that is supposed to work over a network with many different terminal types, each with different screen layouts, escape sequences for inserting and deleting text, moving the cursor, etc.

One way to solve this problem is to define an abstract network virtual terminal for which editors and other programs can be written to deal with. To handle each terminal type, a piece of software must be written to map the functions of the network virtual terminal onto the real terminal. For example, when the editor moves the virtual terminal's cursor to the upper left-hand corner of the screen, this software must issue the proper command sequence to the real terminal to get its cursor there too. All the virtual terminal software is in the application layer. Another application layer function is file transfer. Different file systems have different file naming conventions, different ways of representing text lines, and so on. Transferring a file between two different systems requires handling these and other incompatibilities. This work, too, belongs to the application layer, as do electronic mail, remote job entry, directory lookup, and various other general-purpose and special-purpose facilities.

9.7 The TCP/IP Reference Model

The TCP/IP protocol architecture is a result of protocol research and development conducted on the experimental packet-switch network. ARPANET, was a research network sponsored by the Defense Advanced Research Projects Agency (DARPA). It eventually connected hundreds of universities and government installations using leased telephone lines. The ability to connect multiple networks together in a perfect way was one of the major design goal. This architecture became known as the TCP/IP reference model. This reference model consists of a large collection of protocols hat have been issued as Internet standards by the Internet Architecture Board (IAB).

TCP/IP Layers:

The TCP/IP model organizes the communication task into five relatively independent layers:

- Physical layer
- Network access layer
- Internet layer
- Host-to-host, or Transport layer
- Application layer

1. The Physical Layer:

The physical layer covers the physical interface between a data transmission device (such as workstation, computer) and a transmission medium or network. This layer is concerned with specifying the characteristics of the transmission medium, the nature of the signals, the data rate and related matters.

2. The Network Access Layer:

The network access layer is concerned with the exchange of data between an end system (server, workstation etc.) and the network to which it is attached. The sending computer must provide the

network with the address of the destination computer, so that the network may route the data to the appropriate destination. The specific software used at this layer depends on the type of the network to be used. Different standards have been developed for frame relay, LAN's and others. Thus, it makes sense to separate those functions having to do with network access into a separate layer. The network access layer is concerned with access to and routing data across a network for two end systems attached to the same network.

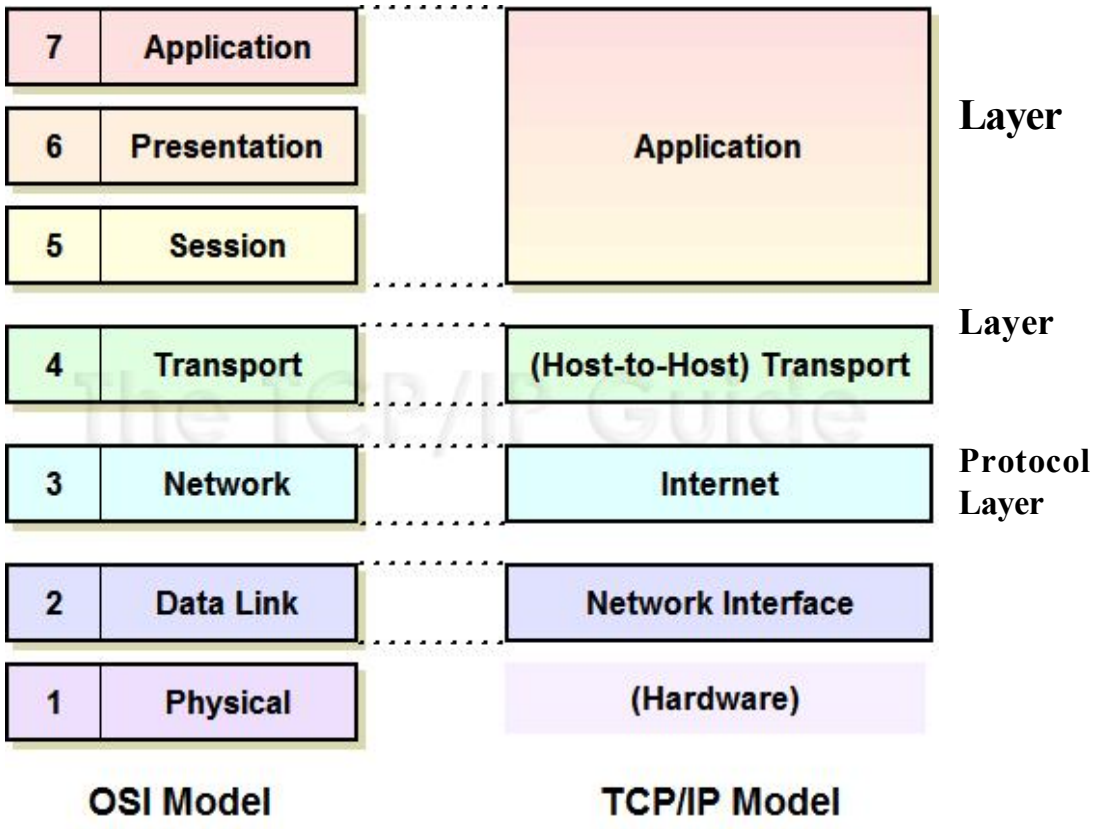


Figure 9.16 : TCP/IP Reference Model

3. The Internet Layer:

If two devices are attached to different networks, procedures are needed to allow data to traverse multiple interconnected networks. This is the function of the internet layer. It holds the whole architecture together. Its job is to permit hosts to injects packets into any network and have them travel independently to the destination (potentially on a different networks). They may even arrive in a different order than they were sent, in which case it is the job of higher layers to rearrange them, if in-order delivery is desired. The similarity here is the (snail) mail system.

This layer defines an official packet format and protocol called IP (Internet Protocol). The job of the internet layer is to deliver IP packets where they are supposed to go. Packet routing is clearly the major issue here, as is avoiding congestion. For these reasons, it is reasonable to say that the TCP/IP internet layer is very similar in functionality to the OSI model's Network Layer.

4. The Transport Layer (Host-to-Host):

The layer above the internet layer in the TCP/IP model is called the transport layer. It is designed to allow peer entities on the source and destination hosts to carry on a conversation, the same as in the OSI transport layer. Two end-to-end protocols have been defined here. The first one is TCP (Transmission Control Protocol) and second one is UDP (User Datagram Protocol).

The TCP is a reliable connection-oriented protocol that allows a byte stream originating on one machine to be delivered without error on any other machine in the internet. It fragments the incoming byte stream into discrete messages and passes each one onto the internet layer. At the destination, the receiving TCP process reassembles the received messages into the output stream. TCP also handles control to make sure a fast sender cannot swap a slow receiver with more messages than it can handle.

The UDP is an unreliable connectionless protocol for applications that do not want TCP's sequencing and flow control and wish to provide their own. It widely used for one-shot, client-server type request-reply applications in which prompt delivery is more important than accurate delivery, such a transmitting speech or video. The relation of IP, TCP and UDP is shown in the below diagram.

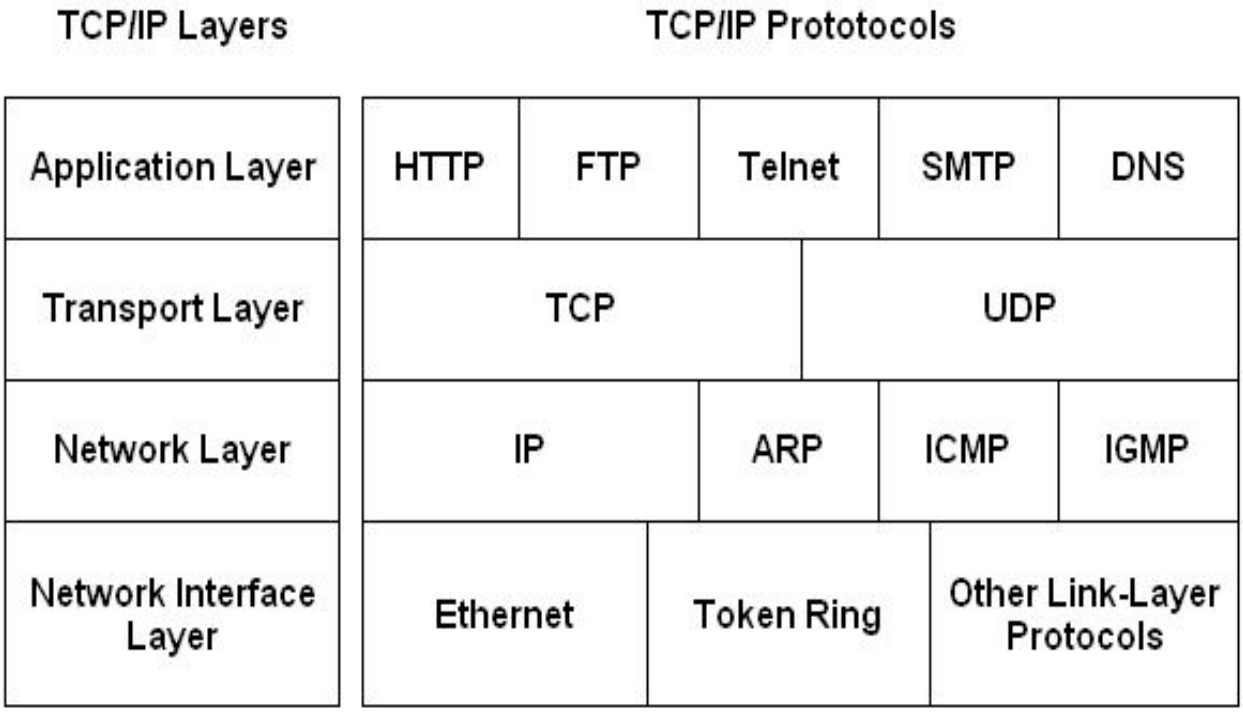


Figure 9.17 : Protocols and Networks in the TCP/IP Model

5. The Application Layer:

Like OSI model, the TCP/IP reference model does not have session or presentation layer. The application layer is located top of the transport layer. It contains all the higher-level protocols. As shown in the above figure, it has FTP (File Transfer Protocol), Telnet, SMTP, and HTTP. The FTP provides a way to move data efficiently from one machine to another. Electronic mail was basically a kind of file transfer, but later a specialized protocol (SMTP) was designed for this purpose. The DNS (Domain Name Server) is used for mapping host name onto their network addresses. And the HTTP (Hyper Text Transfer Protocol) is used for fetching pages on the World Wide Web (WWW) and many other.

9.8 Summary

Computer network are used for various services, for personal and for companies. For companies, networks of PC's using shared servers often provide flexibility and a good performance ratio. For personal use, networks offer access to a variety of information and entertainment resources. Networks are basically divided into three categories like LAN, MAN, WAN and internetworks.

Network uses protocol or rules by which network devices and process can communicate. Protocol can be either connectionless or connection oriented. Protocols are basically based either on the OSI model or the TCP/IP model. Both of these have network, transport, and application layers but they differ on the other layers. Networks topologies define the manner in which network devices are organized. The bus, star, ring and tree topologies are logical architecture but the actual devices need not be physically need not be organized in these configuration.

Key Words

Client/Server - A networking system in which one or more file servers (Server) provide services; such as network management, application and centralized data storage for workstations (Clients).

File Server - A computer connected to the network that contains primary files/applications and shares them as requested with the other computers on the network.

End User - Refers to the human executing applications on the workstation.

Node - End point of a network connection.

Protocol - A formal description of a set of rules and conventions that govern how devices on a network exchange information.

TCP/IP- Transmission Control Protocol/Internet Protocol. This is the standard governing communication between all computers on he Internet TCP/IP.

Packet - This is a unit of data, which is typically a part of a file, prepared for transmission across a network.

P2P - Point-to-Point a direct link between two objects in a network.

Bridge - Devices that connect and pass packets between two network segments that use the same communications protocol.

Thick Net - A thick coaxial cable that is used with a 10Base5 Ethernet LAN.

Thin Net -A thin coaxial cable that is used with a 10Base2 Ethernet LAN.

Hub- A hardware device that contains multiple independent but connected modules of network and internetworks equipment. Hubs can be active (where they repeat signals sent through them) or passive (where they do not repeat but merely split signals sent through them).

Intranet - Network internal to an organization that uses Internet protocols.

Internet - A global network of networks used to exchange information using the TCP/IP protocol. It allows for electronic mail and the accessing ad retrieval of information from remote sources.

Modem – Modulator/Demodulator (Modem) is a Device that convert digital and analog signals. Modems allow computer data (digital) to be transmitted over voice-grade telephone lines (analog).

Repeater - A device used in a network to strengthen a signal as it is passed along the network cable.

Router - It is a device that routes information between interconnected networks. It can select the best path to route a message, as well as translate information from one network to another.

Switch - A "intelligent" type of hub, in that it sends packets only to the intended ports, rather than all computers on the network.

9.9 Self Assessment Questions

1 What is a computer network? Define its components.

2 What is a protocol?

3 Explain protocol architecture?

4 What tasks are performed by transport layer in an OSI model?

5 What do you mean by TCP/IP?

6 Explain the functioning of the network access layer of TCP/IP?

7 What are the types of network? Explain.

8 Differentiate between LAN and WAN network?

9 What is the network topology?

10 Explain ring and mesh topology?

11 What do you understand by hybrid topology?

9.10 Reference Books

- Brian.K.Williams & Stacey C.Sawyer (2005) 'Using Information Technology' ; Tata McGraw Hill Publication company limited, Delhi.
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Unit - 10 : Internet Concepts

Structure of Unit:

10.0 Objectives
10.1 Introduction
10.2 Internet : Definition
10.3 Working Internet
10.4 Basic Services of Internet
10.5 Internet Addressing System
10.6 Impact of Internet on Society
10.7 Intranet
10.8 Extranet
10.9 World Wide Web
10.10 Summary
10.11 Self Assessment Questions
10.12 Reference Books

10.0 Objectives

In this chapter we will discuss the types of hardware and software needed for connecting to the Internet. After read this unit you will know –

- About the Internet.
- How does Internet work?
- How you can connect to Internet?
- Basic services and addressing systems of internet.
- Application of Internet.
- Detailed information of Intranet and Extranet and www.

10.1 Introduction

This chapter introduces the concept of Internet. The internet is a communication technology. Like the telephone, the internet makes it possible for people to communicate in new way. Internet is an extremely large worldwide network that is the most preferred WAN of the world. You can perform access to remote database, file transfers, remote logins to host computers-mail, chatting and surfing.

10.2 Internet : Definition

Some simplified description of the internet is "a large computer network" or "network of networks", "an instantaneous and global messaging system". However, the internet has become more than this. It has grown into an important infrastructure supporting an increasingly widespread, multi-disciplinary community. This community now consists of students, scientists, researchers, large corporations, government agencies and individual consumers.

It is difficult to define the internet simply because it is not a single entity. Instead, it is an immensely complex combination of thousands of technologies and dozens of services used by tens of millions of peoples around the world each day. While overly simplistic definition like "Internet is a network of networks" is technically accurate. Internet mean INTERnation NEtwork, a network of all the computer, network above the globe. So, Internet is a network of networks, made by joining computer networks together with telephone lines.

The internet has a large number of computers all over the world, joined together to form a "spinal column of backbone." Each of these is connected to thousands of others and so on. Thus millions and millions of computers make up the internet. These different computers and networks are united with the common thread of two protocols, like Internet Protocol (IP) and Transmission Control Protocol (TCP).

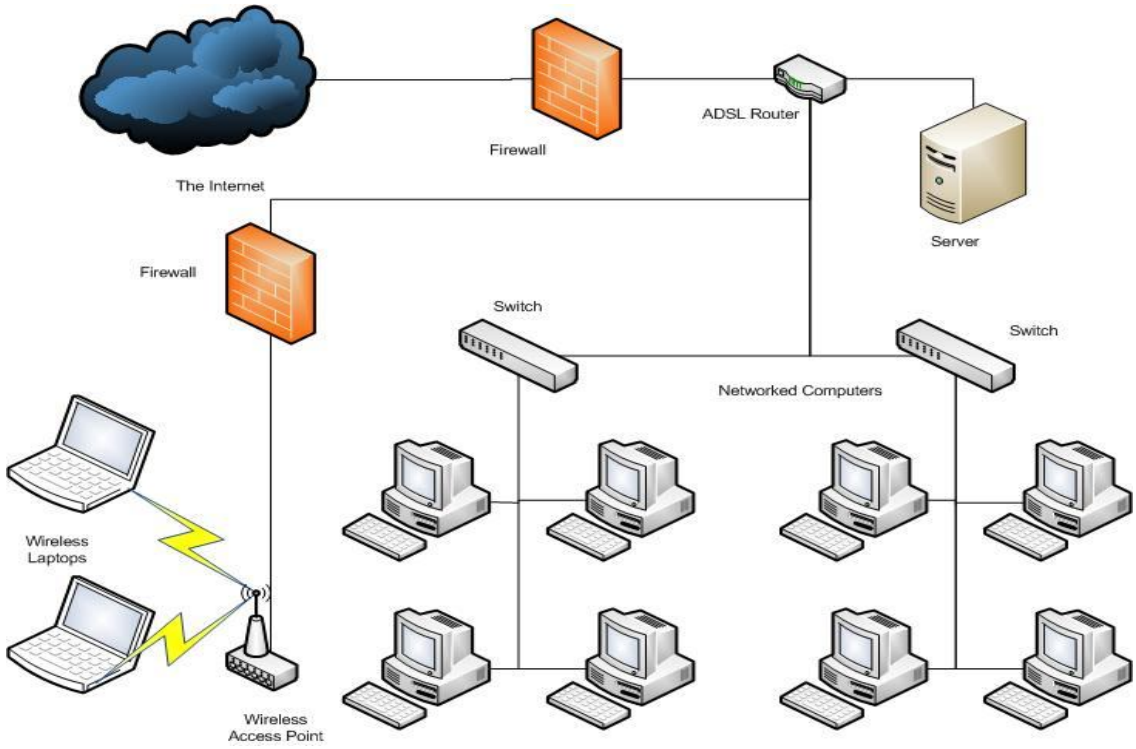


Figure 10.1 : Internet as the Network of Computers

History of Internet:

In 60's a project was undertaken by the U.S. Defense Advanced Research Projects Agency (DARPA). It was, in fact looking for some technology that could enable it to maintain its strategic military based communication worldwide in case of nuclear attack. This can be said as the main conception of the internet.

Later, this development led to the establishment of the Advanced Research Projects Agency Net (ARPANet). The main interest of this agency was to look for a technology that could link computers at various locations by using a new technology called Packet Switching Technology (PST). This new technology allowed the creation of nets that could automatically route data around the downed circuits or computers. It also enabled several users to simultaneously share a single communication line. This technology was then used by National Science Foundation (NSF) to create its own net, and called it NSFnet. Since the user was mostly scientists and researchers, the demand went on increasing endlessly. NSF found itself unable to cope with it. As a result, a decision was taken to open the Net for use by private organizations as well. This allows anyone with a modem and a computer to access the Net. Thus the beginning of Internet was made. Thus NSFnet became the backbone of communication service for the Internet and continues to do so even now. At present, NSFnet comprises a set of high speed data connections that join the major networks all over the world.

Characteristics of Internet:

The internet has the following characteristics:

- **Compressed of Billions of Files** – files pertaining to thousands of subjects, disciplines and professions are available in different file formats.

- **A Complex Network** - as a simplified definition "network of networks" internet comprises over 170 million computers.
- **Disorganized** – the internet can be cumbersome and confusing even for experienced users.
- **A Decentralized System** – millions of individual networks and over 154 millions individual computers connected through the world.
- **Dynamic** – changing every minute of every day. On an average, a new network is connected to the internet every thirty minutes.
- **Widely used** – more than 160 million people use the Internet, over 50 million of whom use it daily.
- **Expanding Exponentially** – the internet is growing at the rate of 15% per month.
- **International in Scope** – this global network is accessed by people in approximately 150 countries.

10.3 Working of Internet

All computers and other equipments within any given network are basically connected to each other with the help of cables or wireless services. The data or messages travel across the network with the help of networking protocols. The protocols used over the Internet provide address for the computers attached to the physical network. Through this way, different types of networks communicate with each other using the same protocol.

The most commonly used protocols are:

- Internet Protocol (IP)
- Transmission Control Protocol (TCP)

These protocols are known as TCP/IP protocol. The TCP/IP protocol architecture is a result of protocol research and development conducted on the experimental packet-switch network. The internet layer defines an official packet format and protocol called IP (Internet Protocol). The job of the internet layer is to deliver IP packets where they are supposed to go. Packet routing is clearly the major issue here, as is avoiding congestion. The TCP is a reliable connection-oriented protocol that allows a byte stream originating on one machine to be delivered without error on any other machine in the internet. It fragments the incoming byte stream into discrete messages and passes each one onto the internet layer. At the destination, the receiving TCP process reassembles the received messages into the output stream. TCP also handles control to make sure a fast sender can not swap a slow receiver with more messages than it can handle.



Figure 10.2 : Working of Internet

Internet is dependent on the existing infrastructure developed by the telephone and other telecommunication companies, for transmission. Internet Service Provide (ISP) lease data circuits from the telephone networks, and have dedicated computers at the end points or nodes. They rely on the distributed intelligence of networking equipments known as routers, thus bypassing the telephone company's expansive switching computers, while using their telephone lines. It can be said that the networks on the Internet use a router to communicate with other networks. The router on a network accepts packets addressed to it and passes them as address to other networks. Each computer system with a direct connection to the Internet has to have the necessary hardware and software to allow it to work with these packets of information.

All the contents of the Internet are held by computers known as servers which are owned by organizations or companies who want to distribute the information. Most of the internet services operate according to a scheme called **client and server** Most of you who are familiar with networking, know these works. Server is the main computer which controls all the other computers known as clients. When a request is made to these servers for information, they bundle the requested information in small packets with the address as to where it is to be sent, and sent them down to the nearest connection to the Internet. The packets are read by router and then sent down in the same general directions as the address. A similar thing happens, at the next junction on the internet. This goes till the packet is delivered to the right address, where it is put together again with other packets to make the original information.

10.3.1 Requirements for Connecting to Internet:

To connect to internet, you must have the following hardware and software:

(i) A computer system with software like Microsoft Internet Explorer or Netscape Navigator loaded into it for working on the net.

(ii) A telephone line. It will be better to have a dedicated telephone line, like a line exclusively for your Internet connection only. It is because, this will prevent others from using your telephone or calling you, as they will often get an engaged tone. However, if you wish to use the internet occasionally, then your existing telephone line will suffice.

(iii) A modem (modular-demodulator) is an electronic device that converts digital data from computers into signals. These signals can then be transmitted over a normal telephone line. At the receiving end, another modem converts the signal back into digital data understood by computers. Modems can be interne (inserted in a slot on your computer's motherboard) or external (fitted externally).

(iv) You have to open an account with an Internet Service Provider (ISP) to have the internet connection. An ISP is company that gives you access to the internet for a fee. Presently, a number of ISP's are available in India. These include VSNL (Videsh Sanchar Nigam Limited); Satyam Online; Mantra Online; Tata Nova; BSNL etc. Each one of these allows you to open an account with them and they give an e-mail address too.

10.3.2 Internet Connection:

There are various types of Internet connections. You can choose any one of them to access the Internet. The most common connections are:

- Through local area network
- Through dial-up internet accounts
- Through dedicated internet accounts
- Through ISDN lines
- Wireless method of accessing the internet

(i) Through Local Area Network: Connection to the Internet through local area network is common in big organizations, where there are a large number of departments. Here, computers are connected to each other to form a network. This network is connected to the Internet. With the help of special programs, different computers connected to the network can access the Internet simultaneously. Thus a single can be shared by more than one computer at the same time.

(ii) Through Dial-up Connection: This is the simplest and the most widely used method of getting connected to the Internet. This type of connection is suitable for single user. There is separate software which helps in sharing this type of account with more than one user at the same time. Dial-up Internet connections are provided by ISP's. These are companies specialized in providing Internet connection and they charge for their services. To make use of this service, the user has to register for an account with the service provider. Online registration is also now possible. ISP's allot a user name (called user id), a password and a dial-up telephone number.

Computers are connected to the Internet through telephone lines. Connection to Internet is obtained by dialing the given telephone number using the modem fitted to the computer. Once the connection is established, the user logs into the Internet with his user name and the password. The server computer verifies these details before giving permission to login to the Internet.

(iii) Through Dedicated Internet Accounts: This type of Internet account is very expensive. Large organizations and governmental agencies mainly use this account, as they require transferring a lot of data and files through the Internet regularly. This type of account is also known as IP account. The user is allocated a separate IP account and it is through this account that the connection is made. This is an 'always on' connection and there is no need to dial every time for connecting to the Internet.

(iv) Through ISDN Lines: ISDN or Integrated Services Digital Network is a powerful tool for providing different services such as data, voice and image transmission over telephone lines. One important Advantage of ISDN line is that they are fast, with a connection speed of 128 kbps. This is ideal for small and medium business organizations. High quality video and data can be transmitted over this line at a quick pace. Also video conferencing can be conducted. ISDN line was introduced in 1992 in the US. To transmit digital data, digital devices can be directly connected to the ISDN line.

(v) Wireless Method of Accessing the Internet: It is possible to connect to the Internet using cellular phone, pager or Personal Digital Assistance (PDAs). The technology used is called Wireless Application Protocol or WAP in short. This accessing method is cheaper as no cabling is required.

As wireless terminals become more affordable, more and more people opt for the wireless method of accessing the Internet. This helps to access the Internet through mobile device and as a result, people can access the Internet from anywhere at any time.

The system works like this: the user keys in the URL name in the micro browser in the cell phone and gets connected to the mobile service provider. The request is transmitted over the wireless network to the ISP. At the service provider's site, the request is accepted by a WAP proxy, which converts the request to the standard HTTP request and contacts the addressed web server. The web server sends the requested page back to the WAP proxy which converts the HTTP page for the wireless network and transmits it back to the cell phone.

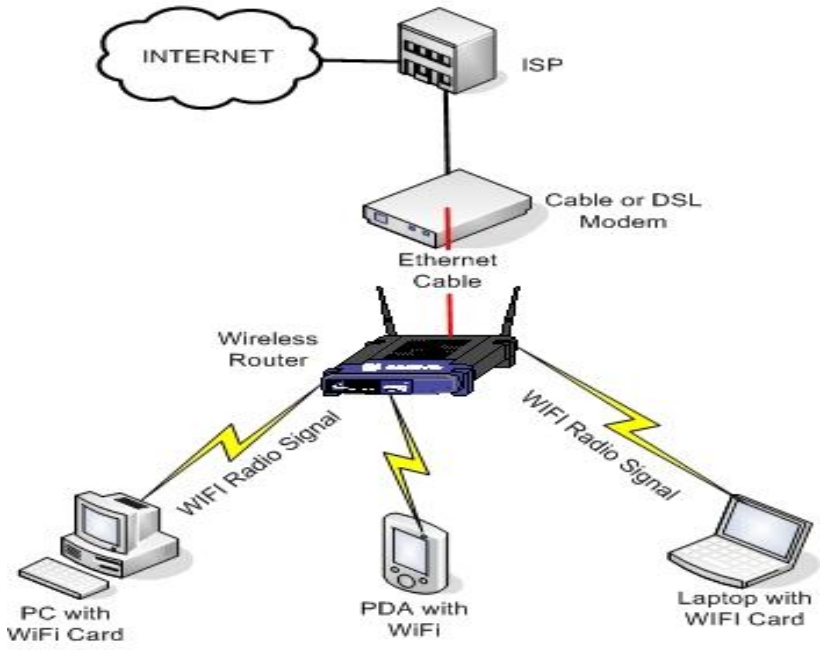


Figure 10.3 :Wireless Method of Accessing the Internet

10.4 Basic Services of Internet

Internet is used for various purposes including sending and receiving information. Today Internet offers a number of services to all its users. In fact, it is like multipurpose tool to communicate with one another, collect information and enhance your knowledge about the subjects that you like, play games, conduct research or just look around in search of the recipes or the latest technological developments.

Some of the most popular usages of Internet are:

(a) Accessing People:

Internet would help people in locating their long lost friends, who were probably lost in school or college. That person must have an e-mail account. Rest is easy. For this purpose, you can visit a commonly used site such as whowhere (just use your search engine to locate it by typing *http://whowhere.lycos.com*). Now, to find the e-mail address types the name of the person in the name field. Then, type the e-mail server domain name (yahoo.com) in the domain field. Once you click the Go Get It button, the result will be displayed on your computer's screen.

(b) Information Retrieval:

One of the most commonly used services on the Net comprises of retrieval of information about various topics that interest you. This getting of information is made possible through the *World Wide Web* (WWW or W3).

(c) Electronic Mail (E-mail):

The electronic mail service allows an Internet user to send a mail (message) to another Internet user in any part of the world in a near-real-time manner. The message takes anywhere from a few seconds to several minutes to reach its destination. E-mail service has many similarities with the postal mail service, which all of us are familiar with. The e-mail service delivers an already sent mail into the receiver's mail box. The receiver extracts the mail from the mailbox and reads it at his convenient time just like in a postal mail system. After reading the message, the receiver can save it, delete it, pass it on to someone else, or respond by ending another message back.

Messages in e-mail service can contain not only text document, but also image, audio and video data. With e-mail service, the Internet has proved to be a rapid and productive communication tool for millions of users.

The following are the popular Web sites which allow to open an e-mail account:

Yahoo	http://www.yahoomail.com
Hotmail	http://www.hotmail.com
Rediff	http://www.rediff.com
Gmail	http://www.gmail.com

Besides these most of your ISP's would allow you to open an account. All these e-mail services are free and the sites do not charge any amount for using the same.

Parts of E-mail Text: Like a formal letter an e-mail is also divided into various sections. As shown in below diagram. Most e-mail has similarities in contents like:

Headers: It is very important that your header must be loud and clear from it can be seen and read from a distance too.

To: The To field contains the e-mail address of the person to whom you are sending the e-mail. If you are sending e-mail to someone in your domain, you do not need to include @ domain.

From: In most of the cases, you would not be tying this, since it would be taken from the system. It, in fact includes your e-mail address.

Subject: The **Subject** field should contain a very short description of what your message is about. This field can also be called Subject of the message or simply message.

Cc: You can send the copy of the same e-mail to another person. For this you have to mention the e-mail address of the second recipient.

Bcc: It is the short form of Blind Carbon Copy, which gives you a way of copying and transmitting an e-mail message to another person, without the first person knowing about it.

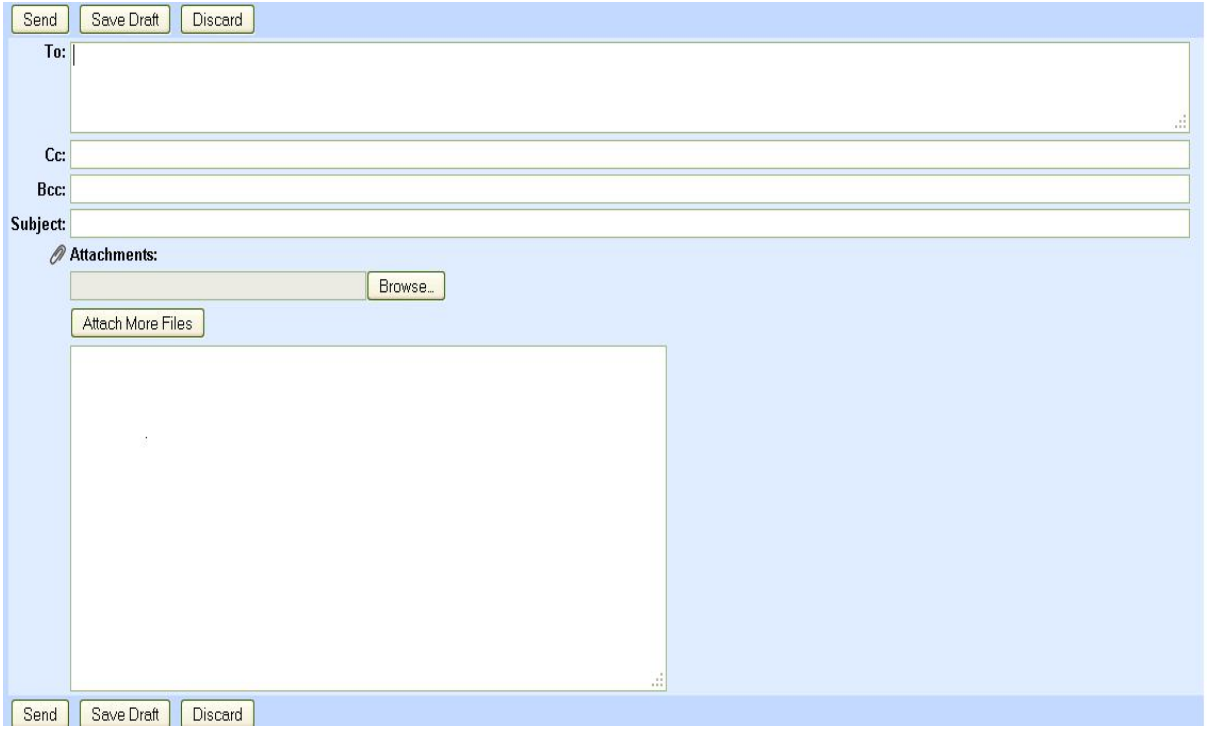


Figure 10.4 : E-mail Format

Attachments: This option is used to attach a file created in other software along with this e-mail. In most of the cases while applying for a job, the letter is typed in the e-mail text and the bio-data which is mostly in some word processing software, attached to it.

Body: The body of an e-mail message is simply the text that you want to send to the other person.

(d) Telnet:

The telnet service allows an Internet user to log in to another computer somewhere on the Internet. That is, a user can execute the telnet command on his local computer to start a login session on a remote computer. This action is also called "remote login". To begin a remote login session, the user types the commend telnet and the address of the remote computer on the terminal of his/her local computer.

The user then receives a prompt asking to enter a login name (user ID) and a password to ensure that the user has the access rights for accessing the remote computer. Ones the login session is established with the remote computer, telnet enters the input mode, and anything typed on the terminal of the local computer by the user is sent to the remote computer for processing.

Some of the most common uses of the telnet service are:

(i) Using software on the remote computer.

(ii) Accessing remote computer's database or archive.

(iii) Using the computing power of the remote computer.

(iv) For logging in to ones own computer from another computer.

(e) File Transfer Protocol (FTP):

The FTP service allows an Internet user to move a file from one computer to another on the Internet. A file may contain any type of information like text document, image, artwork, movie, sound, software etc. Hence, anything that can be stored on a computer can be moved with FTP service. Moving a file from a remote computer to ones own computer is known as downloading the file, and moving a file from ones own computer to a remote computer is known as uploading the file.

A file can be transferred from one computer to another using FTP in the following manner:

(i) A user executes the ftp command on his local computer, specifying the address of the remote computer as a parameter.

(ii) The FTP process running on the user's computer (called FTP client) establishes a connection with an FTP process running on the remote computer (called FTP server pro).

(iii) The user is then prompted for login name and password to ensure the user is allowed to access the remote computer.

(iv) After successful login, the desired files are downloaded or uploaded by using get (for loading) and put (for uploading) commands.

(f) Newsgroups (Usenet):

The Usenet service allows a group of Internet users to exchange their views /ideas /information on some common topic, which is of interest to all the members belonging to group. Several such groups exist on the Internet and are called **newsgroups**. For example, the newsgroup named *comp.security.misc* consists of users having interest in computer security issues. A newsgroup is like a large notice board, which is accessible to all the members belonging to the group. There are two types of newsgroups – moderated and non

moderated. In a moderated newsgroup, only selected members have the right to directly post (write) a message to the virtual notice board, whereas in a non moderated newsgroup, any member can directly post a message to the virtual board.

(g) E-Commerce:

E-commerce (Electronic Commerce) means doing business online. It refers to any manner of conducting business on line by an individual/organization. As part of e-commerce, large organizations also send data from the Internet to conduct research and plan their marketing strategies globally. With credit cards becoming more popular along with computerized banking services, payment for services through Internet is becoming very easy.

(h) Shopping Online:

Some department stores offer their products, both new and old to Internet users for a payment, which is usually made in advanced through a credit card. Online shopping is possible by selling/purchasing items over the Internet, companies save money on hiring shop workers. The advantage for the buyers is that the Internet shops sell their goods at much lower price.

(i) Employment Generation:

Employers and job placement agencies have started to increasingly use the Internet as a source of recruitment by advertising on the Internet to fill up vacancies. Side by side, people seeking job or better employment opportunities also use the Internet.

(j) Entertainment:

Internet now provides you unlimited opportunities to watch latest films, TV programs and listen to music. You can download your favorite movies and music from different sources.

(k) Chatting:

Everybody likes to chat. Even if it on the Internet. You can fact chat with totally unknown people. Technically known as Internet Relay Chat (IRC), it is multi-user and multi-channel chatting net that allows users to communicate in real time. The IRC is a form of instant talking, almost like a telephone conversation but in a written form

10.5 Internet Addressing System

As you have noticed that while mentioning any web address, it is mentioned as www and then has some name followed by dot (.) and then dot again and end with either com or any other code. An Internet address is made up of a code or series of letters, numbers and/or symbols by which the Internet identifies you or a location where information is stored. Through the use of this addresses, people can send you e-mail, look at your web site and send or receive files and documents.

Domain Name:

The names of the various computers are designed by Internet Engineering Task Force (ITEF). This addressing scheme assigns names and numbers to identify the computers on the Internet. These names are called domain names and numbers are called IP addresses. Every compute system on the Internet has both a domain name and an IP address. This address contains four Domain Names which are easier to remember than a combination of 4 level digital numbers of an IP address. This address contains four sets of numbers separated by periods or dots. Each numbers can have the values ranging from 1 to 255. The numbers

between the dots is called an octet. An IP address is organized from left to right where the leftmost represents the largest network organization and the rightmost octet describes the actual network connection. These combined parts are always unique for the given host. This scheme has been proved good but the number become difficult to manage. A method for recognition of computers by names was therefore devised. A smaller network making up the Internet, and having many computers or even smaller network within it, is called a **domain**. This domain may represent either a type of organization or a geographical location. Smaller networks and computers forming part of the domain may be further split up into sub-domains.

For example, the e-mail address ***nda.vsnl.net.in*** has the following meaning –

nda - A code given by VSNL, denoting their computer name

vsnl - Organization code of the service provider VSNL

net - Network provider

in - Country code, India

There can be various other network providers too. For example –

com - A company or commercial organization (for example, sloblenet.com)

net - Network resources or Internet Service Provider (for example, nsf.net)

mil - Military site (for example, army.mil)

org - Organization, like NGOs, Religious bodies, etc. (for example, fidonet.org)

gov - Government organization (for example, pmo.gov)

edu - Educational institutions, colleges, schools, etc. (for example, apeejay.edu)

Countries name cab be:

in for India

uk for United Kingdom

fr for France

us for United States

it for Italy

ca for Canada

Email Address:

The e-mail address of the any person or company has following format like *parvpihuxmis case laxmipany has following format like laxmi@nda.@nda.vsnl.net.in*. In this case vikramsen is the user name. The @ (at the rate) symbol in the middle is a must. Then after that you have the various codes, as mentioned above. In spoken term this would be mentioned as "parvpihu at the rate nda dot vsnl dot net dot in".

URL (Uniform Resource Locator):

A URL describes the location and a method of accessing a resource on the Internet. For example, the URL *http://www.yahoo.com* may lead you to the home page of the company called Yahoo Corporation that is a search engine and social site. Each URL is unique. It identifies a particular point on the Internet. The most common URL type is 'http' which gives the Internet address of a World Wide Web page. Some other URL types are 'gopher' which gives the Internet address of a Gopher directory, and 'ftp' which gives the address of a FTP resource. All Websites have URLs.

Web Address:

A Web address is the same as a URL. This address usually starts with *http://www* and is followed by a dot (.) and then a domain name. Here the term http stands for Hypertext Transfer Protocol. Because domain names are international, many countries use their name instead of dot com. In the Internet, to send a mail or to receive information or to download a file, we must know the precise address of the receiver and the host computer.

HTTP (Hyper Text Transfer Protocol):

It is a network protocol, which is used as the communication protocol to transport hypertext document over the Internet. It tells the server what to send to the client, so the client can view Web pages, FTP sites or other areas on the Net. The HTTP is a method used on Internet to access information. It works in combination with the World Wide Web (WWW), which is responsible for accessing hypertext documents.

Search Engines:

A special software that enables you to systematically search the Web. All you required is to provide a few key words (known as 'query') about the desired topic and the Search Engine will provide you a Web Page listing on the topic. Some of the popular search engines are: Google, Yahoo, India Times, Lycos, AltaVista and Infoseek etc.



Figure 10.5 : Search Engines



Figure 10.6 : Popular Search Engines

10.6 Impact of Internet on Society

The Internet has caused a great evolution in the society, allowing people from all over the world to communicate their ideas and feelings. The Internet has also changed the way society treats people. There are many changes to society because of the Internet, whether such changes enhance or ruin our life is up to us.

Some of the changes or impact on the society of Internet could be summed up in the following way:

(i) **Communication** – The most important thing which Internet has done is that it has brought people of the World very close to each other. The communication has become so fast and efficient. An e-mail just takes approximately 15 seconds to reach at destination from any palace through out the world. This has made a very significant in the approach of people towards computers too, now it has become a necessary tool for each home.

(ii) **Working from Home** – Since most of the information needs is available in the computer on Internet, you need not go anywhere for it. So many people prefer to sit at home and work from there. All correspondence is also done on computer via e-mail.

(iii) **Crime on Internet** – Most of the crimes on the Internet are related to breaking codes of various information available on the Net. You can crack password of somebody's credit card and cash money. The other major crimes are spreading viruses and spreading wrong and inflammatory information.

(iv) **Freedom of Speech** – Since while chatting or sending mail through Internet, you are not facing the other person directly, the chances are that you will come out with what you want to say without any hindrance. This will actually open you up.

10.7 Intranet

There are many people who haven't yet heard of the word 'intranet' and hence whenever the topic is brought up, they often ask the question "**what is intranet**?" Basically intranet is useful for those people who are running their businesses with more than one staff member. These businesspeople can consider taking the help of intranet and they can find out how it works for them. Intranet can be used for a lot of purposes like optimizing the use of one's induction software to ensure that the company files are secure and safe. In the broad sense, intranet can be described as a collection of networks of private computers which are used for work purposes within an organization or company.

An **intranet** is a computer network that uses Internet Protocol (IP) technology to securely share any part of an organization's information or network operating system within that organization. It is the connection of computer networks in a local area. The term is used in contrast to *internet*, a network between organizations, and instead refers to a network within an organization. Sometimes, the term refers only to the organization's internal Website, but may be a more extensive part of the organization's information technology infrastructure. It may host multiple private websites and constitute an important component and focal point of internal communication and collaboration. Any of the well known Internet protocols may be found in an intranet, such as HTTP (web services), SMTP (e-mail), and FTP (file transfer protocol). Internet technologies are often deployed to provide modern interfaces to legacy information systems hosting corporate data. An intranet can be understood as a private analog of the Internet, or as a private extension of the Internet

confined to an organization. The first intranet websites and home pages began to appear in organizations in 1996-1997. Although not officially noted, the term intranet first became common-place among early adopters, such as universities and technology corporations, in 1992.

In organizations, intranets are protected from unauthorized external access by means of a network gateway and firewall. For smaller companies, intranets may be created simply by using private IP ranges, such as 192.168.*.*. In these cases, the intranet can only be directly accessed from a computer in the localnetwork; however, companies may provide access to off-site employees by using a Virtual Private Network (VPN). Other security measures may be used, such as user authentication and encryption.

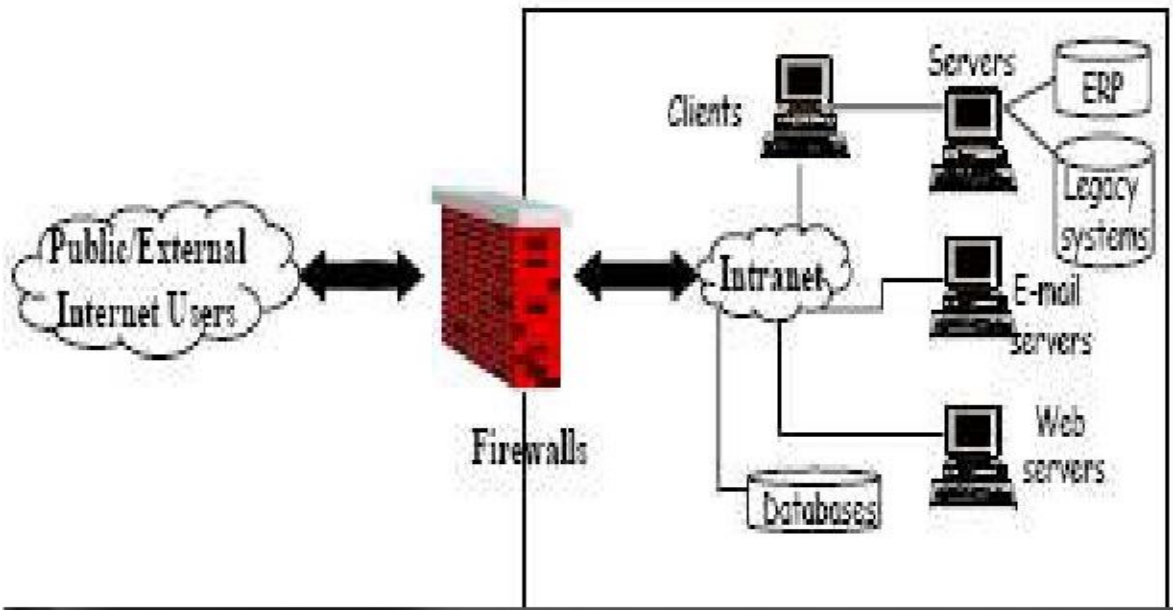


Figure 10.7 : Architecture of Intranet

Use of Intranet:

- Intranet is mostly used in the domain of corporate organizations but in the recent times the importance and usefulness of intranet has been recognized by universities and schools too. Many universities use the intranet to provide private access to student information, lecture notes, library files, online journals, etc.
- The intranet can be used for providing web access as well in sophisticated ranking systems wherein the staffs and the students have different levels of access.
- Increasingly, intranets are being used to deliver tools and applications, e.g., collaboration (to facilitate working in groups and teleconferencing) or sophisticated corporate directories, sales and customer relationship management tools, project management etc., to advance productivity.
- Intranets are also being used as corporate culture-change platforms. For example, large numbers of employees discussing key issues in an intranet forum application could lead to new ideas in management, productivity, quality, and other corporate issues.
- Intranet user-experience, editorial, and technology teams work together to produce in-house sites. Most commonly, intranets are managed by the communications, HR or CIO departments of large organizations, or some combination of these.

Advantages and Disadvantages of Intranet:

There are a number of advantages of Intranet, described below –

(i) Intranets offering workforce productivity which can help user to find and observe information very fast. User may also use applications according to their roles and tasks. Through web browser a user can get access to entire contents of any website from anywhere or any time.

(ii) Intranet also increase the ability of employee's by performing their job confidently very fast, and accurately.

(iii) Intranet permits business companies to share out information to employees according to their need or requirements. Employees may also link to appropriate data at their expediency.

(iv) The best advantage offered by Intranet is communications within an organization or business company, landscape or portrait. Intranets are helpful to converse planned initiative that has an international reach all through the organization. The well known examples of transportation are chat, email, and blogs. An actual world example of Intranet is Nestle had a number of food processing plants.

(v) The most significant advantage of Intranet is Web publishing which permits burdensome corporate knowledge to be continued and effortlessly access all through the company using Web technologies and hypermedia. The familiar examples of web publishing consist of training, news feed, company polices, documents, and employee manual.

(vi) Intranet can be accessed general internet standards such as CGI applications, Flash files, and Acrobat files. Each unit can bring up to date the online copy of a document and intranet always provides the most recent version to employees.

(vii) Intranet offering business operations and administration solutions because it also is being used as a platform of mounting and organizing applications across the internet world.

(viii) Another advantage of Intranet is time saving because there is no need to maintain physical documents such as procedure manual, requisition forms, and internet phone list.

The disadvantages of Intranet are as follows –

i) Management does need to stop control of specific information, this problem can be minimized but with appropriate prudence.

(ii) The other disadvantage of Intranet is security issue.

(iii) Intranet gathered everything in one location which is really good but if it is not prearranged then you will spoil everything.

(iv) The cost of intranet is very high but has lots of advantages after implementing.

(v) Another issue might be the fact that there is too much information. Information overload does exist and can take place when too much data is up on the intranet. This makes it very difficult for employees to navigate and find data that is meaningful or that they need.

10.8 Extranet

A company LAN, or local area network, can house a private Internet-like environment called an *Intranet*. The Intranet is basically a set of HTML pages relating to internal company business, for employee's eyes only, and is not available to the Internet. If access to or from the Internet is provided, it will be through a firewall gateway that will require a username and password. In this case the intranet becomes an **Extranet**. In short, an Extranet is the extension of an Intranet to include public access. An Extranet can allow public

access to employees, customers, clients or partners. The Extranet uses Internet protocols so users can navigate with a browser, but resides on the company's private server rather than on a public Internet server. Extranet access from the Internet can be controlled through various architectures that are password or username specific. In other words, areas of the Extranet will be available according to password credentials. This limits users to Extranet pages relevant to the business they might be conducting, while keeping other areas of the Extranet private and secure.

One very valuable application for an Extranet is customer service. Online patches, upgrades, downloads, knowledge bases, and an interactive *Help Desk* are just a few examples of ways to serve a client base using an Extranet. Extranet chat boards where customers help each other with company products can also build customer confidence and brand loyalty, while saving valuable human resources. Chat boards are also a rich source for potential future product and support development. Another resource an Extranet can provide is the ability to create secure areas for interaction between an organization and its partners or resellers. Development, dissemination of marketing information and tools, data sharing, research, sales reports and more are all possible using an Extranet environment.

An Extranet can also connect to other Extranets through the common language of Internet protocols. This makes it invaluable to organizations involved in collaborative efforts and opens the door to greater creative opportunities. In the past, geography was a significant hindrance to collaboration, but Extranet technology bridges that gap effortlessly and virtually cost-free. Extranets can revolutionize the way a company does business, improve the bottom line, enrich the customer base, and create opportunities that remain out of reach without an Extranet.

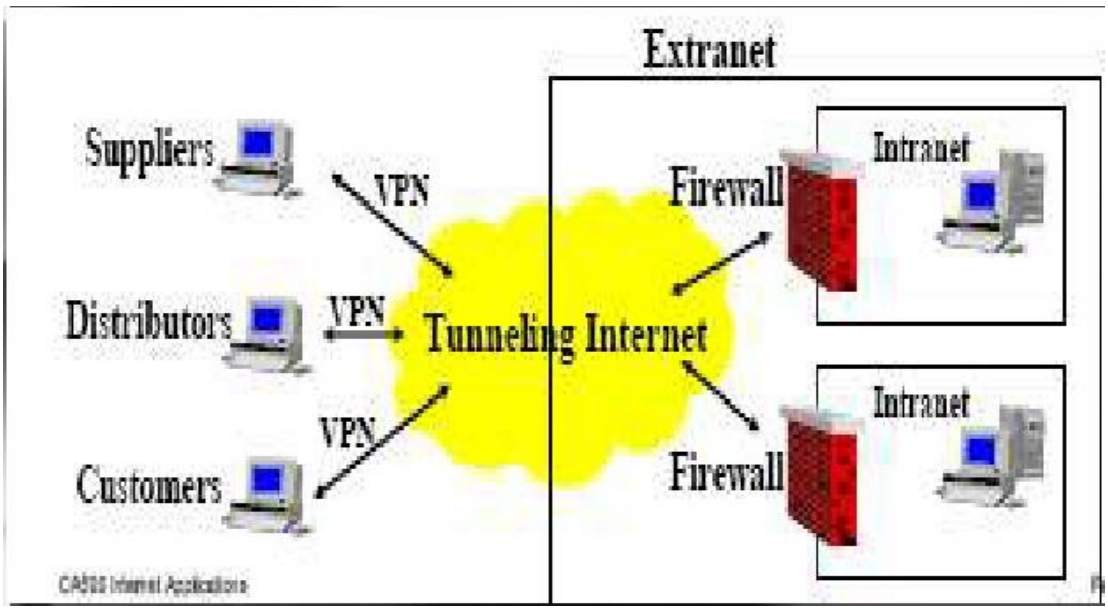


Figure 10.8 : Architecture of Extranet

Advantages and Disadvantages of Extranet:

Advantages of extranet are –

(i) Exchange large volumes of data using Electronic Data Interchange (EDI).

(ii) Collaborate with other companies on joint development efforts.

(iii) Jointly develop and use training programs with other companies.

(iv) Provide or access services provided by one company to a group of other companies, such as an online banking application managed by one company on behalf of affiliated banks.

(v) Share product catalogs exclusively with trade partners.

Disadvantages are –

(i) Extranets can be expensive to implement and maintain within an organization (e.g., hardware, software, employee training costs), if hosted internally rather than by an application service provider.

(ii) Security of extranets can be a concern when hosting valuable or proprietary information.

10.9 World Wide Web

A global hypertext system that uses the Internet as its transport mechanism is called World Wide Web. In a hypertext system, you navigate by clicking hyperlinks, which display another document. The Web makes the Internet easy to use. The World Wide Web is the most popular and promising method of accessing the Internet. The main reason for its popularity is the use of a concept called *hypertext*.

The WWW was created at the European laboratory for Particle Physics (CERN), a research institute in Switzerland, the Web relies upon the Hyper Text Transfer Protocol (HTTP), an Internet standard which specifies how an application can locate and acquire resources stored on another computer on the Internet. HTTP provides transparent, easy-to-use access to Web documents, FTP, file archives, Gopher menus and even UseNet newsgroups, users of Web navigation software, called Web browsers, and HTTP takes care of locating and downloading the desired documents.

The WWW uses the client-server model, and an Internet Protocol called Hyper Text Transfer Protocol (HTTP) for interaction between the computers on the Internet. Any computer on the Internet, which uses the HTTP protocol, is called a Web Server, and any computer, which can access that server, is called a Web Client. The use of the client-server model and the HTTP allows different kinds of computers on the Internet to interact with each other.

An effectively designed hypertext document can help users rapidly locate the desired type of information from the vast amount of information on the Internet. Hypertext document enable this by using a series of links. Hypertext document on the Internet are known as Web Pages. Web Pages are created by using a special language called Hyper Text Markup Language (HTML). HTML is a subset of the more generalized language called Standard Generalized Markup Language (SGML), which is a powerful language for linking documents for easier electronic access and manipulation.

10.9.1 Web Browsers:

A Software that is used to view Web pages is called a Browser. Browser helps you to connect to Web sites. You can surf the Web, view the Web sites and download files and programs, add the favorites etc. A Web browser works by using HTTP protocol to request a specially encoded text document from the Web server. Browsers are designed that they can run on many kinds of computers and operating systems. Some of the popular browsers are –

Microsoft Internet Explorer: This Web browser is the most popular one. It also runs on most of the operating systems. Most important is that it is usually free with Windows operating system.

Netscape Navigator: It is available for Windows, Macintosh Operating System and Unix too. It supports features like integrated news and mail reader etc.

Lynx: It is the text only browser and works on Unix platform. It was developed by University of Kansas; it requires the emulation of terminal VT-100. Designing pages that work equally well in Lynx and in graphical browsers is one of the more interesting challenges of Web page design.

Mosaic: To begin with this was the most popular browser for the Net. It was the first full-color graphical browser and was instrumental in making the Web as popular as it is today. It was available free of cost, it was written by Marc Andreessen, who later started a new venture for making a new browser called Netscape with the passes of time.

Google Chrome: Google Chrome is a web browser developed by Google that uses the WebKit layout engine. It is the most popular web browser. It also runs on most of the operating systems. It was first released as a beta version for Microsoft Windows. The name is derived from the graphical user interface (GUI) frame, or "chrome", of web browsers.

Mozilla Firefox: Mozilla Firefox is a free and open source web browser. Mozilla Firefox is a graphical web browser developed by the Mozilla Corporation, and a large community of external contributors. Mozilla Fire Fox protects you from viruses, spyware and pop-ups. Mozilla Firefox offers to web browsing performance, usability, privacy and security.

Safari: Safari is the default browser of the Mac OS X operating system by Apple Computer and it also support to other operating system. Safari is fast, easy to use with its faster-loading Web pages and faster browsing.

10.10 Summary

After read this chapter, now you are able to access the internet and you know which devices are required for connecting your computer with Internet. You have learned why Internet is so called "network of networks", and what are the basic types of Internet connections? You are now able to send and receive e-mails though internet, and you can chat with your friends and elatives by using Internet social sites. You can use different search engines to search your desired information.

Now, you have learned very much about Intranet, Extranet and World Wide Web. You can use and access any Website, because you know about Web pages, Hyperlinks and Hypertext very well.

Key Words

Home Page: It is the first page that you would see on the Website

Internet Protocol: It is responsible for addressing and sending data from one computer to another.

ISP: Internet Service Provider, it is one gateway to the Internet.

Web Server : It refers to a location (computer) on the Internet that contains information in the form of Web pages.

Web Site : A web site is a collection of Web pages that may be maintained and updated by an organization.

Web Page: A Webpage is a document on the Web site.

FTP : File Transfer Protocol, it is used to transfer files from one computer to another.

URL: It describes the location and a method of accessing a resource on the Internet.

Search Engine: It is a special software that enables you to search the Web systematically.

Ethernet: It is a cabling device for connecting computers for networking.

Hypertext: Information on the Web is made available in Hypertext form.

Hyperlink: It allows you to link to the same document or to a different document.

Client/Server : A networking system in which one or more file servers (Server) provide services; such as network management, application and centralized data storage for workstations (Clients).

File Server : A computer connected to the network that contains primary files/applications and shares them as requested with the other computers on the network.

End User : Refers to the human executing applications on the workstation.

Node : End point of a network connection.

Protocol: A formal description of a set of rules and conventions that govern how devices on a network exchange information.

TCP/IP **:** Transmission Control Protocol/Internet Protocol. This is the standard governing communication between all computers on the Internet TCP/IP.

Packet **:** This is a unit of data, which is typically a part of a file, prepared for transmission across a network.

10.11 Self Assessment Questions

1 What is Internet? What are its characteristics?

2 What are the basic requirements for Internet connection?

3 Which protocols are used in Internet?

4 Explain the types of Internet connections?

5 What do you understand by the term Domain Names? Explain.

6 What is Intranet?

7 What are the uses of Intranet?

8 What do you mean by Extranet? What are its advantages and disadvantages?

9 Define the term WWW (W3)?

10 What do you mean by Web browser? Define its types.

11 Differentiate between Intranet & Extranet?

10.12 Reference Books

- Brian.K.Williams & Stacey C.Sawyer (2005) 'Using Information Technology' ; Tata McGraw Hill Publication company limited, Delhi.
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Unit - 11 : Database Management System

Structure of Unit:

11.0 Objectives
11.1 Introduction
11.2 What is Database?
11.3 Hierarchy of Database
11.4 Why database?
11.5 What is Database Management System?
11.6 Component of DBMS
11.7 Capabilities of Database Management System
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11.10 Data Independence
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11.12 Data Definition Language (DDL)
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11.0 Objectives

After the completing this unit, you will be able to:

- Understanding the database
- Know the use of database
- Understand the characteristics of database
- Manage of database
- Understand database management system

11.1 Introduction

A database system should be a repository of the data needed for an organization‘s data processing. The data should be accurate, private and protected from damage. It should be organized so that diverse application with different data requirement can employ the data.

The main purpose of database system is to provide timely, specific and accurately information at all levels in an organization. To achieve this goal different types of information system are devised by the organization

A database management system is the system in which related data is stored in an efficient and compact manner. “Efficient” means that the data which is stored in the DBMS can be accessed quickly and “compact” means that the data takes up very little space in the computer’s memory. The phrase “related data” is means that the data stored pertains to a particular topic.

11.2 What is Database?

All of us are familiar with the term *data*. In fact, unknowingly we come across data in our day to day life every day. The age of a person, price of potato, number of students in a school, pin code of a city, etc. are some examples of data. In our life we have to remember so much of data. But it is easier for us to remember all information for a few individuals. For example, you may be in a position to tell accurately the age, height, complexion, income, educational qualification, residential address, etc. of your close friends. But it is too difficult for you to memories all these information for a large number of individuals. Let us consider the example of National Open School (NOS). Every year about one lakh students take admission in NOS. If you are asked to memories records of date of birth, subjects offered and postal address of all these students, it will not be possible for you. Those there data are store is a database.

Database is a collection of information in a structured way. We can say that it is a collection of a group of facts. Your personal address book is a database of names you like to keep track of, such as personal friends and members of your family.

Let us look into our earlier example of information on students in NOS. A sample of 5 students is presented in the table below (Fig. 11.1). We have given 6 items of information on every student, namely, Roll No, Name, and Date of birth, Sex, Postal address and Subjects offered by the student.

There are six pieces of information on each student. Each piece of information in database is called a **Field**. We can define *field* as *the smallest unit in a database.* Each field represents one and only one characteristic of an event or item. Thus there are six fields in this database.

ROLL NO	NAME	D.O.B	SEX	ADDRESS	SUBJECTS
9721001	Subrat Das	21.05.1980	M	C36, Sector 2, Bhubaneswar Orissa	Pol Sc, Eco, History, Eng, Hindi
9721002	Aditya Bhoi	11.06.1981	M	At/Po. Burla, Sambal Pur	Phy, Chem, Biology, Eng, Hindi
9732012	Madhu Jain	03.01.1979	F	A31, Pilani, Rajasthan	Pol Sc, Eco, History, Eng, Hindi
9724004	Ahmad Ali	23.11.1979	M	12A, Sheikh Sarai-I, New Delhi	Phy, Chem, Biology, Eng, Hindi
9715023	C. Suresh	07.09.1980	M	96, Malviya Nagar, Bhopal	Pol Sc, Eco, History, Eng, Hindi

Figure 11.1

If you take a close look at all these fields, they are not of the same type. Date of birth is *date* type whereas Name is *character* type. In database there can be five categories of fields.

They are:

- Numeric
- Character
- Logic
- Memo
- Date

We will discuss about each type of field in detail later on in this lesson. First let us be familiar with another concept that we will use frequently.

All the related fields for a particular event (row) is called a **Record**. In the example above, all six fields taken together for a particular student is called a record of that student. Hence, since there are six students there are six records. Thus, we can define record as *a collection of logically related fields*.

Now we are in a position to define **database** in a formal manner. We can say that *it is a collection of logically related records.* In other words a database is a collection of database files, and each database file is a collection of records.

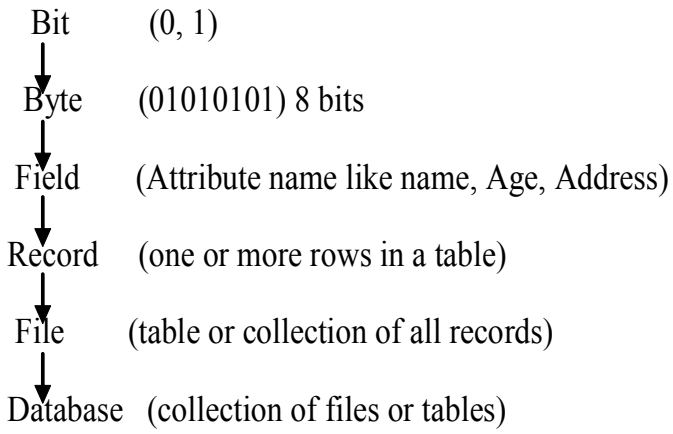
The task before us is creation of a database and its management. Data management involves creating, modifying, deleting and adding data in files, and using this data to generate reports or answer queries. The software that allows us to perform these functions easily is called a *Data Base Management System* (DBMS). Using a DBMS files can be retrieved easily and effectively.

There are many DBMS packages available in the market. Some of them are:

- dBASE III Plus
- FoxBASE Plus
- SoftBASE
- Clipper
- Paradox

There are some WINDOWS based database packages available in the market such as MS ACCESS (part of MS OFFICE).

11.3 Hierarchy of Database



11.4 Why Database?

We need database for:

Compactness: no need for possibly voluminous paper files.

Accuracy: Accurate, up-to-date information is available on demand at any time.

Speed: The machine can retrieve and change data faster than a human being.

Less Drudgery: much of the sheer tedium of maintaining files by hand is eliminated. Mechanical tasks are always better done by machines.

Redundancy: It means duplicate records. Same data is store is multiple location. Database helps us to eliminate redundancy.

Inconsistency: It means incomplete record. Database helps us to remove inconsistency in the database. Inconsistency occurs due to redundancy.

11.5 What is Database Management System?

A number of different application program are written to extract record from and add records to the appropriate files. But this scheme has a number of major limitations and disadvantages, such as data redundancy (duplication of data), data inconsistency, un sharable data, un standardized data, insecure data, incorrect data etc.

A database management system is answer to all these problems as it provides a centralized control of the data.

1. A **database management system** (DBMS), or simply a **database system** (DBS), consists of:
   - A collection of interrelated and persistent data (usually referred to as the **database** (DB)).
   - A set of application programs used to access, update and manage that data (which form the data management system (MS)).

2. The goal of a DBMS is to provide an environment that is both **convenient** and **efficient** to use in
   - Retrieving/updating information from /in the database.
   - Storing information into the database.

3. Databases are usually designed to manage **large** Quantity of information. This involves Definition of structures for information storage (data modeling).
   - Provision of mechanisms for the manipulation of information (file and systems structure, query processing).
   - Providing for the safety of information in the database (crash recovery and security).
   - Concurrency control if the system is shared by users.

In other words **Database Management System** (**DBMS**) is a software package with computer system that controls the creation, maintenance, and the use of database as per the need of the user.

It allows organizations to conveniently develop databases for various applications by Database administrator (DBAs) and other specialists.

A DBMS allows different user application programs to concurrently access the same database. DBMSs may use a variety of database models such as the model or object models, to conveniently describe and support applications.

It typically supports query language which is in fact high-level programming languages, dedicated database languages that considerably simplify writing database application programs.

Database languages also simplify the database organization as well as retrieving and presenting information from it. A DBMS provides facilities for controlling data access enforcing data integrity managing concurrently control he database after failures and restoring it from backup files, as well as maintaining database security.

The following are examples of database applications:

1. Computerized library systems
2. Automated teller machines
3. Flight reservation systems

11.6 Component of DBMS

A database system is composed of four components;

- Data
- Hardware
- Software
- Users

Which coordinate with each other to form an effective database system.

1. Data - Data is a very important component of the database management system. Most of the organizations generate, store and process 1arge amount of data which are stored in database. The data acts a bridge between the machine parts i.e. hardware and software and the users which directly access it or access it through some application programs.

Data may be of different types.

User Data - It consists of a table(s) of data called Relation(s) where Column(s) are called fields of attributes and rows are called Records for tables. A Relation must be structured properly.

Metadata - A description of the structure of the database is known as Metadata. It basically means "data about data". System Tables store the Metadata which includes.

- Number of Tables and Table Names
- Number of fields and field Names
- Primary Key Fields
- Nature of data to be store in the field eg. character Numeric etc.

Application Metadata - It stores the structure and format of Queries, reports and other applications components.

2. Hardware - The hardware consists of the secondary storage devices such as magnetic disks (zip disk, floppy disks), optical disks (CD-ROM), magnetic tapes etc. on which data is stored Hardware with the Input/output devices used for storing and retrieving the data in a fast and efficient manner. Since database can range from a single user with a desktop computer to those on mainframe computers with thousand of users, therefore proper care should be taken for choosing appropriate hardware devices for a required database.

3. Software - The Software part consists of DBMS which acts as a bridge between the user and the database or in other words, software that interacts with the users, application programs, and database and files system of a particular storage media (hard disk, magnetic tapes etc.) to insert, update, delete and retrieve data. For performing these operations such as insertion, deletion and updation we can either use the Query Languages like SQL, QUEL, Gupta SQL or application softwares such as Visual 3asic, Developer etc.

4. Users - There are two types of users Technical user like Database Administrator DBA) and end user. Users are those persons who need the information from the database to carry out their primary business responsibilities i.e. Personnel, Staff, Clerical, Managers, Executives etc. On the basis of the job and requirements made by them they are provided access to the database totally or partially.

11.7 Capabilities of Database Management System

- Retrieving data collectively or selectively
- Mathematical functions can be performed and the data stored in the database can be manipulated with these functions to perform the desired calculation
- Various reports can be produced from system. These may be either standardized reports or that may be specifically generated according to specific user definition
- To maintain data integrity and database use.

11.8 Advantages of Database Management System

A DBMS allows large amounts of data to be stored in the most efficient manner possible. The data is stored in lists of independent information. Additional data sets can be added at any time. Relationships between the data sets are defined in the DBMS, and can be altered without affecting the data.

1. Controlling Data Redundancy: In the conventional file processing system, every user group maintains its own files for handling its data files. This may lead to duplication of some data in different file. This may cause wastage resource.

2. Elimination of Inconsistency: In the file processing system information is duplicated throughout the system. So changes made in one file may not be necessary be carried over to another file. This may lead to inconsistent data. DBMS help us to remove this duplication of data in multiple file to eliminate inconsistency.

3. Better Service to the Users: A DBMS is often used to provide better services to the users. In conventional system, retrieval of information is often poor. Once several conventional systems are combined to form one centralized database, the availability of information and its updateness is likely to improve since the data can now be shared and DBMS makes it easy to respond to anticipated information requests.

Centralizing the data in the database also means that user can obtain new and combined information easily that would have been impossible to obtain otherwise. Also use of DBMS should allow users that don't know programming to interact with the data more easily, unlike file processing system where the programmer may need to write new programs to meet every new demand.

4. Flexibility of the System is Improved: Since changes are often necessary to the contents of the data stored in any system, these changes are made more easily in a centralized database than in a conventional system. Applications programs need not to be changed on changing the data in the database.

5. Integrity can be Improved: Since data of the organization using database approach is centralized and would be used by a number of users at a time. It is essential to enforce integrity-constraints.

In the conventional systems because the data is duplicated in multiple files so updating or changes may sometimes lead to entry of incorrect data in some files where it exists.

6. Standards can be Enforced: Since all access to the database must be through DBMS, so standards are easier to enforce. Standards may relate to the naming of data, format of data, structure of the data etc. Standardizing stored data formats is usually desirable for the purpose of data interchange or migration between systems.

7. Security can be Improved: In conventional systems, applications are developed in a temporary manner. Often different system of an organization would access different components of the operational data, in such

an environment enforcing security can be quiet difficult. Setting up of a database makes it easier to enforce security restrictions since data is now centralized. It is easier to control that has access to what parts of the database. Different checks can be established for each type of access (retrieve, modify, delete etc.) to each piece of information in the database.

Consider an **Example** of banking in which the employee at different levels may be given access to different types of data in the database. A clerk may be given the authority to know only the names of all the customers who have a loan in bank but not the details of each loan the customer may have. It can be accomplished by giving the privileges to each employee.

8. Organization's Requirement can be Identified: All organizations have sections and departments and each of these units often consider the work of their unit as the most important and therefore consider their need as the most important. Once a database has been setup with centralized control, it will be necessary to identify organization's requirement and to balance the needs of the competition units. So it may become necessary to ignore some requests for information if they conflict with higher priority need of the organization.

It is the responsibility of the DBA (Database Administrator) to structure the database system to provide the overall service that is best for an organization.

For example: A DBA must choose best file Structure and access method to give fast response for the high critical applications as compared to less critical applications.

9. Overall Cost of Developing and Maintaining Systems is Lower: It is much easier to respond to unanticipated requests when data is centralized in a database than when it is stored in a conventional file system. Although the initial cost of setting up of a database can be large, one normal expects the overall cost of setting up of a database, developing and maintaining application programs to be far lower than for similar service using conventional systems, Since the productivity of programmers can be higher in using non-procedural languages that have been developed with DBMS than using procedural languages.

10. Data Model Must be Developed: Perhaps the most important advantage of setting up of database system is the requirement that an overall data model for an organization be build. In conventional systems, it is more likely that files will be designed as per need of particular applications demand. The overall view is often not considered. Building an overall view of an organization's data is usual cost effective in the long terms.

11. Provides Backup and Recovery: Centralizing a database provides the schemes such as recovery and backups from the failures including disk crash, power failures, software errors which may help the database to recover from the inconsistent state to the state that existed prior to the occurrence of the failure, though methods are very complex.

11.9 Disadvantages of Database Management System

- Security may be compromised without good controls
- Integrity may be compromised without good controls
- Extra hardware may be required
- Performance overhead may be significant
- System is likely to be complex
- Database systems are complex, difficult, and time-consuming to design
- Substantial hardware and software start-up costs
- Damage to database affects virtually all applications programs

- Extensive conversion costs in moving form a file-based system to a database system
- Initial training required for all programmers and users

11.10 Data Independence

The ability to modify a scheme definition in one level without affecting a scheme definition in a higher level is called **data independence**. Data independence is the separation of the data that had been used for many different programs. So it is important to distinguish among both the data and the programs that are being used for that data.

Data independence also works with the database management system which is concerned with the portfolio of the data that is incorporated with a firm. Moreover it also represents the way in which the data is being managed and the management of the data needs to be done on separate levels for the entire data exists within a company.

Sometimes data independence does not require any changes at all and some of the changes that the user had to deal with may be with the size of the elements that is contained in the data or even the problem may also be encountered with the format of the data too. Transferring the data into some other format is a difficult job and it may require some people to exert efforts on a greater scale too on it. Mostly the changes that are made by the user are done in the data organization and its presentation.

There are two kinds:

- **Physical data independence**
  - The ability to modify the physical scheme without causing application programs to be rewritten
  - Modifications at this level are usually to improve performance
- **Logical data independence**
  - The ability to modify the conceptual scheme without causing application programs to be rewritten
  - Usually done when logical structure of database is altered

Logical data independence is harder to achieve as the application programs are usually heavily dependent on the logical structure of the data. An analogy is made to abstract data types in programming languages.

11.11 Data Abstraction

The major purpose of a database system is to provide users with an **abstract view** of the system. The system hides certain details of how data is stored and created and maintained. Complexity should be hidden from database users.

1. There are several levels of abstraction:

1. **Physical Level:**
   - How the data are stored. e.g. index, B-tree, hashing.
   - Lowest level of abstraction.
   - Complex low-level structures described in detail.
2. **Conceptual Level:**
   - Next highest level of abstraction.
   - Describes *what* data are stored.
   - Describes the relationships among data.
   - Database administrator level.

3. View Level:

- Highest level.
- Describes *part* of the database for a particular group of users.
- Can be many different views of a database.
- E.g. tellers in a bank get a view of customer accounts, but not of payroll data

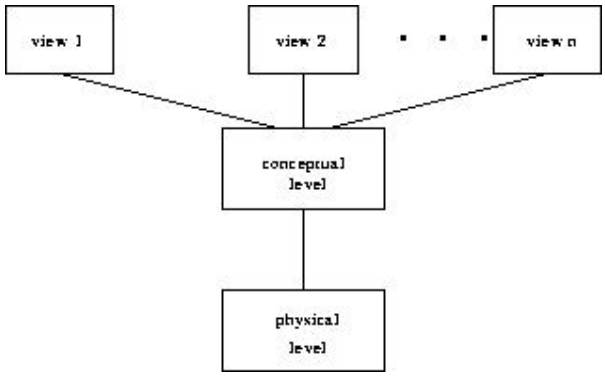


Figure 11.2: The Three Levels of Data Abstraction

11.12 Data Definition Language (DDL)

1. Used to specify a database scheme as a set of definitions expressed in a DDL

2DDL statements are compiled, resulting in a set of tables stored in a special file called a **data dictionary** or **data directory**.

2. The data directory contains **metadata** (data about data) .

3. The storage structure and access methods used by the database system are specified by a set of definitions in a special type of DDL called a **data storage and definition** language.

4. **Basic idea:** hide implementation details of the database schemes from the users .

DDL Include these Commands

1. Create 2. Alter 3. Truncate 4. Drop

1. Create Command :

The SQL syntax for CREATE TABLE is

CREATE TABLE "table_name" ("column 1" "data_type_for_column_1", "column 2""data_type_for_column_2",...)

Here column 1 and column 2 are field name ex. In the student table student name , class , address, and mob no. are the field name and data type are types of data example char, varchar,numbe, date etc.

Example: Create Table student using fields student name ,student class, student address .

Create table student(st_name varchar(10),st_calss varchar(10),st_add varchar(10));

For view the table we use select command :

Select * from student

St_name	St_class	St_add

2. Alter Command

SQL ALTER is the command used to add, edit, and modify data objects like tables, databases, and views. ALTER is the command responsible for making table column adjustments or renaming table columns. New table columns can also be added and dropped from existing SQL tables.

Add a new column in a table :

Alter table table_name add(new field name data type,new field2 data type …..);

Example :Alter the table student using Add new column Roll .no.

Alter table student add(Roll_no number(10));

St_name	**St_class**	**St_add**	Roll_no.

Modifying column(s) in a table

To modify a column in an existing table, the ALTER TABLE syntax is:

ALTER TABLE table_name

MODIFY column_name column_type;

Example :- Alter table student modify(Roll_no number(8));

Drop column(s) in a table

To drop a column in an existing table, the ALTER TABLE syntax is:

ALTER TABLE table_name DROP COLUMN column_name;

Example:- Alter table student drop column(st_add);

St_name	St_class	Roll_no

3. Truncate Table

TRUNCATE TABLE is functionally identical to DELETE statement with no WHERE clause: both remove all rows in the table. But TRUNCATE TABLE is faster and uses fewer system and transaction log resources than DELETE.

TRUNCATE removes all rows from a table. The operation cannot be rolled back and no triggers will be fired. As such, TRUCATE is faster and doesn't use as much undo space as a DELETE.

Command : **Truncate table student;**

4. Drop

The DROP command removes a table from the database. All the tables' rows, indexes and privileges will also be removed. No DML triggers will be fired. The operation cannot be rolled back.

Command **drop table student**

11.13 Data Manipulation Language (DML)

1. Data Manipulation is:

- **Retrieval** of information from the database
- **Insertion** of new information into the database
- **Deletion** of information in the database
- **Modification** of information in the database

2. A DML is a language which enables users to access and manipulate data. The goal is to provide efficient human interaction with the system.
3. There are two types of DML:
   - **Procedural**: the user specifies *what* data is needed and *how* to get it
   - **Nonprocedural**: the user only specifies *what* data is needed
     - Easier for user
     - May not generate code as efficient as that produced by procedural languages

4. A **query language** is a portion of a DML involving information retrieval only. The terms DML and query language are often used synonymously.

DML Commands : Select, Insert, Update, Delete

1) Insert - This command is used to add record(s) to a table. While inserting a record using the insert statement, the number of records being entered should match the columns of the table. In case the number of items being entered are less than the number of columns, in that case the field names also need to be specified along with the insert statement. See code example below

Example: insert into student sr_no,st_name,st_class,st_add values(1,'Ram', 'BCA',1101,'jaipur' ; **1 row inserted**

2) Select - This command is used to fetch a result set of records from a table, view or a group of tables, views by making use of SQL joins. Retrieval of data using SQL statements can be done by using different predicates along with it like

A

a) Where **b) Group By** **c) Having** **d) Order By**

Examples :

There are a table student that are shown in bellow:

S_no	St_name	St_class	St_roll	St_add
1	Ram	BCA	1101	Jaipur
2	Mohan	BBA	1204	Delhi
3	Rohan	MCA	2342	Jaipur
4	Monika	BA	2212	Jaipur
5	Richa	Bcom	3323	Ajmer

Use of where using select command:

i) Select * from student where st_ad='jaipur';

Output :

1	**Ram**	**BCA**	**1101**	**Jaipur**
2	**Rohan**	**MCA**	**2342**	**Jaipur**
3	**Monika**	**BA**	**2212**	**Jaipur**

ii) Select st_name,st_roll,st_class from student where st_name='ram';

Ram 1101 BCA

Group by

The Group By statement in SQL is used for aggregation, which means that the result that is returned is based on grouping of results based on a column aggregation.

Example : select st_add,sum(st_roll) from student where groupby st_add

Having

The Having statement in SQL makes sure that an SQL SELECT statement should only return rows where aggregate values match conditions that are stated.

Example : select st_add,sum(st_roll) from student where groupby st_add having st_roll>2000;

Order By

The Order By clause in SQL is used to set the sequence of the output in terms of being alphabetical, magnitude of size, order of date. It may accompanied by an 'asc' or 'desc' clause so as to specify whether the results are in ascending or descending order. Note: The results of a select query that does not use asc or desc is in ascending order, by default.

Example : for ascending order :

Select * from student order by st_name asc;

For descending order : Select * from student order by st_name desc ;

3) Update - This command is used to edit the record(s) of a table. It may be used to update a single row based on a condition, all rows, or a set of rows based on a condition. It is used along with the set clause. Optionally, a where clause may be used to match conditions. See code example Update table student set st_roll=6576 where st_name='Ram';

4) Delete - This command is used to remove record(s) from a table. All records may be removed in one go, or a set of records may be deleted based on a condition. See code example below:

Delete from student where st_name=1101

11.14 Database Manager

1. The database manager is a program module which provides the interface between the low-level data stored in the database and the application programs and queries submitted to the system.

2. Databases typically require lots of storage space (gigabytes). This must be stored on disks. Data is moved between disk and main memory (MM) as needed.

3. The goal of the database system is to simplify and facilitate access to data. Performance is important. Views provide simplification.

4. So the database manager module is responsible for

   - **Interaction with the File Manager:** Storing raw data on disk using the file system usually provided by a conventional operating system. The database manager must translate DML statements into low-level file system commands (for storing, retrieving and updating data in the database).
   - **Integrity Enforcement:** Checking that updates in the database do not violate consistency constraints (e.g. no bank account balance below 2500/- Rs. 500
   - **Security Enforcement:** Ensuring that users only have access to information they are permitted to see
   - **Backup and Recovery:** Detecting failures due to power failure, disk crash, software errors, etc., and restoring the database to its state before the failure
   - **Concurrency Control:** Preserving data consistency when there are concurrent users.

5. Some small database systems may miss some of these features, resulting in simpler database managers. (For example, no concurrency is required on a PC running MS-DOS.) These features are necessary on larger systems.

11.15 Data Administrator

The **database administrator** is a **person** having central control over data and programs accessing that data. Duties of the database administrator include:

- **Scheme Definition:** the creation of the original database scheme. This involves writing a set of definitions in a DDL (data storage and definition language), compiled by the DDL compiler into a set of tables stored in the data dictionary.
- **Storage Structure and Access Method Definition:** writing a set of definitions translated by the data storage and definition language compiler
- **Scheme and Physical Organization Modification:** writing a set of definitions used by the DDL compiler to generate modifications to appropriate internal system tables (e.g. data dictionary). This is done rarely, but sometimes the database scheme or physical organization must be modified.
- **Granting of Authorization for Data Access:** granting different types of authorization for data access to various users
- **Integrity Constraint Specification:** generating integrity constraints. These are consulted by the database manager module whenever updates occur.

11.16 Types of Database

There are four structural types of database management systems:

1. Hierarchical Database

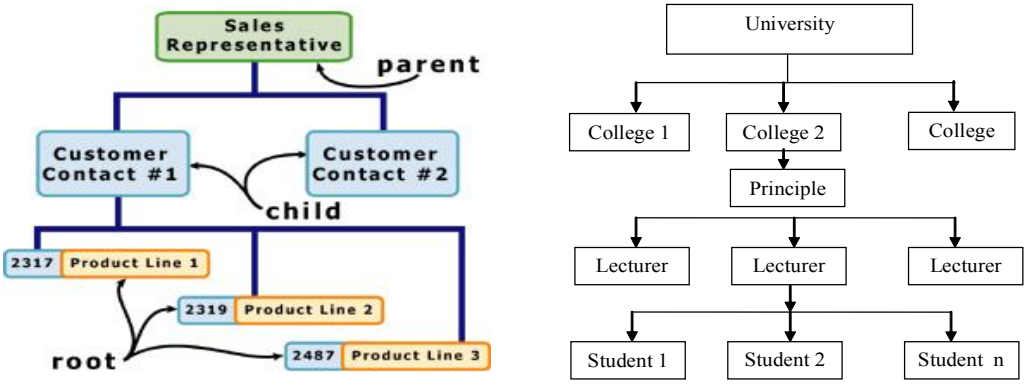


Figure 11.3 : Hierarchical Database

The **hierarchical structure** was used in early mainframe DBMS. Records' relationships form a treelike model. This structure is simple but nonflexible because the relationship is confined to a one-to-many relationship. IBM's IMS system and the RDM Mobile are examples of a hierarchical database system with multiple hierarchies over the same data. RDM Mobile is a newly designed embedded database for a mobile computer system. The hierarchical structure is used primarily today for storing geographic information and file systems.

Hierarchical Databases (DBMS), commonly used on mainframe computers, have been around for a long time. It is one of the oldest methods of organizing and storing data and it is still used by some organizations for making travel reservations. A hierarchical database is organized in pyramid fashion, like the branches of a tree extending downwards. Related fields or records are grouped together so that there are higher-level records and lower-level records, just like the parents in a family tree sit above the subordinated children.

Based on this analogy, the parent record at the top of the pyramid is called the **root record**. A child record always has only one parent record to which it is linked, just like in a normal family tree. In contrast, a parent record may have more than one child record linked to it. Hierarchical databases work by moving from the top down. A record search is conducted by starting at the top of the pyramid and working down through the tree from parent to child until the appropriate child record is found. Furthermore, each child can also be a parent with children underneath it.

The advantage of hierarchical databases is that they can be accessed and updated rapidly because the tree-like structure and the relationships between records are defined in advance. However, this feature is a two-edged sword. The disadvantage of this type of database structure is that each child in the tree may have only one parent, and relationships or linkages between children are not permitted, even if they make sense from a logical standpoint. Hierarchical databases are so rigid in their design that adding a new field or record requires that the entire database be redefined.

2. Network Database

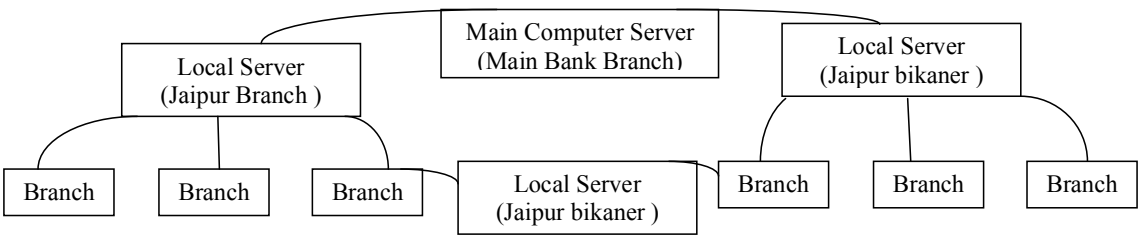


Figure 11.4 : Network Database

The **network structure** consists of more complex relationships. Unlike the hierarchical structure, it can relate to many records and accesses them by following one of several paths. In other words, this structure allows for many-to-many relationships.

Network databases are similar to hierarchical databases by also having a hierarchical structure. There are a few key differences, however. Instead of looking like an upside-down tree, a network database looks more like a cobweb or interconnected network of records. In network databases, children are called **members** and parents are called **owners**. The most important difference is that each child or member can have more than one parent (or owner).

Like hierarchical databases, network databases are principally used on mainframe computers. Since more connections can be made between different types of data, network databases are considered more flexible. However, two limitations must be considered when using this kind of database. Similar to hierarchical databases, network databases must be defined in advance. There is also a limit to the number of connections that can be made between records.

3. Relational Databases

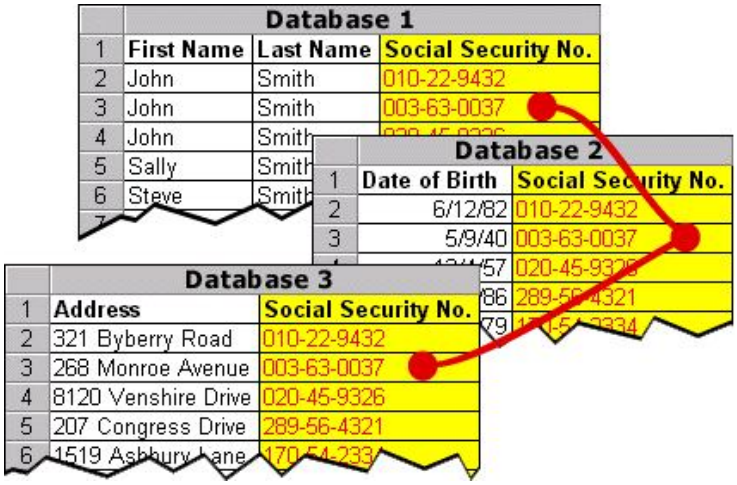


Figure 11.5

The **relational structure** is the most commonly used today. It is used by mainframe, midrange and microcomputer systems. It uses two-dimensional rows and columns to store data. The tables of records can be connected by common key values. While working for IBM, E.F. Codd designed this structure in 1970. The model is not easy for the end user to run queries with because it may require a complex combination of many tables.

In **relational databases**, the relationship between data files is relational, not hierarchical. Hierarchical and network databases require the user to pass down through a hierarchy in order to access needed data. Relational databases connect data in different files by using common data elements or a key field. Data in relational databases is stored in different tables, each having a key field that uniquely identifies each row. Relational databases are more flexible than either the hierarchical or network database structures. In relational databases, tables or files filled with data are called **relations**, **tuples** designates a row or record, and columns are referred to as **attributes** or fields.

Relational databases work on the principle that each table has a key field that uniquely identifies each row, and that these key fields can be used to connect one table of data to another. Thus, one table might have a row consisting of a customer account number as the key field along with address and telephone number. The customer account number in this table could be linked to another table of data that also includes

customer account number (a key field), but in this case, contains information about product returns, including an item number (another key field). This key field can be linked to another table that contains item numbers and other product information such as production location, color, quality control person, and other data. Therefore, using this database, customer information can be linked to specific product information.

The **multidimensional structure** is similar to the relational model. The dimensions of the cube-like model have data relating to elements in each cell. This structure gives a spreadsheet-like view of data. This structure is easy to maintain because records are stored as fundamental attributes - in the same way they are viewed - and the structure is easy to understand. Its high performance has made it the most popular database structure when it comes to enabling online analytical processing (OLAP).

The **object oriented structure** has the ability to handle graphics, pictures, voice and text, types of data, without difficultly unlike the other database structures. This structure is popular for multimedia Web-based applications. It was designed to work with object-oriented programming languages such as Java.

The dominant model in use today is the ad hoc one embedded in SQL, despite the objections of purists who believe this model is a corruption of the relational model since it violates several fundamental principles for the sake of practicality and performance. Many DBMSs also support the Open Database Connectivity API that supports a standard way for programmers to access the DBMS.

Before the database management approach, organizations relied on file processing systems to organize, store, and process data files. End users criticized file processing because the data is stored in many different files and each organized in a different way. Each file was specialized to be used with a specific application. File processing was bulky, costly and nonflexible when it came to supplying needed data accurately and promptly. Data redundancy is an issue with the file processing system because the independent data files produce duplicate data so when updates were needed each separate file would need to be updated. Another issue is the lack of data integration. The data is dependent on other data to organize and store it. Lastly, there was not any consistency or standardization of the data in a file processing system which makes maintenance difficult.

11.17 Summary

A DBMS is a set of Software program that controls the system organization storage, management, and retrieval of data in a database. DBMSs are categorized according to their data structures or types. The DBMS accepts requests for data from an application program and instructs the operating system to transfer the appropriate data. The queries and responses must be submitted and received according to a format that conforms to one or more applicable protocols. When a DBMS is used, information system can be changed more easily as the organization's information requirements change. New categories of data can be added to the database without disruption to the existing system.

11.18 Assessment Questions

1. What is DBMS? What are the advantages of DBMS?
2. What are the different types of database management? Explain.
3. Explain data model used in creation of database
4. Illustrate data, database, records, fields.

11.19 Reference Books

- Brian.K.Williams & Stacey C.Sawyer (2005) 'Using Information Technology' ; Tata McGraw Hill Publication company limited, Delhi.
- Henry.C.Lucas,Jr. (2001) ' Information Technology'; Tata McGraw Hill Publication company Limited, New Delhi.
- D.P.Sharma (2008); 'Information Technology' ; College Book Centre , 2008, Jaipur.
- P.K.Sinha, Priti Sinha,(2007) 'Computer Fundamentals' ; BPB Publication, New Delhi.

Unit - 12 : Data and Information

Structure of Unit:

12.0 Objectives
12.1 Introduction
12.2 Concept of Data and Information
12.3 Data Processing
12.4 Classification of Information
12.5 Quality of Information
12.6 Use of Information in Different Levels of Hierarchy in an Organization.
12.7 Summary
12.8 Self Assessment Questions
12.9 Reference Books

12.0 Objectives

After completing this unit, you will be able to:

- Understand the meaning of Data and Information and the difference between them.
- Understand the data processing concept and systems
- Classify the information types
- Know about the measures of the quality of information
- Information need of different levels of management in an organization.

12.1 Introduction

Information has a great impact on decision making, and hence its value is closely tied to the out come of the decisions. It is very necessary to understand the concept of data and information. This unit introduces the concept of data and information and makes you able to understand information need of the various level of the organization differ from each other. As a student of management graduation, you need to understand their requirement to give you, perspective of information need.

12.2 Concept of Data and Information

Data refers to raw, unevaluated facts, figures, symbols, objects, etc. Data may be a collection of facts lying in storage, like a telephone directory or census records.

Information is data that have been put into a meaningful and useful context and communicated to a recipient who uses it to make decisions. Information involves the communication and reception of intelligence or knowledge. It appraises and notifies, surprises and stimulates, reduces uncertainty, reveals additional alternatives, helps eliminate irrelevant, and influences individuals and stimulates them to action. An element of data may constitute information in a specific context; for example, when you want to contact your friend, his or her telephone number is a piece of information; otherwise, it is just one element of data in the telephone directory.

We all know that Computer is an electronic machine that takes something from us and converts it into some desired output after processing based on some specified logic. Here we can say in simple terms that whatever we insert or input in the computer can be referred to as 'data' and whatever computer produces after the processing can be referred to as 'information'.

For example if we are entering the details of all the students of a particular class of a school into the computer such as each student's name, address, marks, age etc., these all details can be collectively called as 'data' of a particular class. Now, if we are to find the students having marks more than 60%, then, this takes some processing inside the computer and, as a result, a list of the students having marks more than 60% is produced. This result or output provided by the computer is called the 'information'.

We can illustrate the concept of data and information as per the following figure:

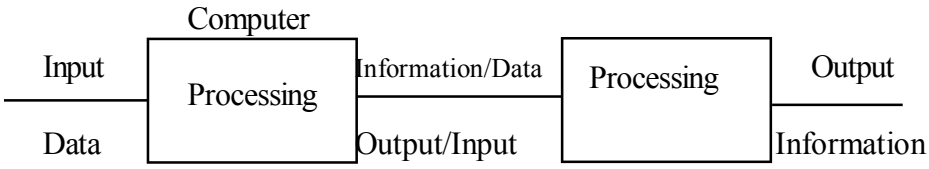


Figure 12.1 : Data and Information

As, we see in the above figure the information can further be treated as data if it is reprocessed by the computer. So, the 'data' and 'information' is interchangeable as per the input and output requirements based up on.

Nature of Processing: Therefore, we can say that data means which we are giving as input to the system and information means, the result which we are seeing on the screen for the given data after the completion of all the processes.

1. Data

Data is a collection of facts, such as values or measurements. It can be numbers, words, measurements, observations or even just descriptions of things. Not only numbers, the term 'Data' also refers all types of text, images, audio, video etc. Text includes alphabets, numbers, special symbols like ? , . / ~ @ # $ % ^ & * ( ) _ + < > etc.

A more specific and technical meaning of data is that "Data is a Representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means."

Dictionary meaning of Data: "Data is a plural of datum, which is originally a Latin noun meaning "something given." Today, data is used in English both as a plural noun meaning "facts or pieces of information", Data is a singular mass noun meaning 'information'. "

2. Information

Simply speaking, 'Information' is the processed 'Data', means when we do some processing on given raw data, the result produced is referred to as 'Information'.

Information is a stimulus that has meaning in some context for its receiver. When information is entered into and stored in a computer, it is generally referred to as data. After processing (such as formatting and printing), output data can again be perceived as information.

Information is the collection of useful data and provides meaningful knowledge. It most restricted technical sense is an ordered sequence of symbols that record or transmit a message. It can be recorded as signs, or conveyed as signals by waves. It is presented within a context that gives it meaning and reverence.

3. Difference between Data and Information

The frequency of the use of the words data and information are very high in our daily lives. Depending on the context the meanings and use of these words differ. Both data and information are types of knowledge or something used to attain knowledge. Though used interchangeably, there are many differences between the meanings of these two words.

Data refers to the lowest abstract or a raw input which when processed or arranged makes meaningful output called information. It is the group or chunks which represent quantitative and qualitative attributes pertaining to variables. Information is usually the processed outcome of data. More specifically speaking, it is derived from data. Information is a concept and can be used in many domains.

Information can be a mental stimulus, perception, representation, knowledge, or even an instruction. The examples of data can be facts, analysis, or statistics. In computer terms, symbols, characters, images, or numbers are data. These are the inputs for the system to give a meaningful interpretation. In other words, data in a meaningful form is information.

Information can be explained as any kind of understanding or knowledge that can be exchanged with people. It can be about facts, things, concepts, or anything relevant to the topic concerned.

The word information was derived from Latin. The verb from which it is derived is informare, which means 'to instruct'. It also means giving form to an idea or fact. Data is the plural of the Latin word datum. It can mean 'to give'. In the realms of mathematics and geometry, the terms data and given are very often used interchangeably. This is how the term was derived for use in computer realm.

If data is at the lowest level in the series, information is placed at the next step. As an example, if you have a list on the Seven Wonders of the World, that is a data; if you have a book giving details about each wonder, it is information.

Data can be in the form of numbers, characters, symbols, or even pictures. A collection of these data which conveys some meaningful idea is information. It may provide answers to questions like who, which, when, why, what, and how.

The raw input is data and it has no significance when it exists in that form. When data is collected or organized into something meaningful, it gains significance. This meaningful organization is information.

Data is often obtained as a result of recordings or observations. For example, the temperature of the days is data. When this data is to be collected, a system or person monitors the daily temperatures and records it. Finally when it is to be converted into meaningful information, the patterns in the temperatures are analyzed and a conclusion about the temperature is arrived at. So information obtained is a result of analysis, communication, or investigation.

12.3 Data Processing

Computer Data Processing is a process that include: data entry summaries, analyse, convert data into usable information. The process may be automated and run on a computer. It involves recording, analysing, sorting, summarising, calculating, disseminating, updating and storing data. Data is most useful when well-presented and actually informative. Data-processing systems are often referred to as information systems. Data-processing systems typically manipulate raw data into information, and likewise information systems typically take raw data as input to produce information as output.

In order to be processed by a computer, data needs first be converted into a machine acceptable readable format. Once data is in digital format, various procedures can be applied on the data to get useful information. It means Data Processing can convert any data from one format to another. By means of various sources, customers give their opinions as data. Information system takes that raw data as input to produce Information as output.

12.3.1 Data Processing Cycle

A **data processing cycle** starts from the stage whereby you collect data then input the data in into a **computer system**.

For instance, if you are using a **spreadsheet application** such as Excel, The sales clerk inputs the sales made for the day in to a spreadsheet. At the end of the day, just before the close of work, the total sales for that day are added together, in other words the sales data is processed and the result (the output) is printed and sent to the sales manager. The printed sales report which is being sent to the sales manager is referred to as information.

Three basic stages of data process are illustrated below:

1. Daily sales invoice is collected and inputted into the computer(data)
2. All sales are added together (process)
3. The total sale is printed out (output)

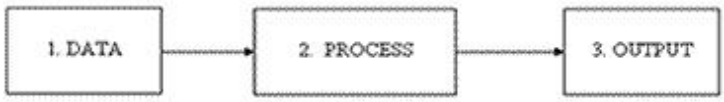


Figure 12.2

The data process cycle has the following basic stages:

- Data collection and input
- Data processing
- Data output

(a) Data Collection and Input Stage: The stage of data collection and input varies with the application used. However, this stage may include the following:

- Preparation of the source document
- Data coding and verification
- Data validation Data storage

These stages are further explained below:

Preparation of the Source Document

What is Source Document?: Source document as the name implies is the initial source of data. Examples are receipts, invoices, vouchers case notes, checks and any document from which data originates.

Data Coding and Verification: Data is encoded and verified in this phase. Data is transferred from the source document to the machine. The process of transferring **source document** details into the computer system can be done manually or electronically. For instance, data is transcribed though a keyboard device into a storage medium such as a magnetic tape or hard disk. **Source document** can also be transmitted over a network.

Data is Validated: Data may be validated by using a computer-controlled process that checks the data for validation. For example, if the user inputs number instead of text, the computer rejects the inputs.

The Data is Sorted: Data is sorted for efficiency. A good example is when using database software; you can use a **primary key** to sort records in the relevant master file.

A major example of the data collection and input stage is using the **Excel software application** to produce a **sales ledger**. The data input may include: · Account number · Name and address of the customer · The credit limit for the customer · The balance in the customer's account at any point in time; a zero balance is normally the first input when an account is first created.

(b) Data Processing Stage: This is a computer-controlled stage in which the data is processed after input. For example the sales transaction for the day is totalled and transferred from the sales daybook to the sales ledger, using the excel software package. This data processing stage also involves storage and retrieval.

(c) Data Output Stage: At this stage, the data that has been processed and is now in a useful form. That is, when that has been processed, it becomes information. The output (using the above example) will be the summary transaction for the day. This will be displayed in the Excel worksheet and can now be printed for management use. As said earlier it can also be saved and stored in an electronic format for future use.

12.3.2 Five Steps of Data Processing

It involves basically following 5 steps for Data Processing:

1. **Editing –** To determine the relevance of data is a crucial step in a data processing. Once the data has been accumulated from the different sources, the relevance of the data is been tested-out then. All the inappropriate data is taken out and only the relevant information is been kept.
2. **Coding –** All the needed information would be in a random order. Therefore, it needs to be aligned into a particular system so that it is unproblematic to comprehend it. This method other than Coding, is also called as 'netting' or 'bucketing' which necessitates certain codes.
3. **Data Entry –** Data is entered into the software that does the eventual cross tabulation. After the decision has been made on a code, edited data is than entered into the software.
4. **Validation –** Validation is the second phase of 'cleaning' in which thorough quality-check is been done. Data is double-checked so as to ensure that the process has been done infallibly.
5. **Tabulation –** Final step is the production of the end product which is tabulated in a systematic format so that thorough analysis can be done.

12.3.3 Data of Processing System

A Data Processing System is a system which processes data which has been captured and encoded in a format recognizable by the data processing system or has been created and stored by another unit of an information processing system.

A data entry is a specialized component or form of information processing (sub) system. Its chief difference is that it tends to perform a dedicated function (i.e., its program is not readily changeable). Its dedicated function is normally to perform some (intermediate) step of converting input ('raw' or unprocessed) data, or

semi-processed information, in one form into a further or final form of information through a process called decoding / encoding or formatting or re-formatting or translation or data conversion before the information can be output from the data processor to a further step in the information processing system.

12.4 Classification of Information

Information can be classified in five types, which are facts, concepts, procedures, processes, and principles. A description of each type of information is provided below:

Fact - A unique bit of information that identifies an object, person, place, or date.

Concept- A category of items or ideas that share common features.

Procedure- A series of steps that show how to make or do something.

Process- A description of how something works or operates.

Principle- Rules, heuristics, guidelines, criteria that predict an outcome.

12.5 Quality of Information

12.5.1 Information Quality Dimensions

"Information quality (IQ)" is a measure of the value which the information provides to the user of that information. "Quality" is often perceived as subjective and the quality of information can then vary among users and among uses of the information. Nevertheless, a high degree of quality increases its objectivity or at least the inter subjectivity. Accuracy can be seen as just one element of IQ but, depending upon how it is defined, can also be seen as encompassing many other dimensions of quality.

If not, it is perceived that often there is a trade-off between accuracy and other dimensions, aspects or elements of the information determining its suitability for any given tasks. A list of dimensions or elements used in assessing subjective Information Quality is:

Intrinsic IQ: Accuracy, Objectivity, Believability, Reputation

Contextual IQ: Relevancy, Value-Added, Timeliness, Completeness, Amount of information

Representational IQ: Interpretability, Ease of understanding, Concise representation, Consistent representation

Accessibility IQ: Accessibility, Access security

While information as a distinct term has various ambiguous definitions, there's one which is more general, such as "description of events". While the occurrences being described cannot be subjectively evaluated for quality, since they're very much autonomous events in space and time, their description can — since it possesses a garnishment attribute, unavoidably attached by the medium which carried the information, from the initial moment of the occurrences being described.

12.5.2 Illustration: Quality Information Criteria for Career Development Information

The information provided by the computer must follow some standard quality parameters that are critical. Let's take example of the information related to the career development. Here are the key criteria used to determine the quality information:

- **Accurate** - The information must be true, verifiable, and not deceptive. Accurate career information is based on empirical data and can be validated by comparing sources or checking for internal consistency.

- **Current** - The information must be applicable to the present time. Keeping information current requires a process of eliminating the old and adding the new. While some types of information are more perishable than others, it is generally accepted that occupation and education information should be reviewed and updated at least annually to be current.
- **Relevant** - Relevant information applies to the interests of the individuals who use it for the decisions they are facing. It should reduce a person's uncertainties about work and education while facilitating choice and planning. Since we live and work in local labor markets rather than in national ones, the better the description of local conditions, the more relevant it is to us. State and local information is usually more valuable than national.
- **Specific** - For information to be specific, it must contain concrete facts. General observations are often interesting and can provide a background for further analysis, but specific facts are essential to realistic planning and decision making.
- **Understandable** - People using information must be able to comprehend it before they can use it. Data must be analyzed and converted into words. The content of the message should avoid ambiguities and be informative to the intended audiences.
- **Comprehensive** - The information should include all the important categories within its scope of coverage. In CIS that includes the full range of occupational opportunities, their related educational programs of study and training, and the schools that offer them as the core. Related to that is information about money for school, looking for work, employers and industries, working for yourself, and so on.
- **Unbiased** - This characteristic is about the motivation or purpose for which the information is being produced and delivered. It is unbiased when the individual or organization delivering the information has no vested interest in the decisions or plans of the people who are receiving the information.
- **Comparable** - The information presented should be of uniform collection, analysis, content, and format so that you can compare and contrast the various occupations, programs of study, and schools.

These are some of the most important qualities that quality resources strive to achieve in making information useful for planning and decision-making. Information obtained from lots of sources creates a better picture and is more likely to result in successful career decisions and sound educational plans. Though it can sometimes be confusing and even conflicting, each source has its own unique strengths and limitations.

12.5.3 Proposed Quality Matrices

In an attempt to deal with this natural phenomenon, qualified professionals primarily representing the researchers' guild, have at one point or another identified particular metrics for information quality. They could also be described as 'quality traits' of information, since they're not so easily quantified, but rather subjectively identified on an individual basis.

Authority/Verifiability: Authority refers to the expertise or recognized official status of a source. Consider the reputation of the author and publisher. When working with legal or government information, consider whether the source is the official provider of the information. Verifiability refers to the ability of a reader to verify the validity of the information irrespective of how authoritative the source is. To verify the facts is part of the duty of care of the journalistic deontology, as well as, where possible, to provide the sources of information so that they can be verified

Scope of Coverage: Scope of coverage refers to the extent to which a source explores a topic. Consider time periods, geography or jurisdiction and coverage of related or narrower topics.

Composition and Organization: Composition and Organization has to do with the ability of the information source to present its particular message in a coherent, logically sequential manner.

Objectivity: Objectivity is the bias or opinions expressed when a writer interprets or analyze facts. Consider the use of persuasive language, the source's presentation of other viewpoints, it's reason for providing the information and advertising.

Integrity:

1. Adherence to moral and ethical principles; soundness of moral character
2. The state of being whole, entire, or undiminished

Comprehensiveness:

1. Of large scope; covering or involving much; inclusive: a comprehensive study.
2. Comprehending mentally; having an extensive mental grasp.
3. Insurance covering or providing broad protection against loss.

Validity: Validity of some information has to do with the degree of obvious truthfulness which the information caries

Uniqueness: As much as 'uniqueness' of a given piece of information is intuitive in meaning, it also significantly implies not only the originating point of the information but also the manner in which it is presented and thus the perception which it conjures. The essence of any piece of information we process consists to a large extent of those two elements.

Timeliness: Timeliness refers to information that is current at the time of publication. Consider publication, creation and revision dates. Beware of Web site scripting that automatically reflects the current day's date on a page.

Reproducibility (utilized primarily when referring to instructive information): Means that documented methods are capable of being used on the same data set to achieve a consistent result.

12.6 Use of Information in Different Levels of Hierarchy in an Organization

Information is a critical resource in the operation and management of organizations. Timely availability of relevant information is vital for effective performance of managerial functions such as planning, organizing, leading, and control. An information system in an organization is like the nervous system in the human body: it is the link that connects all the organization's components together and provides for better operation and survival in a competitive environment. Indeed, today's organizations run on information.

The term information system usually refers to a computer-based system, one that is designed to support the operations, management, and decision functions of an organization. Information systems in organizations thus provide information support for decision makers. Information systems encompass transaction processing systems, management information systems, decision support systems, and strategic information systems.

Information consists of data that have been processed and are meaningful to a user. A system is a set of components that operate together to achieve a common purpose. Thus a management information system collects, transmits, processes, and stores data on an organization's resources, programmes, and

accomplishments. The system makes possible the conversion of these data into management information for use by decision makers within the organization. A management information system, therefore, produces information that supports the management functions of an organization.

Why are there different types of Information System?

In the early days of computing, each time an information system was needed it was 'tailor made' - built as a one-off solution for a particular problem. However, it soon became apparent that many of the problems information systems set out to solve shared certain characteristics. Consequently, people attempted to try to build a single system that would solve a whole range of similar problems. However, they soon realized that in order to do this, it was first necessary to be able to define how and where the information system would be used and why it was needed. It was then that the search for a way to classify information systems accurately began.

How do you identify the different types of Information System in an organization?

The different types of information system that can be found are identified through a process of classification. Classification is simply a method by which things can be categorized or classified together so that they can be treated as if they were a single unit. There is a long history of classification of things in the natural world such as plants or animals, however, Information systems are not part of the 'natural' world; they are created and acquired by man to deal with particular tasks and problems.

The classification of information systems into different types is a useful technique for designing systems and discussing their application; it not however a fixed definition governed by some natural law. A 'type' or category of information system is simply a concept, an abstraction, which has been created as a way to simplify a complex problem through identifying areas of commonality between different things. One of the oldest and most widely used systems for classifying information systems is known as the pyramid model; this is described in more detail below.

How many different kinds of Information System are there?

As can be seen above, there is not a simple answer to this. Depending on how you create your classification, you can find almost any number of different types of information system. However, it is important to remember that different kinds of systems found in organizations exist to deal with the particular problems and tasks that are found in organizations. Consequently, most attempts to classify Information systems into different types rely on the way in which task and responsibilities are divided within an organization.

As most organizations are hierarchical, the way in which the different classes of information systems are categorized tends to follow the hierarchy. This is often described as "the pyramid model" because the way in which the systems are arranged mirrors the nature of the tasks found at various different levels in the organization.

Information system can be classified on the basis of its level where it is used. The information generated by their system are used at respective levels. The nature of activity performed at a level describes nature of decision under that level which in turn describe nature information used at that level. For example, this is a three level pyramid model based on the type of decisions taken at different levels in the organization.

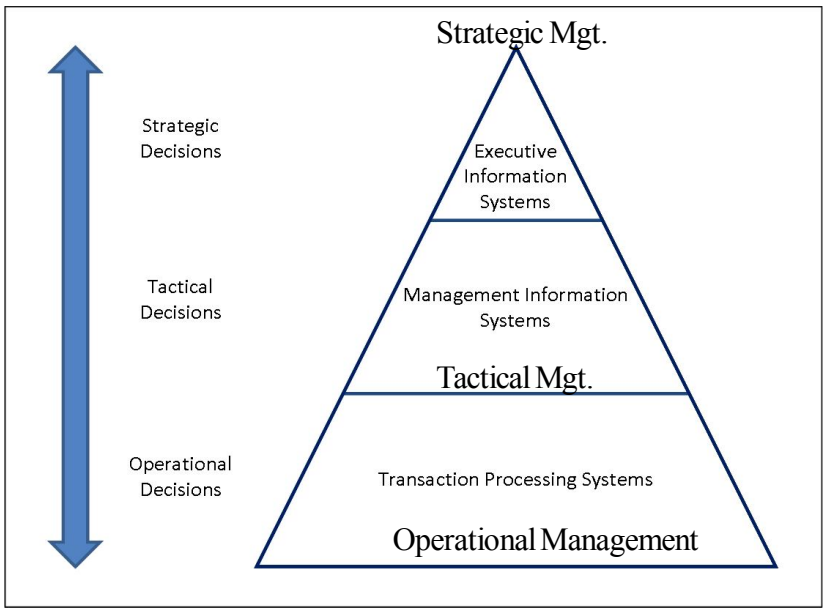


Figure 12.3 Three Level Pyramid Model

Similarly, by changing our criteria to the different types of date / information / knowledge that are processed at different levels in the organization, we can create a five level model.

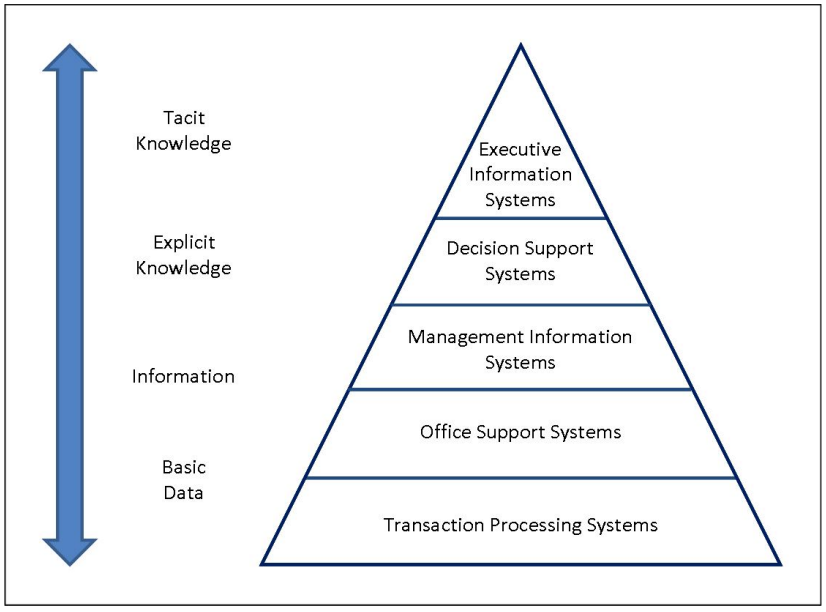


Figure 12.4 : Five Level Pyramid Model Based on the Processing Requirement of Different Levels in the Organization

What are the most common types of information system in an organization?

While there are several different versions of the pyramid model, the most common is probably a four level model based on the people who use the systems. Basing the classification on the people who use the information system means that many of the other characteristics such as the nature of the task and informational requirements, are taken into account more or less automatically.

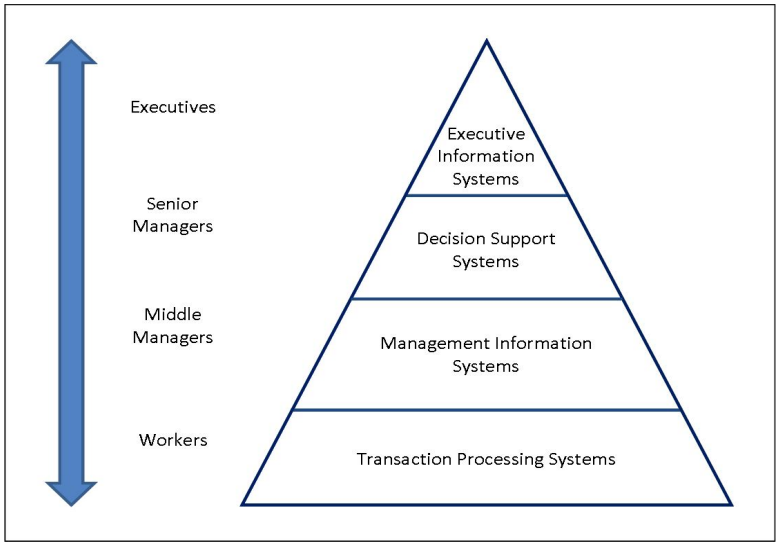


Figure 12.5 : Four Level Pyramid Model Based on the Different Levels of Hierarchy in the Organization

12.7 Summary

In this unit, we have understood the basic concept of Data and Information and the difference between them. First Section introduced the concept of Data and Information with good examples and the next section illustrated the Data Processing Cycle. Next section introduced the types and classification of information in which various categories of the information have been listed. Further we have also learnt about the quality matrices of Information. In the last section the role of Information for various levels of hierarchy in an organization have been discussed in detail.

12.8 Self Assessment Questions

1. Define Data.
2. Define Information.
3. Differentiate between Data and information.
4. What do you mean by Data Processing? Explain.
5. What are the types of information? List out.
6. What are various quality parameters of information? Explain.
7. Discuss the use of information for different levels of hierarchy in an organization.
8. What are the characteristics of information required by various level of management?

12.9 Reference Books

- Brian.K.Williams & Stacey C.Sawyer (2005) 'Using Information Technology' ; Tata McGraw Hill Publication company limited, Delhi.
- Henry.C.Lucas,Jr. (2001) ' Information Technology'; Tata McGraw Hill Publication company Limited, New Delhi.
- D.P.Sharma (2008); 'Information Technology' ; College Book Centre , 2008, Jaipur.
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Unit - 13 : Information System and their Classification

Structure of Unit:

13.0 Objectives
13.1 Introduction
13.2 Components of Information System
13.3 Different Kind of Information System
13.4 Role of Information System
13.5 Structure of Information System's Organization
13.6 Challenges in Developing an Information System
13.7 Summary
13.8 Self Assessment Questions
13.9 Reference Books

13.0 Objectives

After completing this unit, students would be able to:

- Understand the concept of information system;
- Categories different components of information systems;
- Classify the various information systems;
- Focus towards the information systems and their applications in real world situations;
- Learn differentiated technological terms and their usage of the era;

13.1 Introduction

In the present era information systems does have wide scope and utilities for proper business functioning. Business enterprises use information system for their regular operations and routine reporting.

Information System is a combination of two English words that are Information and System. Information means usable allocation of data. We had a detailed discussion of information in Unit 12. System is still a crucial issue.

The term system has been derived from Greek language *Systema* which means organized relationship among differentiated but associated elements. Existence of system is to achieve one or more objectives which have been decided before designing of system.

"A system is an orderly grouping in interdependent components linked together according to a plan to achieve a specific objective." **– Barry Boheam**

"A system is the set of elements in the form of ideas, things and people which are interrelated and part of a cohesive set-up, those synergies to achieve a specific goal or goals." **– Raymond Mcleod**

A system is essentially a set of elements which are interconnected or interdependent. In the same way, business organization is a system and parts (section, division, department and functional unit etc.) are the sub-systems, which direct the organizational efforts towards the achievement of its objectives. Modern business has achieved a very high degree of automation and joining of subsystems in scientific mechanical and factory manufacturing operations.

The study of system concepts has following three basic implications:

(i) A system must be designed to achieve a predetermined objective.

(ii) Interrelationship and interdependence must exist among the components.

(iii) The objectives of organization as a whole have a higher priority than the objectives of its subsystems.

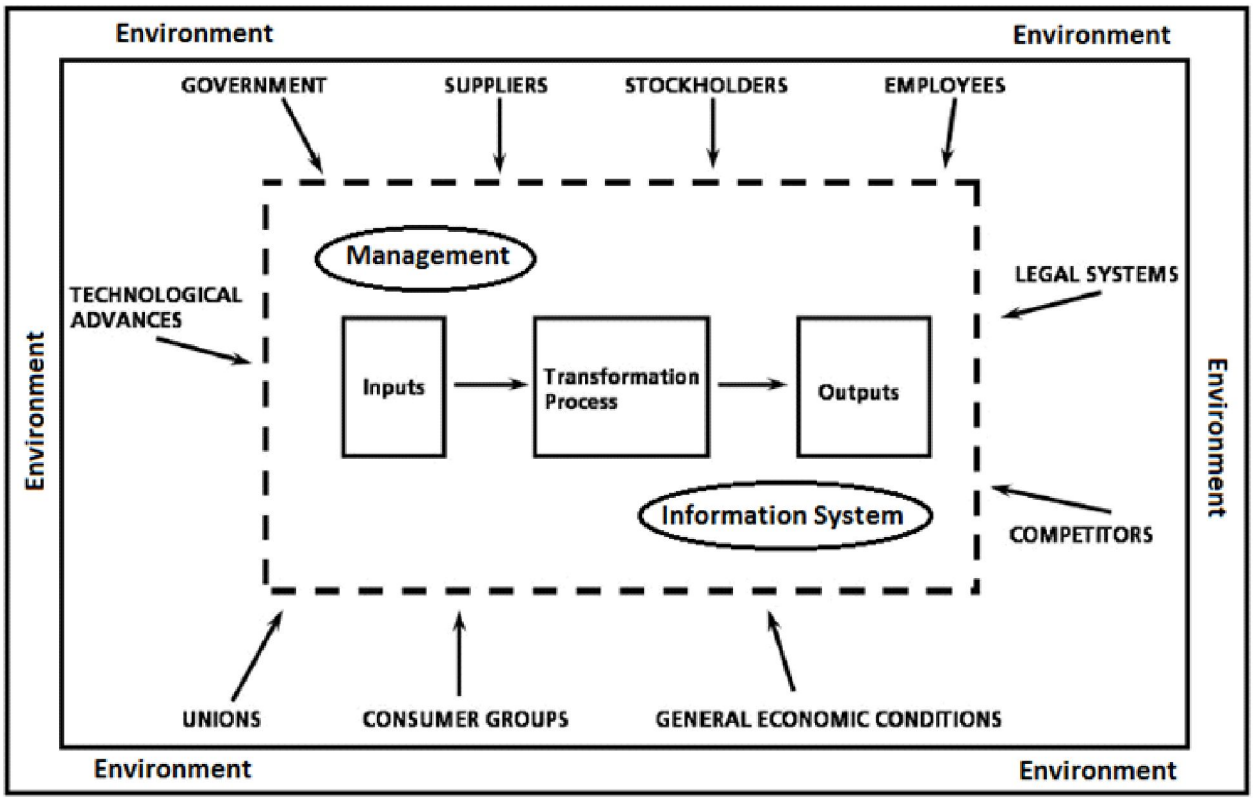


Figure 13.1 : Conceptual Design of System

Evolution of Computer Application for Information System

Information systems are virtual systems that enable management to control the operations of the physical system of the firm.

The physical system of the firm consists of tangible resources- materials, personnel, machines, and money. The soft virtual system consists of the information resources that are used to represent the physical system. For example, an inventory storeroom containing inventory items is a physical system, and the computer-base inventory file is a virtual system that represents the physical system. Figure 13.2 shows the physical system of a firm that transforms input resources into output resources. The input resources come from the internal environment, a transformation or process occurs, and then the output resources are returned to the same environment.

Although figure 13.2 represents a hereditary firm, it is easy to see how it fits a manufacturing operation which raw materials are transformed into finished products. Three other physical resources-machines, money, and human resources-flow through the system as well.

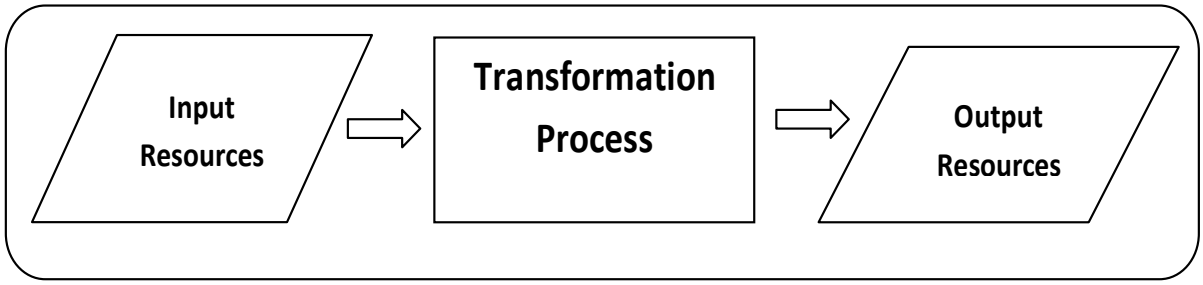


Figure 13.2 : Physical System of Business Organization

(a) Transaction Processing System: Before the computer came into existence, the firm's virtual systems were a combination of manual processes. Those combinations are made of key-driven bookkeeping machines, and punch-card systems that processed the firm's data. Data consist of facts and figures. Which are generally unusable because of their large volume and unprocessed in nature. Pre-computer systems processed inventory, billing data and general ledger records. This system was able to record regular transactions of their organizations. It was natural that these processes would become the first computer applications. After all, these processes were well understood, and speed and accuracy were increased because of improved computer system.

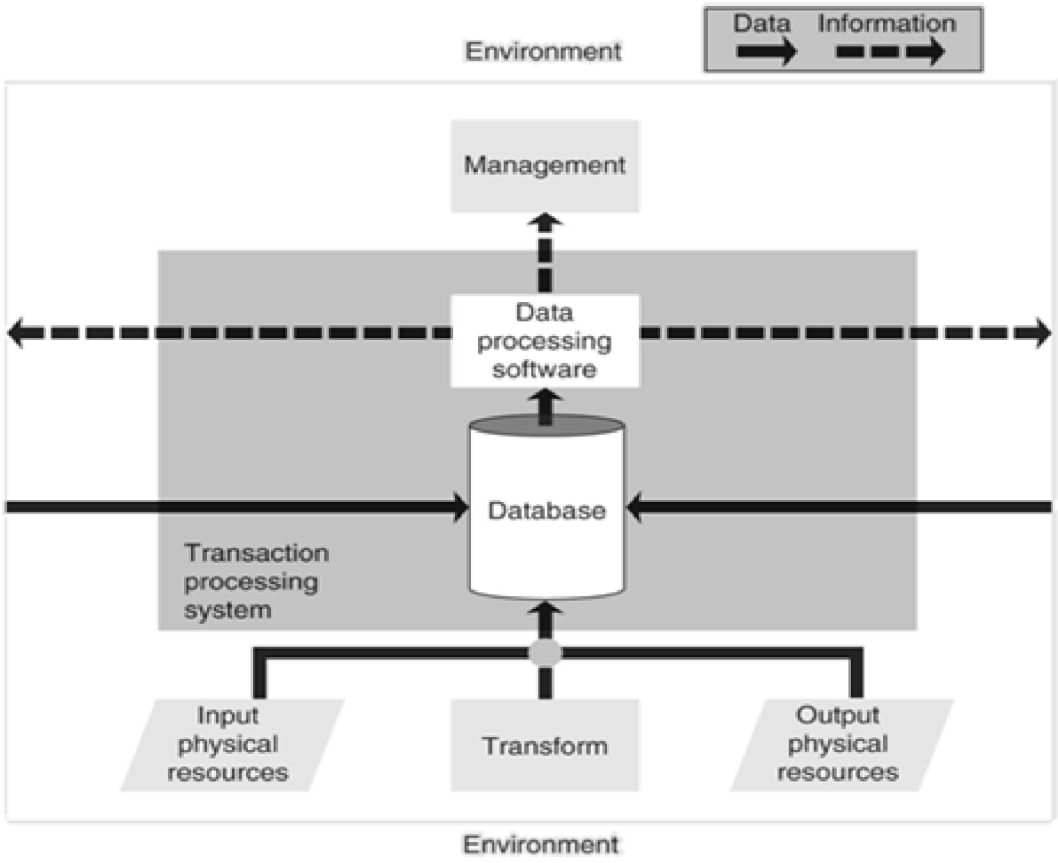


Figure 13.3 : Model of a Transaction Processing System (Adopted from Raymond, 2007)

The first computer-based systems were called Electronic Data Processing (EDP) systems. Later it is named as accounting information system (AIS). Now a day, the term Transaction Processing System (TPS) is common. These systems share a common bond in that they process data that reflects the functionality of the firm.

Figure 13.3 shows a model of a transaction processing system. The input, transformation, and output elements of the physical system of the firm are at the bottom. Data processing software transforms the data into information for the firm's management and for individuals and organizations in the firm's environment. Information is processed data that is meaningful; it usually tells users something that they did not already know; it creates a knowledge base for users and the application for organizations.

It is important to recognize the information flow of the environment. Much of the information produced by the TPS is intended for use by persons or organizations outside the firm.

(b) Management Information Systems: Information specialists and computer manufactures wanted to increase computing activity, so they sought new application areas. It did not take them

long to realize that the information output of transaction processing systems left much to be desired. The systems were generally incapable of transforming the volumes of data into sorted, organized, and processed information needed by managers.

Because of consistent development, managers learned more about the computers they became aware of the underlying logic of the processes, which they were following in solving problems. This activity was helpful in better describing their informational needs. Information specialists learned the basics of management and how to work with managers in designing information systems. The information systems were redesigned so that they fit more closely to the managers' needs. Such systems eventually became established as a major computer application area.

We can define a management information system (MIS) as a computer-based system that makes information available to users with similar needs. MIS users usually comprise a formal organizational entity. The information provided by the MIS describes the firm or one of its major systems in terms of what has happened in the past, what is happening now, and what is likely to happen in the future. The MIS produces the information through the use of two types of software. Following are they:

i) **Report Writing Software:** This tool produces both periodic and special reports. Periodic reports are coded in a programming language and are prepared according to a schedule. Special reports are prepared in response to unanticipated information needs. Today's database management systems have features that quickly generate reports in response to requests for specific data or information.

ii) **Mathematical Models:** This software produces information as a result of simulations of the firm's operations. Mathematical models describe the firm's operations, it can be written in any programming language. Special modeling languages make the task easier and faster.

The output information generated is used by problem solvers (both managers and professionals) to make decisions to solve the firm's problems.

Consider the MIS model in Figure 13.4 the database contains the data provided by the transaction processing system. In addition, both data and information are entered from the environment. The environment becomes involved when the firm interacts with other organizations, like suppliers, to form an Inter-Organizational System (IOS). In that situation, the MIS supplies information to other members of the IOS as well as to the firm's users.

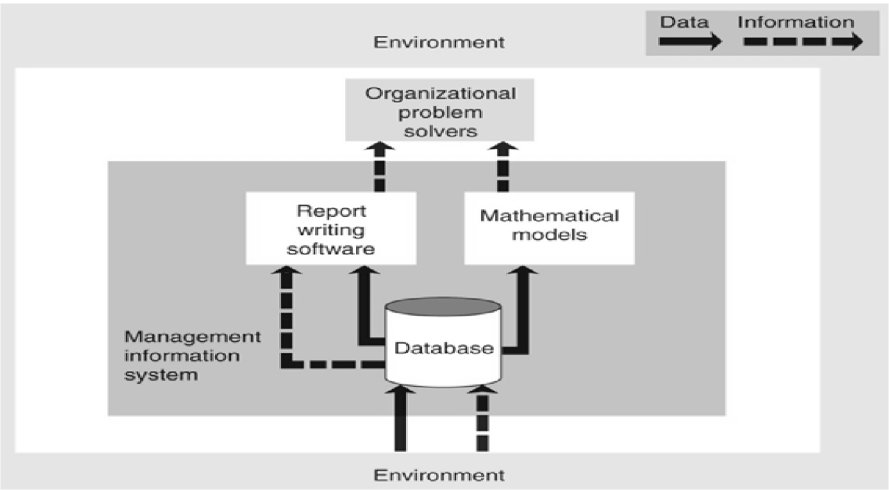


Figure 13.4 : An MIS Model (Adopted from Raymond, 2007)

Activity A:

1. Collect information for different available information system in functioning of business.

13.2 Components of Information System

We are now ready to apply the system concepts we have learned to help us better understand how an information system works. For example, we have said that an information system is a system is a system that accepts data resources as input and processes them into information products as output. How does an information system accomplish this? What system components and activities are involved?

Figure 13.5 illustrates an information system model that expresses a fundamental conceptual framework for the major components and activities of information systems. An information system depends on the resources of people (end users and IS specialists), hardware (machine and media), software (programs and procedures), data (data and knowledge bases), and networks (communications media and network support) to perform input. Processing, output, storage, and control activities that convert data resources into information products.

This information system model highlights the relationships among the components and activities of information systems. It provides a framework that emphasizes four major concepts that can be applied to all types of information systems:

- People, hardware, software, data, and networks are the five basic resources of information systems.
- People resources include end users and IS specialists, hardware resources consist of machines and media, software resources include both programs and procedures, data resources can include data and knowledge base, and network resources include communications media and networks.
- Data resources are transformed by information processing activities into a variety of information products for end users.
- Information processing consists of the system activities of input, processing, output, Storage, and control.

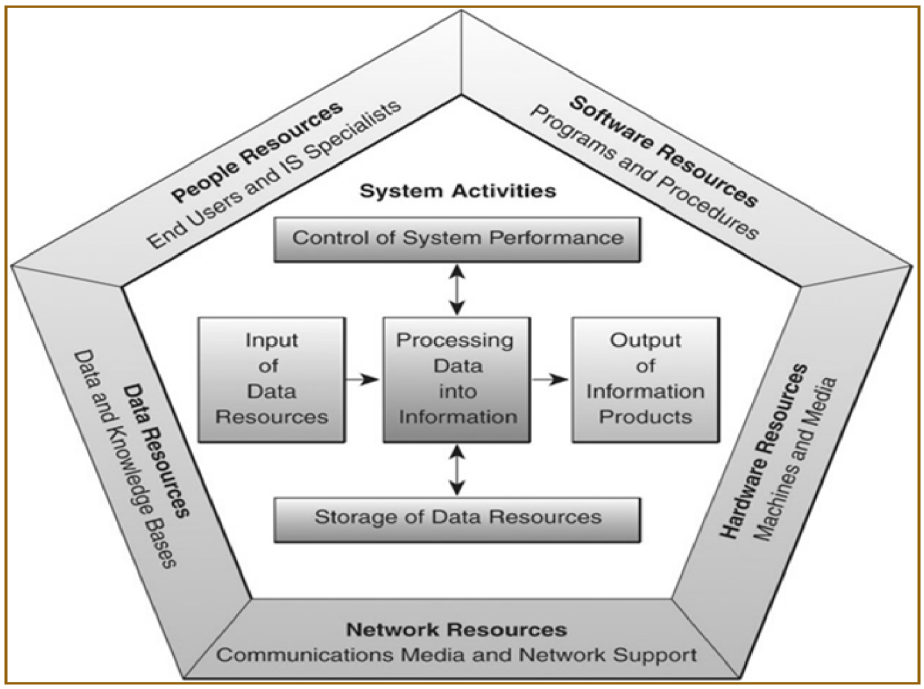


Figure 13.5 : Components of an Information System (Adopted from O'Brien, J. A. and Marakas, G. M., 2007)

Information System Resources

Our basic IS 1model shows that an information system consists of five major resources: people, hardware, software, data, and networks. Let's briefly discuss several basic concepts and examples of the roles these resources play as the fundamental components of information systems. You should be able to recognize these five components at work in any type of information system you encounter in the real world. Table 13.1 outlines several examples of typical information system resources and products.

Table 13.1: Resources and Products of Information System

Resource and Products	Handler	Explanation
People (R) Resource	Specialist	System Analyst, Software Developers, System Operators.
	End Users	Anyone else who use information systems.
Hardware (R) Resource	Machines	Computers, video monitors, magnetic disk drives, printers and optical scanners.
	Media	Floppy disks, magnetic tapes, optical disks, plastic cards, paper forms.
Software (R) Resource	Programs	Operating system programs, spreadsheet programs, word processing, payroll programs.
	Procedures	Data entry procedures, error correction procedures, paycheck distribution procedures.
Data (R) Resource		Product description, customer records, employee files, inventory databases.
Network (R) Resource		Communication media, communication processors, network access and control software.
Information (P) Project		Managing reports and business documents using text and graphics displays, audio responses, and paper forms.

1. **People Resources:** People are the essential ingredient for the successful operation of all information systems. These people resources include end-users and Information System Specialists (ISS).

   - End users (also called users or clients) are people who use an information system or the information it produces. They can be customers, salespersons, engineers, clerks, accountants, or managers, Most of us are information system end users. And most end users in business are knowledge workers, that is, people who spend most of their time communicating and collaborating in teams and workgroups and creating, using, and distributing information.
   - IS specialists are people who develop and operate information systems. They include systems analysts, software developers, system operators, and other managerial, technical, and clerical IS personnel. Briefly, systems analysts design information systems based on the information requirements of end users, software developers create computer programs based on the specifications of systems analysts, and system operators help to monitor and operate large computer systems and networks.

2. **Hardware Resources:** The concept of hardware resources includes all physical devices and materials used in information processing. Specifically, it includes not only machines, such as computers and other equipment, but also all data media, that is, tangible objects on which data are recorded, from sheets of paper to magnetic or optical disks. Examples of hardware in computer-based information systems are:

- Computer systems, which consist of central processing units containing microprocessors, and a variety of interconnected peripheral devices. Examples are handheld, laptop, or desktop microcomputer systems, midrange computer systems, and large mainframe computer systems.
- Computer peripherals, which are devices such as a keyboard or electronic mouse for input of data and commands, a video screen or printer for output of information, and magnetic or optical disks for storage of data resources.

3. **Software Resources:** The concept of software resources includes all set of information processing instructions. This generic concept of software includes not only the sets of operating instructions called programs, which direct and control computer hardware, but also the sets of information processing instructions called procedures that people need.

   It is important to understand that even information systems that don't use computers have a software resource component. This is true even for the information systems of ancient times, or the manual and machine-supported information systems still used in the world today. They all require software resources in the form of information processing instructions and procedures in order to properly capture, process, and disseminate information to their users.

   The following are examples of software resources:

- System software, such as an operating system program, which controls and supports the operations of a computer system.
- Application software, which are programs that direct processing for a particular use of computers by end users. Examples are a sales analysis program, a payroll program, and a word processing program.
- Procedures, which are operating instructions for the people who will use an information system. Examples are instructions for filling out a paper form or using a software package.

4. **Data Resources:** Data are more than the raw material of information systems. The concept of data resources has been broadened by managers and information systems professionals; they realize that data constitute valuable organizational resources. Thus, you should view data as data resources that must be managed effectively to benefit all end users in an organization.

   The concept of data as an organizational resource has resulted in a variety of changes in the modern organization. Data that were previously captured as a result of a common transaction are now stored, processed, and analyzed using sophisticated software applications that can reveal complex relationships about sales, customers, competitors, and markets. In today's wired world, the data to create a simple list of an organization's customers are protected with the same energy as the cash in a bank vault. Data is the lifeblood of today's organizations and the effective and efficient management of data is considered an integral part of organizational strategy.

   Data can take many forms, including traditional alphanumeric data, composed of numbers and alphabets and other characters that describe business transactions and other events and entities. Text data, consisting of sentences and paragraphs used in written communications, image data,

such as graphic shapes and figures, and photographic and video images, and audio data, the human voice and other sounds, are also important forms of data.

The data resources of information systems are typically organized, stored, and accessed by a variety of data resource management technologies into:

- Database that hold processed and organized data.
- Knowledge bases that hold knowledge in a variety of forms such as facts, rules, and case examples about successful business practices.

5. **Network Resources:** Telecommunications technologies and networks like the Internet intranets, and extranets are essential to the successful electronic business and commerce operations of all types of organizations and their computer-based information systems. Telecommunications networks consist of computers, communications processors, and other devices interconnected by communications media and controlled by communications software. The concept of network resources emphasizes that communications technologies and networks are a fundamental resource component of all information systems. Network resources include:

   - Communications media. Examples include twisted-pair wire, coaxial and fiber-optic cables; and microwave, cellular, and satellite wireless technologies.
   - Network infrastructure. This generic category emphasizes that many hardware, software, and data technologies are needed to support the operation and use of a communications network. Examples include communications processors such as modems and internetwork processors, and communications control software such as network operating systems and Internet browser packages.

Activity B:

1. Make a virtual information system for retail vegetable shop and identify required resources for that.

13.3 Different Kind of Information System

Conceptually, the applications of information systems that are implemented in today's business world can be classified in several different ways. For example, several types of information systems can be classified as either operations or functions.

Conceptual classification systems applications, information systems are categorized this way to spotlight the major roles each plays in the operations and management of a business at various levels. Let's look briefly at some examples of such information systems categories. See figure 13.6.

Operations Support Systems: information systems have always been needed to process data generated by, and used in, business operations. Such operations support systems produce a variety of information products for internal and external use. However, they do not emphasize producing the specific information products that can best be used by managers; further processing by management information systems is usually required. The role of a business firm's operation support system is to efficiently process business transactions, control industrial processes, support enterprise communications and collaboration, and update corporate database.

Transaction processing systems are an important example of operations support systems that record and process data resulting from business transactions. They process transactions in two basic ways. In batch processing, transaction data are accumulated over a period of time and processed periodically. In real-time

(or online) processing, data are processed immediately after a transaction occurs. For example, point-of-sale (POS) systems at many retail stores uses electronic cash register terminals to electronically capture and transmit sales data over telecommunications links to regional computer centers for immediate (real-time) or nightly (batch) processing.

Process control systems monitor and control physical processes. For example, a petroleum refinery uses electronic sensors linked to computers to continually monitor chemical processes and make instant (real-time) adjustments that control the refinery process. Enterprise collaboration systems enhance team and workgroup communications and productivity, and include applications that are sometimes called office automation systems. For example, knowledge workers in a project team may use electronic mail to send and receive electronic messages, and video conferencing to hold electronic meetings to coordinate their activities.

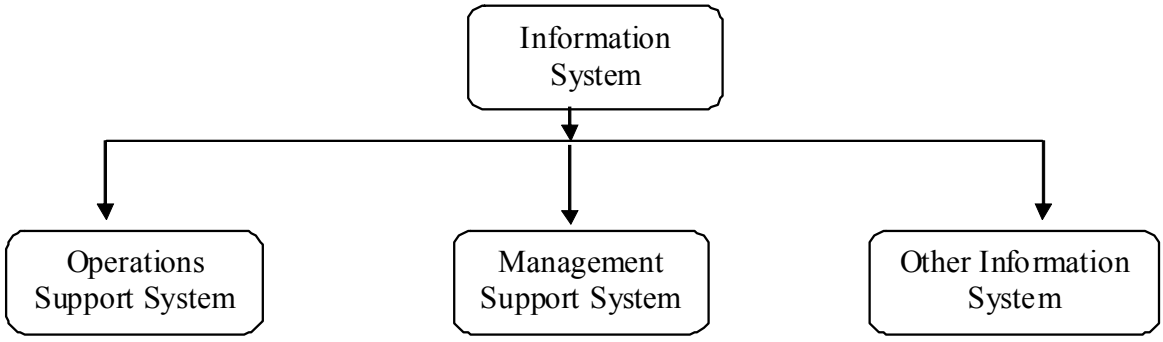


Figure 13.6: Classification of Information System

Management Support Systems: When information sys anagerial decisions such as loan portfolio management. Knowledge management systems are knowledge-base information systems that support the creation, organization, and dissemination of business knowledge to employees and mangers throughout a company. Information systems that focus on operational and managerial applications in support of basic business functions such as accounting or marketing are known as functional business systems. Finally, strategic information systems apply information technology to a firm's products, services, or business processes to help it gain a strategic advantage over its competitors.

It is also important to realize that business applications of information systems in the real world are typically integrated combinations of the several types of information systems we have just mentioned. That's because conceptual classifications of information systems are designed to emphasize the many different roles of information systems. In practice, these roles combined into integrated or cross-functional information systems that provide a variety of functions. Thus, most information systems are designed to produce information and support decision making for various levels of management and business function, as well as do record-keeping and transaction processing chores. So whenever you analyze an information system, you will probably see that it provides information for a variety of managerial levels and business functions.

(a) Executive Information System

Executive information systems (EIS) are information systems that combine many of the features of management information systems and decision support systems. However, when they were first developed, their focus was on meeting the strategic information needs of top management. Thus, the first goal of executive information systems was to provide top executives with immediate and easy access to information about a firm's *critical success factors* (CSFs), that is, key factors that are critical to accomplishing an organization's strategic objectives. For example, the executive of a department store chain would probably consider factors such as its sales promotion efforts and its product line mix to be critical to its survival and success.

Components of an EIS: Executive workstations in an EIS are typically networked to mainframe or midsize systems or LAN servers for access to EIS software. The EIS package works with database management and telecommunications software to provide easy access to internal, external, and special management database (such as multidimensional analytical databases) with almost instantaneous response times. Executive information systems provide information about the current status and projected trends in a company's critical success factors, as determined by its executive users. An analytical modeling capability to evaluate alternatives for decision support is also provided by newer EIS packages, as are some expect system features, such as an explain capability.

In an EIS, information is presented in forms tailored to the preferences of the executives using the system. For example, most executive information systems stress the use of a graphical user interface and graphics displays that can be customized to the information preferences of executives using the EIS. Other information presentation methods used by an EIS include exception reporting and trend analysis. The ability to drill down, which allows executives to quickly retrieve displays of related information at lower levels of detail, is another important capability of an EIS.

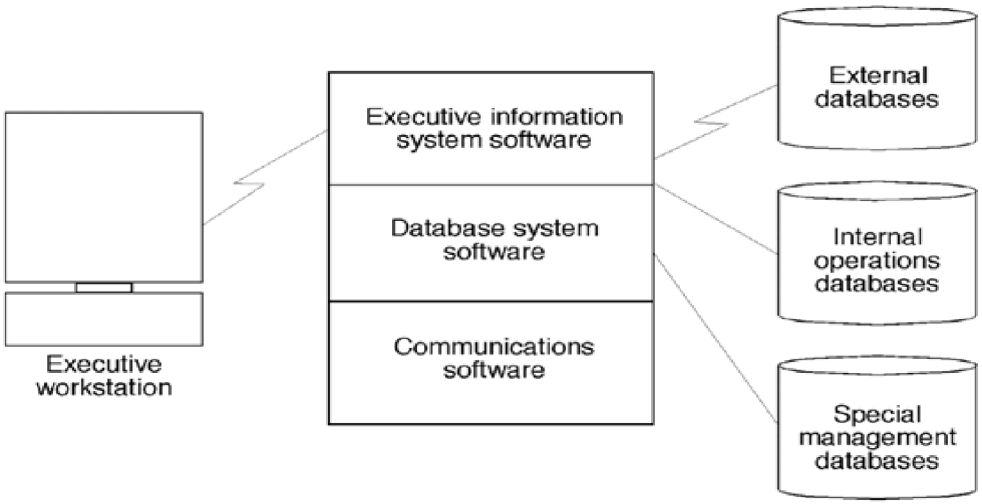


Figure 13.7: Components of EIS (Adopted from O'Brein, 1993)

Key Factors Needed For a Successful EIS: There are many factors behind a successful executive information system. EIS requires a lot of things for its best performance. Few of these are described following:

(i) **Involvement and Commitment of Top Management:** Identify a dedicated executive sponsor with a strategic use of Information Technology (IT).

(ii) **Identifying Data Sources:** A successful EIS implementation depends on the availability of accurate and complete data.

(iii) **Focused Only Important things:** Organization CSFs (Critical Success Factors), exception reporting, accessing information with drill-down capability are a key to success of an EIS.

(iv) **Response Time:** A successful EIS will increase in use, functionality, and scope over time. EIS has to decrease it response time according to data requirement.

(v) **Computer Literacy Level of Executives:** Dictates presentation format, degree of use of graphics, text mouse, touch screen, etc. the EIS must be easy to use.

(vi) **Learning Curve of Development Team:** Tools to be used are key, especially if developing a system. Familiar tools are best. Vendor support for an EIS package is essential.

(vii) Ongoing Support: EIS cannot be implemented and forgotten. Continuing support is critical to satisfy changing needs.

(b) Management Information System

With the completion of planning process clarity in action programs, clarity in units of measure for each activity and the time period, control finally completes the feedback system and helps an organization accomplish its objective.

There are following three steps in controlling process with MIS paradigm:

(i) Establishing standards or measures of performance for each activity or goal.

(ii) Actual measurement of performance.

(iii) Correcting deviations of reinforcing conformity.

The following diagram pictorially demonstrates the control process in organizations as a feedback system or you can say the tools of measurement with the help of MIS scenario.

Concept of MIS: Management Information System (MIS) is a system, which is designed to provide information to various organizational levels, to assist them in decision making. This is certainly not a new system. Many firms have customer information system (CIS), accounting information system (AIS), and marketing information system also. These levels use the use the information for purpose of decision making. As the business organization grow in complexity, managers depend more heavily upon various external and internal sources of information. The growing complexity of the business organizations also increases the quantum of point at which decision must be made, Ranging from individual decision maker at the lowest operating levels to strategic decision-maker. Few definitions of different experts are given below:

"MIS is a planned system of collecting, processing, storing and disseminating data in the form of information needed carry out the functions of management"

- F.B. Cornish

"Management Information System is an integrated men-machine system for providing information to support the operations, management and decision making function in an organization."

- G.B. Davis

"MIS is a system that aids management in making, carrying out and controlling decisions."

- Jerome Kanter

According to James A.O' Brein, Management Information Systems, also called information reporting systems, were the original type of management support systems, and are still a major category of information systems. MIS produce information products that support many of the day-to-day decision making needs of management. Reports, displays, and responses produced by such systems provide information that managers have specified in advance as adequately meeting their information needs. See figure 13.8.

Managers can receive information at their workstations that support their decision making activities. This information takes the forms of periodic, exception, and demand reports and immediate responses to inquiries. Application programs and database management software provide access to information in the corporate database of organization. One of a typical MIS's diagram given below:

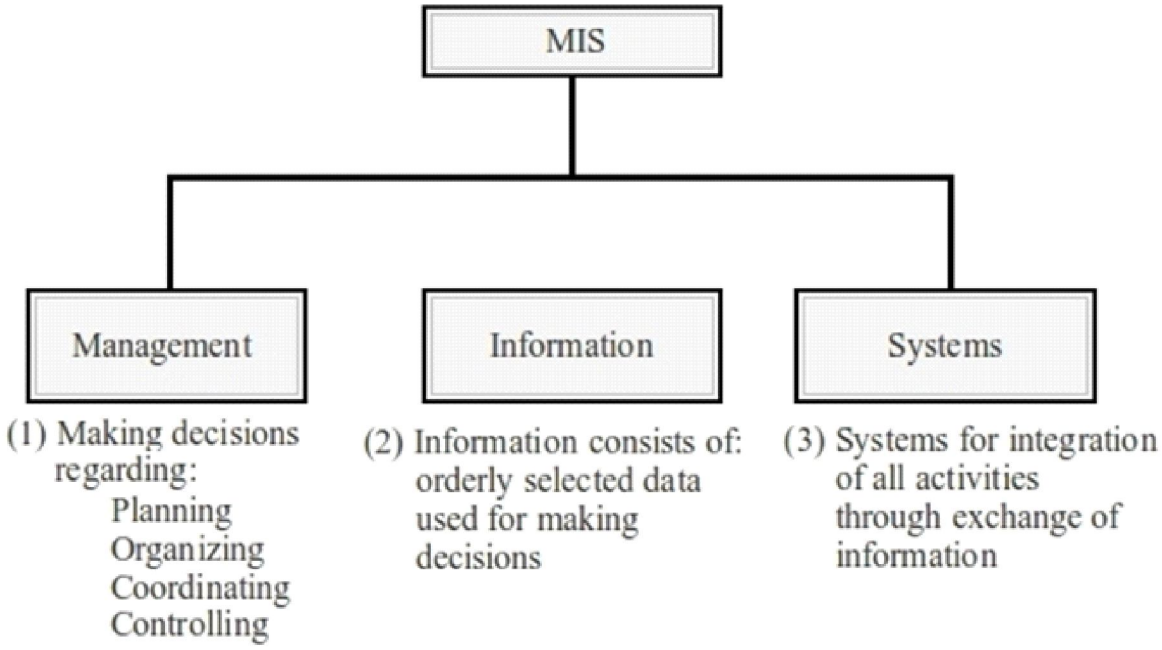


Figure 13.8 : Conceptual framework of Management Information System

Characteristics of MIS: It should be apparent that information systems are vital to company operation. It can be said that today few, if any, enterprises –can operate without information systems. The first step in understanding their potential impact on the business operation is to break through the semantic barriers. Few important characteristic are explained below:

(i) **Business Driven:** A fundamental tenet of meaningful and successful Information System (IS) is that it be driven by the business and not the other way around. The plans of IS must be linked to the overall business plans of the enterprise. The strategies of the corporation must set the IS priorities.

(ii) **Management Oriented/Directed:** This is most significant characteristic of managing with information. The system is designed from the top down. This does not mean that the system will be geared to providing information directly to top management; rather, it means that the system development starts from an appraisal of management needs and overall business objectives.

Because of management orientation of IS, it is imperative that management actively direct the system development efforts Involvement ids not enough. In terms of the preceding examples, management must determine what sales information is necessary to improve its control of management operations.

(iii) **Integrated:** Integration of information subsystem provides more meaningful management information. One can start an IS by attacking a specific subsystem, but unless its place in the total system is realized and properly reflected, serious shortcomings may result. Thus an integrated system that blends information from several operational area is necessary element of IS.

(iv) **Common Data Flows:** Because of integration concept of IS, there is an opportunity to avoid duplication and redundancy in data gathering, storage and dissemination. System designers are aware that a few key source document account for much of the information flow and affect many functional areas.

(v) **Flexibility and Easy to Use:** Despite of careful analysis of management information needs, it is impossible to predict what is desired in three to five year hence. This is true in most industries, and especially in industries with rapid change patterns. It is native to think that anyone possesses the omniscience to predict the future.

(vi) **Data Base:** The database is the mortar that holds the functional systems together. Each system requires access to a master file of data covering inventory, personnel, vendors, customers, general ledger, work in process and so on. If the data is stored efficiently and with common usage in mind, one master can provide the data needed by any of the functional systems.

(vii) **Distributed System:** The majority of companies implementing IS have a geographic network of sales offices, distribution points, manufacturing plants, divisions and subdivisions etc. Some of these entities are operated in completely independent fashion and therefore, may not be a part of integrated Information System (IS).

In order to create an effective IS without arbitrary geographic boundaries, some form of Distributed Systems (DS) is necessary.

(viii) **Feedback System:** A MIS should provide feedback about its own efficiency and effectiveness. The reporting of computer malfunctions and transaction processing error rates is a simple example of their feedback.

(ix) **Information as a Resource:** The Information Resource Management (IRM) concept is overriding philosophy. Pervading the entire organization must be the concept that information is valuable resource, particularly in management control and strategic planning areas, and must be properly managed.

(c) Office Automation System

An office performs many important functions of an organization. All the management and administrative tasks are performed at office. These tasks may be categorized into different types as document handling, data storage and manipulation and communication within or outside the organization.

Office automation is the application of computer and related technologies like communication and networking to integrate the general office tasks so that the efficiency of office work is improved.

Office work includes many administrative and management activities the preparation, distribution, processing and review of documents are the common activities of an organization. Prior to the advent of computer, these office activities were either performed manually or with the help of mechanical and electrical machines. During the past few decades, the basic nature of office has changed remarkably. Office automation deals in application of latest technologies in improving the overall proficiency of the office. We may define office automation as follows:

Office automation does not mean just to install computers and communication devices in an office, but it is much more than that. We will discuss in later part of this chapter, how an office can be automated in a real sense.

Needs for Office Automation: Office automation is needed to do various administrative and management tasks in a better and organized way.

Although all the work of a small or big office can be performed manually, but it is very difficult or even impossible today for an organization to compete in the market without office automation. There are many essential requirements of today's office environment, which are listed below:

(i) To reduce cost of administrative overheads.

(ii) To increase the efficiency of office tasks.

(iii) To provide better service to the customers.

(iv) To provide accurate information to the management.

(v) To provide best and fastest way of communication.

The above requirements cannot be achieved without using latest technologies and therefore, office automation in needed for an organization.

Office automation systems are telecommunications based information systems that collect, process, store, and distribute electronic messages, documents, and other forms of communications among individuals, work groups, and organizations. Such systems can improve the collaboration and productivity of end users and work groups by significantly reducing the time and effort needed to produce, distribute, and share business communications. Other outgrowths of office automation are soft benefits such as improved customer service, better marketing information, faster research and development.

Process of Office Automation: Many types of functions are performed in an office. The function goes with certain process. The process of office automation is described following:

(i) Document Generation: In all offices, many documents are needed to be performed, typed and printed. Typewriters, computers and printers are widely used in automating this routine task of offices.

(ii) Document Processing: Documents are also needed to be processed in order to extract useful information required for MIS and other official purposes. Many office automation tools like word processing, desktop publishing etc. are used to perform this task.

(iii) Document Distribution: All offices require an electronic distribution system for transferring documents and data within and outside the organization. The main office automation tools for distribution of documents are photocopiers, fax machines.

(iv) Archival Storage: The office documents are also needed to be stored for a long period, so that they can be retrieved when required. This task is achieved by the use of different storage devices like tapes, disks, etc.

Types of Office Automation Systems: For achieving the basic functions of an office, different types of office automation systems are used. These systems can be broadly classified into following four types:

(i) Document Management Systems: These systems include computerized tools for generation, storage, processing and distribution of documents.

(ii) Communication Systems: These systems are used for sending messages, documents and data within and outside the organization.

(iii) Teleconferencing Systems: An electronic means of communication for conducting seminars and training programmers in an organization is achieved through various teleconferencing systems.

(iv) Support Systems: Besides the above major office automation systems, certain support systems for managing the activities of work groups are also used in some offices.

Advantages of Office Automation: *Office automation improves the effectiveness of office work.* Office automation provides many advantages to the organization. Some of the main benefits of office automation are:

(i) Increased productivity due to better utilization of human resources.

(ii) Improved qualities of work and decisions due to computerized storage/ retrieval of information.

(iii) Improved organizational effectiveness due to better communication systems.

(iv) Better services to customers due to fast work.

(v) Elimination of manual work of filing and searching of documents.

(vi) Better utilization of time and money.

(vii) Elimination of manual storage systems and spaces.

(viii) Better management control.

(ix) Reduction in travel cost due to telecommunication facilities.

(x) Reduction in costs of conducting in-house meeting due to teleconferencing.

Besides the above main advantages, office automation provides many additional benefits, which depend upon the technology used. In short, office automation improves the effectiveness of all office work and makes the organization most competitive.

Disadvantages of Office Automation: *Office automation make the staff dependent on machines.* Like all other technologies, office automation systems also have certain disadvantages. Some of the drawbacks of office automation systems are:

(i) Office staff becomes dependent on computers and other technologies, they do not want to do work manually or mostly even cannot do work manually in case of failure of automation systems.

(ii) Office automation systems are generally expensive than manual systems if not appropriately installed and implemented and without considering the financial resources of the organization.

(iii) Automated offices can also create health problems to the employees if they continuously work on computers for a long time.

(d) Decision Support System

The Decision Support System (DSS) concept originated in the late years of 1960s with computer time sharing. For the first time the person could interact directly with the computer without having to go through information specialists.

It was not frequently used till 1971, the term DSS is originated by G. Anthony Gorry and Michael S. Scott Morton, both was from MIT. They felt a need for framework to channel computer applications toward management decision making and they developed what has become known as the Gorry and Scott Morton grid. The grid is based on both Simon's concept of programmed and non programmed decisions and management theorist Robert N. Anthony's concept of management levels.

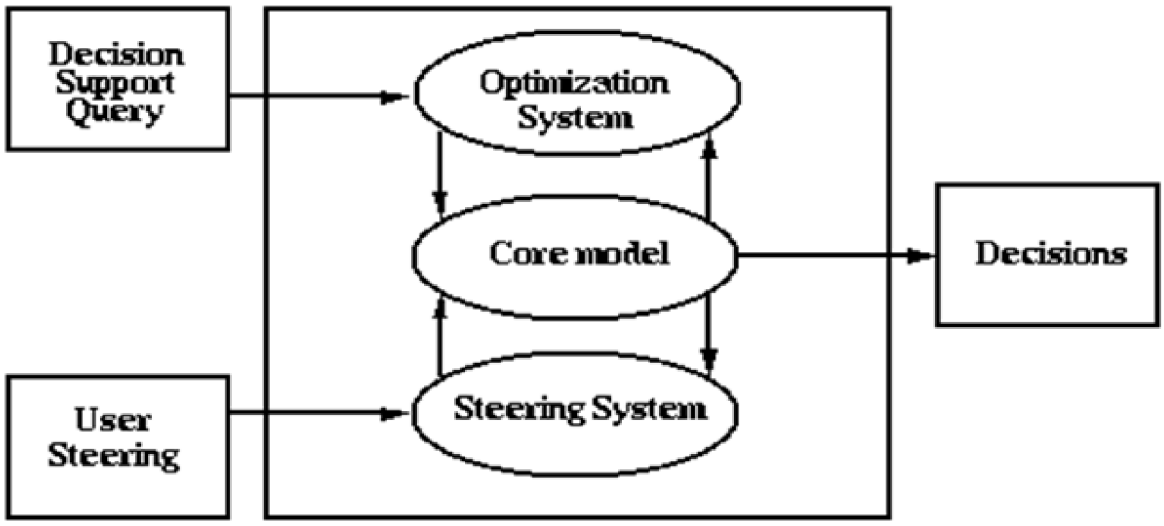


Figure 13.9 : Process of Decision Support System

Decision support systems are a major category of management support systems. They are computer based Information Systems (IS) that provide interactive information support to managers during the decision making process. DSS uses following tools:

(i) Analytical model.

(ii) Specialized database.

(iii) A decision maker's own insights and judgments.

(iv) An interactive, computer based modeling process.

They are designed to be ad-hoc, quick response systems that are initiated and controlled by managerial end users. DSS are thus able to directly support the specific types of decisions and the personal decision making styles and needs of individual managers.

Characteristics and Capabilities of DSS: Different scholars and executives have defined the characteristics and capabilities of DSS differently. Following are the major points to study:

(i) Support is provided for various managerial levels, ranging from top executives to line managers.

(ii) Support is provided to individuals as well as to groups.

(iii) DSS provide support to several interdependent and/or sequential decisions. The decision may be made once, several times, or repeatedly.

(iv) Effective problem solving is interactive and is enhanced by a dialogue between the users and the system.

(v) DSS provide support for decision makers mainly in semi-structured and unstructured situation by bringing together human judgments and computerized information.

(vi) DSS support all phases of decision making process like intelligence, design, choice and implementation.

(vii) DSS support a variety of decision making process and styles.

(viii) DSS must support the manager but not replace their judgment.

(ix) DSS are adaptive over time. DSS are flexible, and so user can add, delete, combine, change, or rearrange basic elements.

(x) User must feel user-friendliness environment with maximum graphical capabilities and chart representation.

(xi) A DSS usually utilizes models for analyzing decision making situations.

(xii) End user should be able to construct and modify simple systems by themselves. Larger systems can be built with assistance from information system specialist.

Needs Decision Support System: DSS is having many reasons to its existence for a long time. These systems have become necessary for today's manager because of following reasons:

(i) Fast Computation: A decision maker can perform a large number of computations very quickly and that too at a low cost with the help of computer support systems. Because modern scenario says *"time is the essence"*.

(ii) Enhanced Productivity: DSS can enhance the productivity of supporting staff and also enable the group members to discuss the problems among themselves at a distance.

(iii) Competitive Edge: Decision support systems enable the users to get a competitive edge over their whole market as these systems enable organizations to change their operations frequently, re-engineer processes and structures, empower employees and innovate.

(iv) **Better Decision Environment:** Computer support systems can help a decision maker in arriving at a better decision.

(v) **Data Transmission:** Sometimes the data, which may be stored at different locations, may be required to be transmitted quickly from distant locations. DSS can search, store and transmit the required data quickly and economical with computers support systems.

(vi) **Comparative Analysis:** At the time when we have more alternatives to choose, confusion's condition, with DSS we can compare the data in form of graphs, charts and various diagrams.

(e) Transaction Processing System

Transaction processing systems (TPS) are the basic business systems that serve the operational level of the organization. A transaction processing system is a computerized system that performs and records the daily routine transaction necessary to the conduct of the business. Example is sales order entry, hotel reservation systems, client information, and shipping.

Transaction is events that occur as part of doing business, such as sales, purchases, deposits, withdrawals, refunds and payments. Think e.g. of the data generated whenever a business sells something to a customer on credit. Data about the customer, product, salesperson, and store and so on, must be captured and processed. This is turn causes additional transactions, such as checks, customer billing, inventory changes, and increases in accounts receivable balances that generate even more data. Thus, transaction processing activities are needed to capture and process such data, or the operations of a business would grind to a halt. Therefore, transaction processing systems play a vital role in supporting the operations of an organization.

Transaction Processing Cycle: Transaction processing system captures and process data describing business transaction. Then they update organizational files and data bases, and produce a variety of information products for internal and external use.

In the transaction processing cycle systems go through a five-stage cycle.

(i) Data entry activities.

(ii) Transaction processing activities.

(iii) File and database processing activities.

(iv) Document and report generation.

(v) Inquiry processing.

Data Entry Process: The input activity in transaction processing system involves a data entry process. In this process, data are captured or collected by recording, coding, and editing activities. Data may then be converted to a form that can be entered up to a computer system. It has always been a problem getting data into computers accurately and quickly enough to match awesome processing speeds. Thus manual methods are replaced by direct automated methods which are more efficient and reliable and known as data automation.

Figure shows how business transactions such as sales to customers and purchases from suppliers are generated by the physical operations systems of this manufacturing firm. Documents describing such transactions are subsequently processed by the firm's transaction processing system resulting in updated database and a variety of information products.

Figure shows that transaction processing systems use a five-stage cycle of data entry, transaction processing database maintenance, document and report generation, and inquiry processing activities. Many companies have found that real time or online transaction processing systems, which capture and process transactions immediately can help them provide superior service to customers. This capability adds value to their products and services, and thus gives them an important way to differentiate themselves from their competitors.

All organizations have these five kinds of TPS. It is difficult to imagine a modern organization without a transaction processing system. These systems are often so central to a business that in the 1960s it was estimated that organization might survive for only a day without functioning computer systems. In the 1990s, TPS failure for a few hours can spell the demise of a firm and perhaps other firms linked to it.

Two features of TPS are noteworthy.

(i) Many TPS span the boundary between the organization and its environment. They connect customers to the firm's, warehouse, factory and management. If TPS do not work well, the organization fails either to receive input from the environment (orders) or to deliver outputs (assembled goods) .

(ii) TPS are major producers of information for the other types of system. Because TPS track relations with the environment, they are the only place where managers can obtain both up to the minute assessments or organizational performance and long-term records of past performance. TPS can be viewed as "organizational message processing systems", informing managers about the status of internal operations and about the firm's relations with the external environment, and supporting other information systems that facilitate management decision making.

(f) Other Kind of Information System

The above mentioned categories of information systems have been defined on the basis of their role in operations and management of a business. However, there are many other applications of information systems which fall in both categories, as they provide support in operations as well as managing of the business. Following are few examples of IS forms:

(i) Strategic Information Systems: Strategic information systems (SIS) apply information technology to the products, services or business processes of an organization to help the organization gain a strategic advantage over its competitor. Thus SIS can be any kind of IS that uses IT to help an organization gain competitive advantages.

(ii) Knowledge Management Systems: Knowledge management systems (KMS) are IS those are knowledge based and, thus, support creation, organization and dissemination of business knowledge to managers and other employees of the organization. Here is a channel diagram for KMS.

Activity C:

1. Read carefully and make report which information system is suitable for Hotel and Travel Agencies.

13.4 Role of Information System

Support Business Processes: As a consumer, you regularly encounter information systems that support the business processes and operations at the many retail stores where you shop. For example, most retail stores now use computer-based information systems to help them record customer purchases, keep track of inventory, pay employees, buy new merchandise, and evaluate sales trends. Store operations would grind to a halt without the support of such information systems.

Support Decision Making: Information systems also help store managers and other business professionals make better decisions, for example, decisions on what line of merchandise need to be added or discontinued, or on what kind of investment they require, are typically made after an analysis provided by computer-based information systems. This not only supports the decision making of store managers, buyers, but also helps them look for ways to gain an advantage over other retailers in the competition for customers.

Support Competitive Advantage: Gaining a strategic advantage over competitors requires innovative application of information technologies. For example, store management might make a decision to install touch-screen kiosks in all of their stores, with links of their e-commerce website for online shopping. This might attract new customers and build customer loyalty because of the ease of shopping and buying merchandise provided by such information systems. Thus, strategic information systems can help provide products and services that give a business a comparative advantage over its competitors

13.5 Structure of Information System's Organization

We have used the term information services (IS) to describe the unit of the firm that has responsibility for the majority of the information resources. Other names-MIS division or MIS department and specially IT (Information Technology) -are also popular.

1. The Information Resources: In earlier chapters, we identified information resources as encompassing computer hardware, computer software, information specialist, users, facilities, database and information. An abundance of these resources are typically located in information services and are the responsibility of the chief information officer (CIO). Information resources located in user areas are the responsibility of the user-area managers.

2. The Information Specialist: We use the term information specialist to describe the employee whose full-time responsibility is to contribute to the availability of information resources in the firm. The original information specialists included the systems analyst, programmer, and operator. Subsequently, the database administrator, network specialist, and webmaster were added.

i) **Systems Analysts**: These specialists work with the users to develop new systems and improve existing systems. Systems analysts are expert at defining problems and in preparing written documentation on how the computer will assist in solving the problems.

ii) **Database Administrators**: An information specialist who has responsibility for the database is called a database administrator (DBA). The duties of the DBA fall into four major areas: planning, implementation, operation, and security. We will describe these duties in chapter six when we address database resources.

iii) **Webmasters**: The webmasters are responsible for the content and presentation of the firm's website. The webmaster must work with network specialists to ensure that the communications network between the firm and its customer and/or business partner is always open. Web sites rely heavily on images, and the webmaster will generally have some expertise in graphics manipulation or design. Often a subordinate of the webmaster will be responsible for making images available that are consistent and complementary among all of the pages on the website.

An important duty of the webmaster is to track people who come to the firm's web pages. These statistics can provide important information about the Web site's effectiveness. For example, the statistics may reveal that many customers begin the purchase process but cancel their transaction after moving from one page to another. This information and the sequence of pages accessed combined with the amount of time spent on each Web page can lead to a different design of the site. Customer relations can be greatly improved by Web sites that operate all day, every day, but poor Web site design can quickly wipe out any benefits.

iv) **Network Specialists**: Network specialists work with systems analysts and users in establishing the data communications network that tie together widespread computing resources. Network

specialists combine expertise from the fields of computing and telecommunications. Maintaining network requirements for Web-based applications are especially difficult, because much of the communications take place beyond the boundaries of the firm.

v) **Programmes**: Programmers use the documentation prepared by the systems analysts to code computer programs that transform the data into information that is needed by the user. Some firms combine the functions of the systems analyst and programmer, creating a programmer analyst position.

vi) **Operators**: Operators run the large-scale computing equipment, such as mainframe computers and servers that is usually located in the firm's computing facilities. The operators monitor the consoles, change paper forms in the printers, manage libraries of tape and disk storage, and perform other similar duties.

All of these information specialists typically are combined with representatives of the user organization to form project teams that develop the systems. The specialists also have responsibility for maintaining the systems after they are implemented.

13.6 Challenges in Developing an Information System

The development of any type of information system can be a challenge but when the system spans international boundaries developers must address several unique constraints. The term global information system (GIS) has been coined to describe an information system that consists of networks that cross national boundaries. The following are just some of the constraints that GIS developers must address.

1. Politically Imposed Constraints: The national governments in the countries where subsidiaries are located can impose a variety of restrictions that make it difficult for the parent firm to include subsidiaries in the network. A common restriction is limited access to high- speed communications. Because the telephone infrastructure is frequently owned and operated by the government, not private firms, this can be a formidable barrier.

2. Cultural and Communications Barriers: Interaction with technology can vary greatly among cultures. GIS interfaces need to be consistent even as different languages are used. As a result, most GIS interfaces rely on graphics and icons for interactions with users and less on commands typed into fields. In addition, the issue of GIS design may be settled by offering multiple formats that yield the same functionality. If a firm decides to establish a GIS, it must be willing to adapt its systems to the varying needs of a global population.

Cultural barriers also influence the design of a GIS. In some societies, technology use is considered a menial task, whereas in others it is seen as a sign of social importance.

i) **Restrictions on Hardware Purchases and Imports**: National governments seek to protect local manufacturers and stimulate foreign investment in local manufacturing by specifying that only equipment produced or assembled in that country is to be used. This requirement can affect the interoperability of different hardware and software systems.

ii) **Restriction on Data Processing:** National policy may dictate that data be processed within the country, rather than transmitted out of the country and processed elsewhere.

iii) **Restrictions on Data Communications**: The most publicized data communications restriction is that put on transborder data flows. Transborder data flow, or TDF, is the movement of machine-readable data across national boundaries. TDF legislation, which began in the 1970s, has been enacted by many countries as a way to protect the personal privacy of their citizens.

3. Technological Problems: MNCs are often plagued with problems related to the level of technology that exists in subsidiary countries. In some countries, reliable power sources are not available, resulting in frequent power outages. Telecommunications circuits often can only transmit data at slow speeds, and the transmission quality may be poor. Software can also be a problem. Because many countries do not honor software copyrights and condone black-market software, some software vendors refuse to do business in certain countries.

4. Lack of Support from Subsidiary Managers: The managers of subsidiary offices often are part of the problem. Some are convinced that they can run their subsidiaries without help, and they view headquarters-imposed regulations as unnecessary. Some subsidiaries managers are paid based on profitability, and they will drag their feet when they think that corporate solutions will reduce their earnings. Foreign office management may also view the GIS as a "Big Brother" type of surveillance. Middle-level managers may fear being bypassed by the new information links that funnel operational data to the parent.

With all of these all potential problems, it is a minor miracle that MNCs ever attempt GISs. Although it is impossible to eliminate the problems completely, their effects can be minimized by following well-thought-out strategies that are incorporated into the strategic plan for information resources. We discuss such a plan later in the chapter.

Activity D:

1. Write some practical challenges in development of information system.

13.7 Summary

In this unit we have tried to solve a problem which occurs at the time of differentiating in all the dimensions of information systems. This unit deals with all aspects of IS in form of management information system. Carefully reading of this unit will make us understood the classification of information systems with all the components. We go through components and kinds of information system with Executive Information System, Management Information System, Office Automation System, Decision Support System, Transactional Processing System and some other kind of information system which you may find at the functioning of business like KMS and SIS.

In the present scenario, a very important aspect the roles of information system and challenges in the development of information systems are also discussed.

13.8 Self Assessment Questions

1. What do you mean by information system?
2. How computer application evolutes for information system?
3. What are the components of information systems?
4. Write the classification of information system with illustrative examples. Draw the diagrams also.
5. What is EIS? Explain the factors which needed for successful EIS.
6. How MIS can be understood? Enumerate its characteristics also.
7. Explain office automation system. Why it is needed?

8. How office automation can be processes? What are its advantages and disadvantages?

9. Discuss the decision support system and its characteristics. Explain its needs also.

10. Explain Transactional Processing System's cycle.

11. What are the roles of information system in functioning of business?

12. Explain structure of information systems organization. What are the challenges in developing information system?

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Unit - 14 : Introduction to Management Information System

Structure of Unit:

14.0 Objectives
14.1 Introduction : Levels of Information
14.2 Role of Information Systems in Business
14.3 Information System Challenges
14.4 Management Information Systems
14.5 MIS: A Control and Tool Device
14.6 Characteristics of MIS
14.7 Classification of MIS
14.8 Enterprise Applications of MIS
14.9 Advantages of MIS
14.10 Limitations of MIS
14.11 Summary
14.12 Self Assessment Questions
14.13 Reference Books

14.0 Objectives

After completing this unit, you would be able to:

- Learn and appreciate Management Information System (MIS), their importance and characteristics;
- Follow various types of MIS;
- Determine the enterprise applications of MIS;
- Discover the advantages and limitations of MIS.

14.1 Introduction : Levels of Information

Information can be categorized in different levels accordingly. These levels are based on the levels of management and their functions. So according to different management levels, information can be categorized as:

(i) **Strategic Information:** It helps in making strategy for a company for future. It may be for around years or may exceed.

(ii) **Tactical Information:** As the name suggest it helps to lay out tactics for period of around 1-4 years. It lays foundation or base to take decision related to implementation of strategic plans.

(iii) **Operational Information:** It deals with allotting the task and responsibility to the individuals. The individuals are explained and told about the goals of the company and their department. This information may also contain the details of employees.

(iv) **Scheduling Information:** It helps in planning day to day work of individuals and their department. It may include, responsibilities, time frame of the task.

However, need for information in management system can be extrapolated reviewing with following points:

i. The fundamental tasks or the organizational goals of the management.
ii. The fundamental functions of the management seeking the objectives to fulfill and implement basic tasks.
iii. Deciphering the role of the flow of information (communication) within a management process.

Characteristics or Economics of Information

Economy, value and characteristics are the three words that are inter-related and are of great importance. Economy or value of information is judged on the basis of characteristics. If the information obtained by the users has the following characteristics then it is of great value to him:

(i) Timeliness: This means on time, if the information you received at the time that is usable to you but in a situation when you not got information on time, may be possible the information will be a waste to you.

(ii) Availability: The information should be available when and whenever required. Some time it might happen that a person who receives information is new, and then it is of great importance for him.

(iii) Accuracy: The information obtained should be error free and correct. Because incomplete or faulty information may result in great losses to the company.

(iv) Adequacy: Adequacy of information is used to determine that the information presented to the MIS is adequate as per the information required by an organization. Adequacy of information also insures that a report that a report generated in an organization represents complete picture of operational processes in execution.

(v) Presentation: The information should always be presented in more meaningful manner, as it becomes clearer, valuable and adds meaning to it.

14.2 Role of Information Systems in Business

Study of information system has become a necessarily in business field. Below we give some main reasons for studying it in business. Information system in business is as much important as the other subjects like accounting, finance, operation research, marketing, human resource management etc. Information systems have become an important part of successful businesses. So it becomes an essential field of study in business management. To understand the different functional area in business, it is necessary to have a basic understanding of information system.

An information system is an arrangement of people, data, processes, interfaces, networks and technology that interacts to support and improve both day to day operations in a business as well as support the problem-solving and decision-making needs of management.

An information system collects, processes, analyzes and disseminates information for a specific purpose. Any business firm requires physical resources such as men, machines, materials and money for its functioning. In addition to these, an abstract resource, information, is also needed for the functioning of a business organization. Employees working in an organization need to use information. Information has to be managed effectively in the same manner just like any other resource. For managing the information effectively, it is essential to know when and what information to acquire, how to use it and when to discard it. Information has a cost. Therefore, handling of information cannot be ignored. Managing information is called information management and the systems used to present information in the required from are called information systems.

Information system plays three vital roles in the field of business. That is, they support business operations, strategic advantages and managerial decision making of an organization. Those three roles are described below:

(i) Business Operation: It provides the record of customer purchase, keep track of inventory, record of pay of employees and evaluates sales trends, etc.

(ii) **Managerial Decision Making:** After analyzing all the stored records helps the manager to make better decisions.

(iii) **Strategic Advantages:** It is not only based on managerial decision but also keeps them looking for ways to gain advantages over the other retailers in the competition.

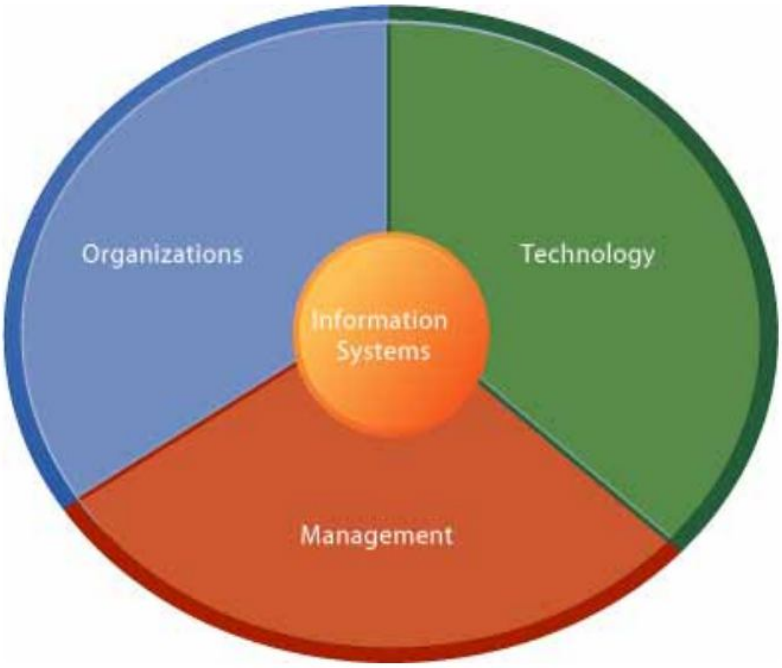


Figure 14.1 : Information Systems in Business

14.3 Information Systems Challenges

Although information technology is advancing at a blinding pace, there is nothing easy or mechanical about building and using information systems.

There are five major challenges confronting managers:

- **The Information Systems Investment Challenge:** Not all companies realize good returns from information systems investments. It is obvious that one of the greatest challenges facing managers today is ensuring that their companies do indeed obtain meaningful returns on the money they spend on information systems. It's one thing to use information technology to design, produce, deliver, and maintain new products. It's another thing to make money doing it. How can organizations obtain a sizable payoff from their investment in information systems? How can management ensure that information systems contribute to corporate value?
- **The Strategic Business Challenge:** Despite heavy information technology investments, many organizations are not realizing significant business value from their systems, because they lack — or fail to appreciate—the complementary assets required to make their technology assets work. The power of computer hardware and software has grown much more rapidly than the ability of organizations to apply and use this technology. To benefit fully from information technology, realize genuine productivity, and become competitive and effective, many organizations actually need to be redesigned. They will have to make fundamental changes in employee and management behavior, develop new business models, retire obsolete work rules, and eliminate the inefficiencies of outmoded

business processes and organizational structures. New technology alone will not produce meaningful business benefits.

- **The Globalization Challenge:** The rapid growth in international trade and the emergence of a global economy call for information systems that can support both producing and selling goods in many different countries. In the past, each regional office of a multinational corporation focused on solving its own unique information problems. Given language, cultural, and political differences among countries, this focus frequently resulted in chaos and the failure of central management controls. To develop integrated, multinational, information systems, businesses must develop global hardware, software, and communications standards; create cross-cultural accounting and reporting structures; and design transnational business processes.
- **The Information Technology Infrastructure Challenge:** How can organizations develop an information technology infrastructure that can support their goals when business conditions and technologies are changing so rapidly? Many companies are saddled with expensive and unwieldy information technology platforms that cannot adapt to innovation and change. Their information systems are so complex and brittle that they act as constraints on business strategy and execution.
- **Ethics and Security:** How can organizations ensure that their information systems are used in an ethically and socially responsible manner? How can we design information systems that people can control and understand? Although information systems have provided enormous benefits and efficiencies, they have also created new ethical and social problems and challenges. A major management challenge is to make informed decisions that are sensitive to the negative consequences of information systems as well to the positive ones.

14.4 Management Information Systems

When information systems are designed to provide information needed for effective decision making by managers, they are called management information systems. MIS is a formal system for providing management with accurate and timely information necessary for decision making. The system provides information on the past, present and project future and on relevant events inside and outside the organization. It may be defined as a planned and integrated system for gathering relevant data, converting it in to right information and supplying the same to the concerned executives. The main purpose of MIS is to provide the right information to the right people at the right time.

The Concept of management information systems originated in the 1960s and become the byword of almost all attempts to relate computer technology and systems to data processing in business. During the early 1960s, it became evident that the computer was being applied to the solution of business problem in a piecemeal fashion, focusing almost entirely on the computerization of clerical and record – keeping tasks. The concept of management information systems was developed to counteract such in efficient development and in effective use of the computer. The MIS concept is vital to efficient and effective computer use in business of two major reasons:

- It serves as a systems framework for organizing business computer applications. Business applications of computers should be viewed as interrelated and integrated computer – based information systems and not as independent data processing job.
- It emphasizes the management orientation of electronics information processing in business. The primary goal of computer based information systems should be the processing of data generated by business operations.

A management information system is an integrated man – machine systems that provides information to support the planning and control function of manager in an organization. The output of an MIS is information that sub-serves managerial functions. When a system provides information to persons who are not managers, then it will not be considered as part of an MIS. For example, an organization often processes a lot of data which it is required by law to furnish to various government regulatory agencies. Such a system, while it may have interfaces with an MIS, would not be a part of it. Instances of such systems are salary disclosures and excise duty statements. By the same token to sophisticated computer – aided design system for engineering purposes would also not be a part of an MIS.

Generally, MIS deals with information that is systematically and routinely collected in accordance with a well-defined set of rules. Thus, and MIS is a part of the formal information network in an organization. Information that has major managerial planning significance is sometimes collected at golf courses. Such information is not part of MIS; however, one- shot market research data collected to gauge the potential of a new product does not come within the scope of an MIS by our definition because although such information may be very systematically collected, it is not collected on a regular basis.

Generally, MIS is concerned with planning and control. Often there are elaborate systems for information that assists operations. For example, the car manufacturer will have a system for providing information to the workers on the shop floor about the job that needs to be done on a particular batch of material. There may be route sheets, which accompany the rate materials and components in their movement through various machines. This system per se provides only information to support operation. It has no managerial decision-making significance. It is not part of an MIS. If, however, the system does provide information on productivity, machine utilization or rejection rates, then we would say that the system is part of an MIS.

According to James A.O' Brein, Management Information Systems, also called information reporting systems, were the original type of management support systems, and are still a major category of information systems. MIS produce information products that support many of the day-to-day decision making needs of management. Reports, displays, and responses produced by such systems provide information that managers have specified in advance as adequately meeting their information needs.

Thus, Management Information System (MIS) is an Information System that generates accurate, timely and organized information to help managers make decisions, control processes, solve problems, supervise activities, and track progress. MIS are often integrated with transaction processing systems and other information systems.

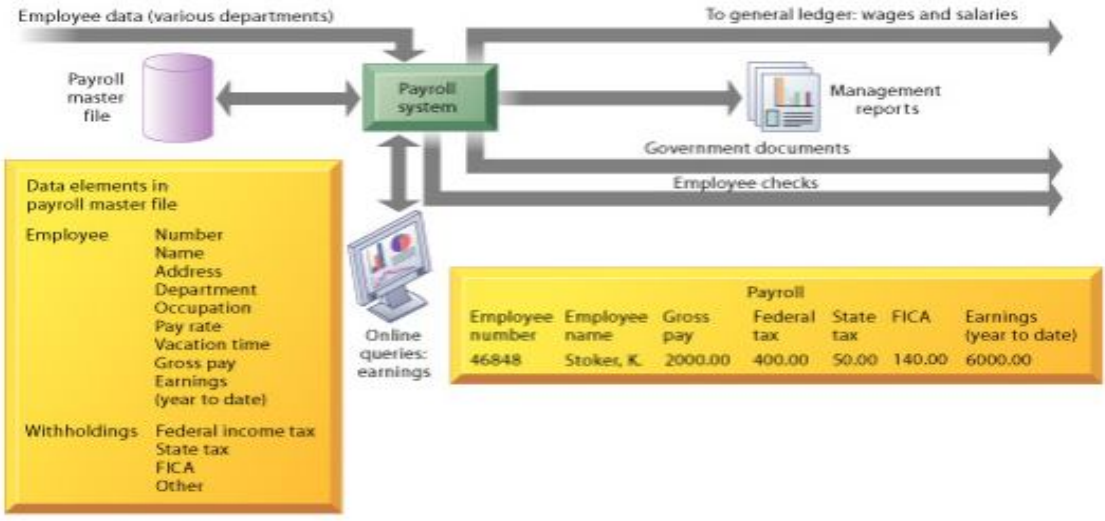


Figure 14.2 : Management Information Systems

Need of Management Information Systems

The management needs to know happenings in the company. However they should not be overburdened with too much operational and transactional *data*. The data should be processed into *information* i.e. analysis, summary, and exception reporting. The bottom line is that the information systems should enable them to implement, control, and monitor plans, strategies, tactics, new products, new business models or new business ventures. The reporting should be made periodically. They, should however be alerted immediately when significant events occur.

Management needs to get information for:

- Activity forecasting
- Monitoring Performance
- Customer satisfaction
- Setting revenue goals
- Market penetration
- Cost

MIS aids in decision making such as:

- Setting earnings targets
- Making business continuity plans
- Compensation plans
- Performance measures

Objectives of Management Information Systems

When any organization wishes to establish the MIS, it must be very clear about the need of information required by the different levels of management. Following are the reasons for objectives for adoption of the MIS in any organization:

- To provide the logical support in decision making, in both structured and unstructured problems
- To provide information for planning, organizing, and controlling purposes.
- To store and manage data efficiently from all the functional areas of business.
- To process the collected data and derive information out of them.
- To provide information quickly as and when required.
- To reduce the risk and uncertainties in the managerial decision making.
- To collect and store the data for purpose of internal research and development.
- To assist in identifying the managerial problems and their solution.
- To provide information regarding work force planning.
- To smooth up the flow of data through various levels of the organization.
- To speed up the execution of the results with the reliable data available.
- To provide information regarding production and inventory.
- To provide the information regarding the financial health of the business organization.
- To provide information regarding sales and other marketing aspects i.e. product, price, promotion, market, physical distribution, payment collection, market segmentation etc.

- To help in highlighting the critical factors.
- To provide information at all management levels.

Importance of Management Information Systems

In present business organization, MIS play a very important role. It is a process of collection and storing the data useful for organization. Executives retrieve these data, when required and processed them for generating information. Executives determine the future course of action of organization over the long and short term periods. The responsibility of corporate executives is decision making, laying down policy, planning, organizing, directing, controlling, communicating, motivating, evaluating and gathering things done to meet the overall objectives of organization. MIS provides the information regarding all these aspects of managing business.

In this context, the following points can summarize the importance of MIS:

- Information primarily geared to assist managerial decisional process and control.
- Flexibility of an information system to incorporate future requirements of management on need basis.
- Basic function of MIS, it helps in minimizing risk in decision making.
- It processes the data and derives information about the various aspects of business.
- It helps the executives to avail the information regarding the functional areas quickly.
- The database of MIS helps in conducting research. The data stored can be used as secondary data.
- It provides sound information regarding the financial health of business organization.
- It helps in preparing various corporate reports for the analysis of final performance either in financing or in marketing.
- The data regarding production helps the production manager in deciding about capacity utilization, number of rejection per batch, frequency of break down, status of shipment of processed order and product, region wise.
- It provides information regarding inventory position, and ensures that the chances of inventory out of stock may be minimized.
- It provides timelines of Information (delayed information may be contrived or obsolete and therefore useless for decision making process).
- It helps the HRD manager in finding the requirement of the human resource, their wages and salary, PA (Performance Appraisal), training, promotion, absenteeism and employees turnover, which is useful in drafting sound HRP (Human Resource Policies).

At present, every business organization is giving due importance to IT department and focusing the MIS part. The credit of growth and development of many of business organizations goes to selection of right MIS. If organization underestimates the importance of MIS, they may have greater changes of generating negative profit.

Managers can receive information at their workstations that support their decision making activities. This information takes the forms of periodic, exception, and demand reports and immediate responses to inquiries. Application programs and database management software provide access to information in the corporate database of organization.

Pre-requisites of an Effective MIS

An effective MIS means the information system which is highly supportable and flexible for higher level management in strategy formation. Essential requirements of an effective MIS are following described:

(i) Qualified systems and management staff.

(ii) Control and maintenance of MIS in integrated environment.

(iii) Common database for all users by a good network.

(iv) Understanding a better evolution process for MIS architecture.

(v) Proper support and monitoring by top management.

(vi) Expert's advice and system audit with proper schedule.

14.5 MIS: A Control and Tool Device

The process of management requires a lot of data and information for execution of the plan. The decisions or actions are prompted due to the feedback given by the control system incorporated in management system. The control of overall performance is made possible by way of budget summaries and reports. The summery showing sales, cost profit and return on investment throw light on the direction of organization is moving to. The exception reports identify the weakness in the system of management.

The MIS should provide the support to act and to act decisively. It should support management in terms of basic business information at the corporate level and meet the specific needs of the managers. It should highlight on the *critical success factor* (CSF) and support key areas of management. MIS should have, wherever possible, *decision support system* (DSS) to help the manager in decision making.

Modern Management systems rely on MIS. The complexity of business management and competitive nature of business requires handling of business operations with skill and foresight to avert the crisis. *Modern business management* (MBM) requires shift from the traditional control to managerial and realistic control.

MBM has become more technology oriented wherein the manager is required to be up-to-date on technological advancement, not only in his field of operations but also in other technologies. A good MIS is designed for such a support is absolutely essential. MIS is a tool for effective execution of management process, or as a controlling device.

14.6 Characteristics of MIS

It should be apparent that information systems are vital to company operation. It can be said that today few, if any, enterprises –can operate without information systems. The first step in understanding their potential impact on the business operation is to break through the semantic barriers. Few important characteristic are explained below:

- **Business Driven:** A fundamental tenet of meaningful and successful Information System (IS) is that it be driven by the business and not the other way around. The plans of IS must be linked to the overall business plans of the enterprise. The strategies of the corporation must set the IS priorities.
- **Management Oriented/Directed:** This is most significant characteristic of managing with information. The system is designed from the top down. This does not mean that the system will be geared to providing information directly to top management; rather, it means that the system development starts from an appraisal of management needs and overall business objectives. Because of management orientation of IS, it is imperative that management actively direct the system development efforts. In terms of the preceding examples, management must determine what sales information is necessary to improve its control of management operations.

- **Integrated:** Integration of information subsystem provides more meaningful management information. One can start an IS by attacking a specific subsystem, but unless its place in the total system is realized and properly reflected, serious shortcomings may result. Thus an integrated system that blends information from several operational area is necessary element of IS.
- **Common Data Flows:** Because of integration concept of IS, there is an opportunity to avoid duplication and redundancy in data gathering, storage and dissemination. System designers are aware that a few key source document account for much of the information flow and affect many functional areas.
- **Flexibility and Ease of Use:** Despite of careful analysis of management information needs, it is impossible to predict what is desired in three to five year hence. This is true in most industries, and especially in industries with rapid change patterns. It is native to think that anyone possesses the omniscience to predict the future.
- **Data Base:** The database is the mortar that holds the functional systems together. Each system requires access to a master file of data covering inventory, personnel, vendors, customers, general ledger, work in process and so on. If the data is stored efficiently and with common usage in mind, one master can provide the data needed by any of the functional systems.
- **Distributed System:** The majority of companies implementing IS have a geographic network of sales offices, distribution points, manufacturing plants, divisions and subdivisions etc. Some of these entities are operated in completely independent fashion and therefore, may not be a part of integrated Information System (IS). In order to create an effective IS without arbitrary geographic boundaries, some form of Distributed Systems (DS) is necessary.
- **Feedback System:** A MIS should provide feedback about its own efficiency and effectiveness. The reporting of computer malfunctions and transaction processing error rates is a simple example of their feedback.
- **Information as a Resource:** The Information Resource Management (IRM) concept is overriding philosophy. Pervading the entire organization must be the concept that information is valuable resource, particularly in management control and strategic planning areas, and must be properly managed.

14.7 Classification of MIS

The discipline of MIS is in its evolutionary stage. MIS is a concept, which is a matter of degree rather than an absolute one. In management, there are perhaps few other areas other than MIS which have evoked such a controversy. Over the years, it has evolved from an elementary concept to an advanced discipline of today. Following are the points of MIS classification:

(i) **Operation Support Systems:** As and when they take place in an organization, data, which is by-product of a transaction, is generated. Also, business operations are carried out using data. In order to process such data, information systems are required, which are called operations support systems. These systems produce various types of information products for internal and external use. However, such systems do not lay emphasis on producing the specific information products that can be used by the managers. Following are a brief description of various forms of operations support systems:

(a) **Transaction Processing Systems:** As the name indicates, transaction processing system (TPS) records and process data, and produces reports. It represents the automation of the fundamental, routine processing used to support business operations. It does not provide any information to the user for his/her decision making. These systems process transactions either in batch processing or in real time processing.

(b) **Process Control Systems:** The systems which monitor and control physical process physical are known as process control system (PCS). For example, pharmaceutical manufacturing company uses electronic sensors linked to computers to monitor chemical processes and make the required adjustments.

(c) **Office Automation Systems:** Office automation refers to the application of computer and communication technology to office functions. Office automation systems are meant to improve the productivity of managers at various levels of management by providing secretarial assistance and better communication facilities.

(ii) **Management Support Systems:** MSS are the information system' applications that focus on providing information and decision support for effective decision-making by managers. There are various types of information systems that support a variety of decision making process. Following are a brief description of various forms of management support systems:

(a) **Decision Support Systems:** A decision support systems (DSS) is an information system application that assist decision making. DSS tends to be used in planning, analysis alternatives, and trial and error search for solutions. Such systems are generally operated through terminal based interactive dialogues with users. They incorporate a variety of decision models and thus are capable of performing 'What-if' analysis for managers. Here is a simple Model of DSS for our better understanding.

(b) **Executive Support Systems:** Executive support system (ESS) is widely known as Executive Information System (EIS) also. ESS is an extension of management information system, which is a special kind of DSS and provides critical information from various inter and intra sources in easy to use displays. An ESS is specially tailored for the use of chief executive of an organization to support his decision-making.

(c) **Business Expert Systems:** Business expert systems (BES), which are based on artificial intelligence (AI), are advanced information systems. Artificial intelligence may be referred to as the capability that makes computers display intelligent, human like behavior. Below given diagram can give you a better understanding of the concept.

(iii) **General Support Systems:** The above mentioned categories of information systems have been defined on the basis of their role in operations and management of a business. However, there are many other applications of information systems which fall in both categories, as they provide support in operations as well as managing of the business. Following are few examples of IS forms:

(a) Strategic Information Systems: Strategic information systems (SIS) apply information technology to the products, services or business processes of an organization to help the organization gain a strategic advantage over its competitor. Thus SIS can be any kind of IS that uses IT to help an organization gain competitive advantages.

(b) Knowledge Management Systems: Knowledge management systems (KMS) are IS those are knowledge based and, thus, support creation, organization and dissemination of

business knowledge to managers and other employees of the organization. Here is a channel diagram for KMS.

The classification of MIS is depicted in Figure below:

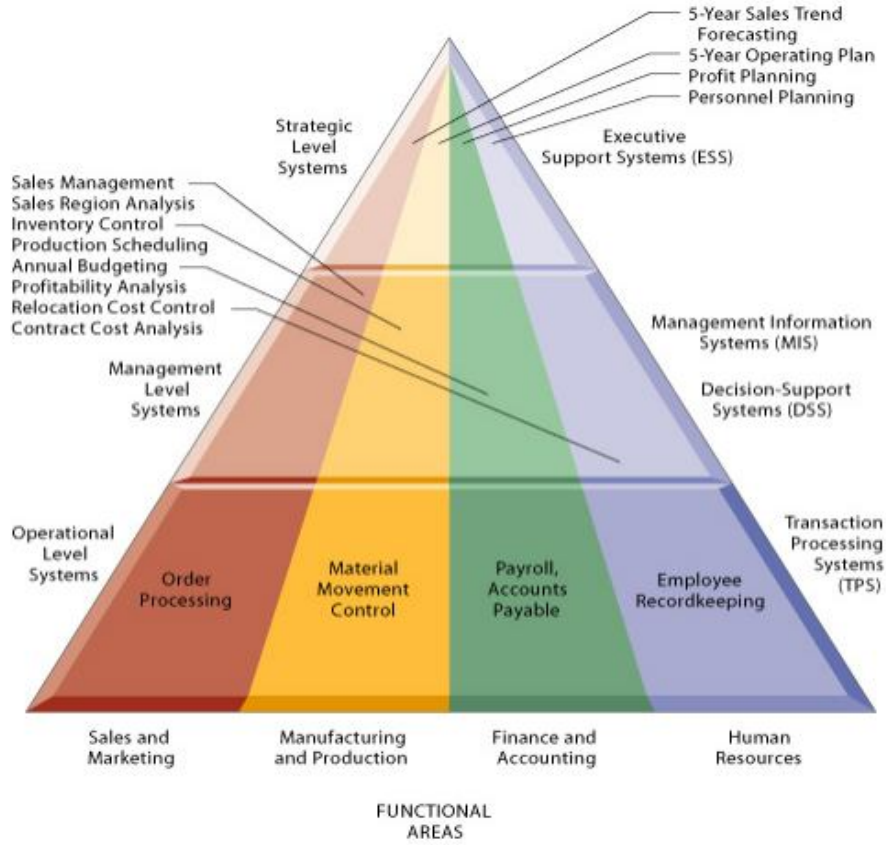


Figure 14.3 : Classification of MIS

14.8 Enterprise Applications of MIS

The enterprise applications of MIS are discussed below:

- **Supply Chain Management** (SCM) systems enable more efficient management of the supply chain by integrating the links in a supply chain. This may include suppliers, manufacturer, wholesalers, retailers and final customers.
- **Enterprise Systems,** also known as enterprise resource planning (ERP) systems provide an organization with integrated software modules and a unified database which enable efficient planning, managing, and controlling of all core business processes across multiple locations. Modules of ERP systems may include finance, accounting, marketing, human resources, production, inventory management and distribution.
- **Customer Relationship Management** (CRM) systems help businesses manage relationships with potential and current customers and business partners across marketing, sales, and service.
- **Knowledge Management System** (KMS) helps organizations facilitate the collection, recording, organization, retrieval, and dissemination of knowledge. This may include documents, accounting records, and unrecorded procedures, practices and skills.

The enterprise applications of MIS are diagrammatically shown below:

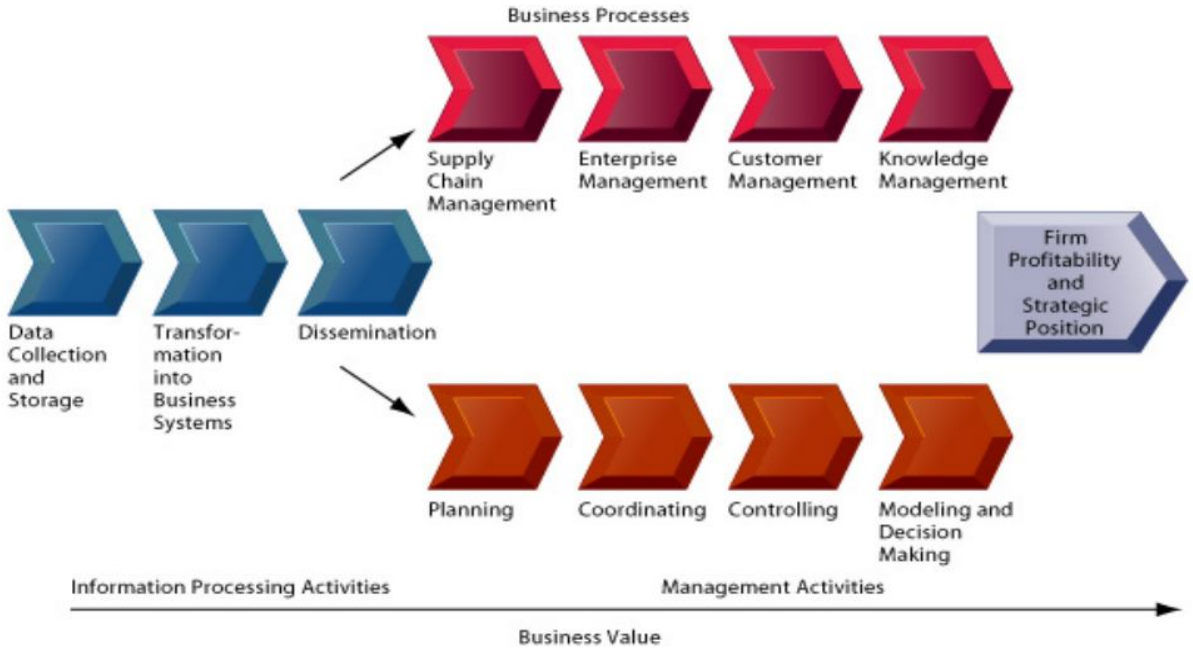


Figure 14.4 : Enterprise Applications of MIS

14.9 Advantages of MIS

Effective management information systems are needed by all business organization because of the increased complexity and rate of change of today's business environment. For example, marketing manager need information about sales performance and trends, financial manager returns, production managers needs information for analyzing resources requirement and worker productivity and personnel manager requires information concerning employee compensation and professional development. Thus, effective management information systems must be developed to provide modern managers with the specific marketing, financial, production and personnel information products they require to support their decision making responsibilities.

Management information systems have changed the dynamics of running businesses efficiently. Decentralization is one of the biggest advantages; it allows monitoring of operations at low levels and frees up resources for departmental managers to devote time to strategic activities. Coordination of specialized projects and activities is much better and decision makers in the organization are aware of issues and problems in all departments. Another advantage of MIS is that it minimizes information overload, which can be quite common with conventional businesses in the modern era.

An MIS provides the following advantages.

- **It Aids in Decision Making:** The purpose of MIS is to generate synthesized and processed information from computerized/automated and certain manual systems. Information distribution to all levels of corporate managers, professionals and key executives becomes quite seamless with streamlined MIS. Managers are able to make quick, timely and informed decisions. Top management and board members can take strategic decisions, plan future growth and business expansion activities based on the data and information generated by MIS.
- **It Facilitates Planning:** MIS improves the quality of plants by providing relevant information for sound decision–making. Due to increase in the size and complexity of organizations, managers have lost personal contact with the scene of operations.

- **It Minimizes Information Overload:** MIS change the larger amount of data in to summarized form and thereby avoids the confusion which may arise when managers are flooded with detailed facts.
- **MIS Encourages Decentralization:** Decentralization of authority is possibly when there is a system for monitoring operations at lower levels. MIS is successfully used for measuring performance and making necessary change in the organizational plans and procedures.
- **It Brings Coordination:** MIS facilities integration of specialized activities by keeping each department aware of the problem and requirements of other departments. It connects all decision centers in the organization.
- **It Facilitates Better Planning and Control:** MIS has to be designed and managed in such way that it aggregates information, monitors the company's activities and operations and enhances communication and collaboration among employees. This ensures better planning for all activities and better ways to measure performance, manage resources and facilitate compliance with industry and government regulations. Control helps in forecasting, preparing accurate budgets and providing the tools and vital information to employees, top management and business partners.
- MIS assembles, process, stores, retrieves, evaluates and disseminates the information efficiently and effectively.

14.10 Limitations of MIS

Depending on organization deployment, usage and extraneous factors, some disadvantages related to Management Information Systems can come to the fore. Allocation of budgets for MIS upgrades, modifications and other revisions can be quite tricky at times. If budgets are not allocated uniformly or as per immediate requirements, key functionalities might get affected and benefits might not be realized consistently. Integration issues with legacy systems can affect the quality of output and vital business intelligence reports. Following are limitations or drawbacks of MIS:

- Change in management, exits or departures of department managers and other senior executives has a broad effect on the working and monitoring of certain organization practices including MIS systems. Since MIS is a critical component of an organization's risk management strategy and allied systems, constant monitoring is necessary to ensure its effectiveness. Quality of inputs into MIS needs to be monitored; otherwise consistency in the quality of data and information generated gets affected. Managers are not able to direct business, operational and decision-making activities with the requisite flexibility.
- MIS takes into account mainly quantitative factors, thus it ignores the non-quantitative factors like morale, attitudes of members of the organization, which have an important bearing on the decision making process of executives.
- MIS is less useful for making non-programmed decision making. Such type of decision is not of routine type and thus they require information, which may not be available from existing MIS to executives.
- MIS effectiveness decreases due to frequent changes in top management, organizational structure and operational team.

- MIS is not a substitute for effective management. It means that it can not replace managerial judgment in making decisions in different functional areas. It is merely an important tool in the hands of executives for decision making and problem solving.
- The qualities of the outputs of MIS are basically governed by the quality of inputs and processes.
- MIS may not have requisite flexibility to quickly update itself with the changing needs of time, especially in a fast changing and complex environment.
- The effectiveness of MIS is reduced in organization, where the culture of hoarding information and not sharing with others hold.
- MIS cannot provide tailor made information packages suitable for the purpose of every type of decision made by executives.

14.11 Summary

Information drives modern organizations. It consists of data that have been retrieved and processed for informative purpose. A system is essentially a set of things inter connected or interdependent so as to form a complex unit. An information system is a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization.

Management Information System (MIS) is an Information System that generates accurate, timely and organized information to help managers make decisions, control processes, solve problems, supervise activities, and track progress. MIS are often integrated with transaction processing systems and other information systems. These days, MIS provides the information regarding all aspects of managing business.

Modern Management systems rely on MIS. The complexity of business management and competitive nature of business requires handling of business operations with skill and foresight to avert the crisis. Modern business management (MBM) requires shift from the traditional control to managerial and realistic control.

MIS can be classified as Operation Support Systems, Management Support Systems and General Support Systems. MIS helps in supply chain management (SCM), enterprise resource planning (ERP), Customer relationship management (CRM) and Knowledge management system (KMS).

Management information systems have changed the dynamics of running businesses efficiently. Decentralization is one of the biggest advantages. Coordination of specialized projects and activities is much better and decision makers in the organization are aware of issues and problems in all departments. Another advantage of MIS is that it minimizes information overload.

Depending on organization deployment, usage and extraneous factors, some disadvantages related to Management Information Systems can come to the fore. Allocation of budgets for MIS upgrades, modifications and other revisions can be quite tricky at times. Integration issues with legacy systems can affect the quality of output and vital business intelligence reports.

14.12 Self Assessment Questions

1. Discuss the role of Information Systems in Business.
2. What are the various challenges faced by organizations while applying Information Systems. Explain with the help of suitable examples.
3. Define Management Information Systems. Discuss the various types of Management Information Systems.

4. MIS is a control and tool device. Explain.

5. What is the importance of Management Information Systems in modern time? Explain with examples.

6. Discuss enterprise applications of MIS

7. What are the advantages and limitations of MIS?

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Unit - 15 : Development of Management Information System

Structure of Unit:

15.0 Objectives
15.1 Introduction
15.2 MIS within an Organization
15.3 Factors Responsible for Success and Failure of MIS
15.4 Developing MIS
15.5 Approaches to MIS Development
15.6 Designing MIS
15.7 Implementation of MIS
15.8 Impact of MIS
15.9 Evaluation of MIS
15.10 Summary
15.11 Self Assessment Questions
15.12 Reference Books

15.0 Objectives

After completing this unit, you would be able to:

- Determine information requirements
- Appreciate the importance of MIS within an organization
- Learn about the factors responsible for the success and failure of MIS
- Comprehend the strategies and approaches to MIS development
- Know the steps to design and implement MIS
- Identify the impact of MIS on business performance
- Obtain the knowledge to evaluate MIS

15.1 Introduction

The classic three tiers on which the management systems are based upon is top level management, middle level management and the lower level management or operating management which is based on the distinct role assignments but common goals are mutual inter responsibilities towards optimization of the business organization's productivity.

Operative management is responsible for day-to-day operations and decision of middle management. Middle management is responsible for implementing the policies and overall plans of the top management. Top management is responsible for establishing plans, objectives of organization and budget framework. Relevance of MIS and levels of management can be understood better by following points:

(i) **Top Level Management:** The basic role of the top management is to establish the policies, plans and objectives of the organization. Top management is also responsible for formulation of the budget framework i.e. allocation of the resources on the basis of which the business activities within the various segments of organization flourish.

(ii) **Middle Level Management:** The basic role of the middle management is to translate the vision of the top management into a pragmatic business activity. The impetus is on realization of optimum profit and efficiency for the organization in concurrence to the objectives of business. The middle management operates on the parameters of cost revenue and profit under direction from the top management. The middle management formulates the measurement yardsticks and issues specific job schedules with specified work plan and targets to the operating management.

(iii) **Lower or Operating Level Management:** The role of operating or lower level management is to accomplish the specified tasks of production and providing services as assigned to it as per the schedules. The mutual co-ordination amongst the three levels of management is imperative and a controllable factor that can translate the objectives of business entity into attainable goals.

MIS is applied at different management levels in functional areas like:

- Sales and Marketing
- Manufacturing and Production
- Finance and Accounting
- Human Resources



Figure 15.1 : MIS at Different Management Levels across Different Functional Areas

15.2 MIS within an Organization

To facilitate the management decision making at all levels of company, the MIS must be integrated. MIS unit are companywide MIS is available for the strategic management (top management). The top management of the company should play an active role in designing, redeeming, modifying and maintenance of the total organization wide management information system.

Regarding the reporting of MIS systems head, there are three views prevailing among the thinkers and users of MIS.

(i) Reporting to Vice President Finance.

(ii) Reporting to President.

(iii) Reporting to Corporate Head of Computer Facilities.

The popular policy of MIS is under the vice president of finance, because in many companies finance/ accounting organization gained early control over the computer centre. Therefore, MIS were conceived as controlling and decision making tool rather than planning and decision-making tool. Under this system, there is possibility of the distortion of the information, so the second concept, reporting to President was evolved.

(i) Reporting to President: It is most desirable and under this practice, the MIS organization should be in line command to President which ensures free and fair flow of information from grassroots level to top level. In addition, the possibility of distortion of information is minimized to a great extent. However, next is to place the MIS reporting to the corporate head of computer facilities. At this level MIS activities are being centralized at the level under the director corporate information system or vice president corporate information service.

(ii) Organization with in its Function: First of all .steering committee is constituted including manager MIS, production manager, marketing manager, finance manager, HRD manager and R and D manager. This steering committee would carryout the design a fresh with intense managerial involvement. Once, the first MIS has been installed, there must be an organization, which monitor it, and keeps it running smoothly. The figure explains the permanent MIS organization structure.

(a) Manager EDP is the inchoate of MIS departments; system manager, manager application programming, and manager software programming assist him.

(b) System manager, the sectional head of system analysis and design, is being assisted by senior and junior system analyst.

(c) Manager application programming is sectional head of application programming. He is responsible for the collection feeding, editing, and processing of data collected from different functional areas of the company. Lead application programmers, senior application programmers and junior application programmers assist him.

(d) Manager software programming is sectional head of software development and planning. He is responsible for the development of software needed by the organization i.e. for sales forecasting, inventory requirement and management, capital expenditure evaluation and for maintaining employee's recall etc. Level software programmers, senior and junior software programmers, assist him.

To locate the position of information in an organization these are different procedures followed by different business organization. Generally known forms of organization of MIS are following:

(i) Data processing organization under a separate direction.

(ii) Data processing organization as a separate company.

(iii) As part of financial departments.

(iv) As a part of decisional department for executives level.

15.3 Factors Responsible for Success and Failure of MIS

Many organizations use MIS successfully, others do not. Though the hardware and the software is the latest and has appropriate technology, its use is more for the collection and storage of data and its elementary processing. There are some factors which make the MIS a success and some others, which make it a failure.

Factors Responsible for Success

If a MIS is to be success then it should have all the features listed as follows:

- The MIS is integrated into the managerial functions. It sets clear objectives to ensure that the MIS focuses on the major issues of the business.
- An appropriate information processing technology required to meet the data processing and analysis needs of the users of the MIS is selected.
- The MIS is oriented, defined and designed in terms of the user's requirements and its operational viability is ensured.
- The MIS is kept under continuous surveillance, so that its open system design is modified according to the changing information needs.
- MIS focuses on the results and goals, and highlights the factors and reasons for non achievement.
- MIS is not allowed to end up into an information generation mill avoiding the noise in the information and the communication system.
- The MIS recognizes that a manager is a human being and therefore, the systems must consider all the human behavioral factors in the process of the management.
- The MIS recognizes that the different information needs for different objectives must be met with. The globalization of information in isolation from the different objectives leads to too much information and information and its non-use.
- The MIS is easy to operate and, therefore, the design of the MIS has such features which make up a user-friendly design.
- MIS recognizes that the information needs become obsolete and new needs emerge. The MIS design, therefore, has a basic potential capability to quickly meet new needs of information.
- The MIS concentrates on developing the information support to manager critical success factors. It concentrates on the mission critical applications serving the needs of the top management.

Factors Responsible for Failures:

Many a times MIS is a failures. The common factors which are responsible for this are listed as follows:

- The MIS is conceived as a data processing and not as an information processing system.
- The MIS does not provide that information which is needed by the managers but it tends to provide the information generally the function calls for. The MIS then becomes an impersonal system.
- Underestimating the complexity in the business systems and not recognizing it in the MIS design leads to problems in the successful implementation.
- Adequate attention is not given to the quality control aspects of the inputs, the process and the outputs leading to insufficient checks and controls in the MIS.

- The MIS is developed without streamlining the transaction processing systems in the organization.
- Lack of training and appreciation that the users of the information and the generators of the data are different, and they have to play an important responsible role in the MIS.
- The MIS does not meet certain critical and key factors of its users such as a response to the query on the database, an inability to get the processing done in a particular manner, lack of user-friendly system and the dependence on the system personnel.
- A belief that the computerized MIS can solve all the management problems of planning and control of the business.
- Lack of administrative discipline in following the standardized systems and procedures, wrong coding and deviating from the system specifications result in incomplete and incorrect information.
- The MIS does not give perfect information to all the users in the organization.

15.4 Developing MIS

MIS is not just about implementing a system but it is all about providing the right information to the recipient either it is derived from a system or otherwise.

The actions that are taken to create an information system that solves an organizational problem are called system development. These include system analysis, system design, programming, testing, conversion, production and finally maintenance. These actions usually take place in that specified order but some may need to repeat or be accomplished concurrently.

System analysis is accomplished on the problem the company is facing and is trying to solve with the information system. Whoever accomplishes this step will identify the problem areas and outlines a solution through achievable objectives. This analysis will include a feasibility study, which determines the solutions feasibility based on money, time and technology. Essentially the feasibility study determines whether this solution is a good investment. This process also lays out what the information requirement will be for the new system.

System design shows how the system will fulfill the requirements and objectives laid out in the system analysis phase. The designer will address all the managerial, organizational and technological components the system will address and need. It is important to note that user information requirements drive the building effort. The user of the system must be involved in the design process to ensure the system meets the users need and operations.

Programming entails taking the design stage and translating that into software code. This is usually outsourced to another company to write the required software or companies buy existing software that meets the systems needs. The key is to make sure the software is user friendly and compatible with current systems.

Testing can take on many different forms but is essential to the successful implementation of the new system. You can conduct unit testing, which tests each program in the system separately or system testing which tests the system as a whole. Either way there should also be acceptance testing, which provides a certification that the system is ready to use. Also, regardless of the test a comprehensive test plan should be developed that identifies what is to be tested and what the expected outcome should be. Conversion is the process of changing or converting the old system into the new. This can be done in four ways:

- **Parallel Strategy** – Both old and new systems are run together until the new one functions correctly (this is the safest approach since you do not lose the old system until the new one is "bug" free).
- **Direct Cutover –** The new system replaces the old at an appointed time.

- **Pilot Study** – Introducing the new system to a small portion of the operation to see how it fares. If good then the new system expands to the rest of the company.
- **Phased Approach** – New system is introduced in stages.

In order to implement the conversion, organization must document the good and bad during the process to identify benchmarks and fix problems. Conversion also includes the training of all personnel that are required to use the system to perform their job.

15.5 Approaches to MIS Development

In order to make sure that the systems are analyzed and designed efficiently and effectively, it is essential to adopt a suitable model, for which a basic understanding of various system development approaches/models currently in use, is a must. In a system development effort, the goal is to produce high quality software. As has already been discussed, the development process consists of activities, namely,

(i) Investigation.
(ii) Analysis.
(iii) Design.
(iv) Construction/coding.
(v) Implementation.
(vi) Maintenance.

There are some methods by which we develop a management information system:

- **System Approach:** It is used when the organization is very small.
- **Top Down Approach:** In this approach top management is the whole sale in-charge for the different activities of the system.
- **Bottom Up Approach:** It is started from the lowest level in a hierarchy. All the lowest levels are combined to form the middle level are combined to form the top level or the system.
- **End User Approach:** In this approach end user is responsible for system development. It is a low cost technology.
- **Integrative Approach:** In this approach evaluation, modification, etc. continues till a final design is acceptable to all levels.
- **Prototyping Approach:** In this approach first we develop a small or pilot version of the system. Pilot version is also known as prototype.
- **Traditional Approach:** In this approach activities are performed in sequences. When a activity is completed then the new one is started.

CASE: Computer aided system engineering; concept was introduced by *Wangler* in 1993. He has given the concept from business modeling and requirements capture for development tools. The concept of CASE is includes compilers project management tools and even editors. This modeling tool is usually used to support early phases of ISD (information system development).

15.6 Designing MIS

A general approach has to be followed to design develop a suitable system that can fulfill the requirements of the organization. Here requirement means the function and decision making techniques etc. Data is

generated at different levels of management, that becomes information and now this information is helpful in making decisions. There are many steps which are taken in designing an MIS, they are as follows:

(i) **Identifying Information:** In this step we have to be known the exact problem and the requirement of organization for which the system has to be made. If the objective is not well defined then the design will not exact, what an organization want. Objectives help in framing various plans and to achieve each objective we need some information. Following steps are necessary to consider this phase of process:

   (a) Asking queries about the requirement.

   (b) Initiating the information requirement.

   (c) Suggesting interpretations of that requirement.

   (d) Explain in detail the original statement.

   (e) Review the requirements.

(ii) **Determining Objectives:** Users have to define system objectives in terms of information. Objectives are known by asking following questions:

   (a) What is the purpose of MIS system?

   (b) What is it expected to do?

   (c) What are the users and what are their objectives?

   (d) Why the system is needed?

(iii) **Identifying System Constraints:** System constraint means the restriction under which objectives may be achieved. These constraints are created by the designer or the end uses. Constraints are of two types: internal and external.

   Following are internal constraints:

      (a) Top management support.

      (b) Cost and resources.

      (c) Manpower and availability.

      (d) Organizational Policy.

      (e) Acceptance.

   Following are external constraints:

      (a) Ordered entry.

      (b) Billing.

      (c) Government policies.

(iv) **Determining Information Needs and Resources:** To design the system first we have to find the information needs to achieve the objectives. After finding the information needs, we have to find the resources. Sources of information are of two types: internal and external. Internal sources of information are found in form of file records, letters, and reports etc. External sources of information are found in form of personal interviews of managers, trade publication, personal interaction with decision makers, and government publication etc.

(v) **Developing Alternative Conceptual Designs:** Skelton of MIS is the conceptual design of an MIS. Conceptual design is the restrict form of detailed design. Conceptual design of an MIS consists of many items such as type of information flow, channels through information is passing, and role of decision makers etc. Evaluation of alternative system is done by following methods:

(a) Prepare a cost-effectiveness data for the systems, for quantified comparison.
(b) Compare performance of conceptual design with respect to objectives of system developed earlier.
(c) If none of the methods provide a preferred design then expand the conceptual designs.

(vi) **Preparing the Reports of Conceptual Design:** This report consists the expenditure of funds, possible changes in an organization set-up, summary of problems, objectives of system, nature of system, reason why this concept was selected over others, resources required to design the system and resources required for implementation.

15.7 Implementation of MIS

Implementation is a process of planning a newly developed MIS into operation or functioning at the user's workstation. Steps to implement MIS are:

(i) Planning for Implementation: Planning involves identifying various activities such as deciding the sequence for the activities and estimating the time needed for each activity that is required to implement MIS. To specify and describe the planning, various tools can be used such as *Gantt Charts* and *Network Diagram* or *CPM* (Critical Path Method).

(ii) Acquisition of Facilities and Space Planning: To implement MIS at the users workstation, various facilities such as office, computer room and computer library are required. Therefore, the MIS managers also need to do space planning. The MIS managers also need to decide the location of the computer room and its safety and security factors.

(iii) Developing MIS Organization and Procedure: Now MIS manager starts recruiting other required human resources for the MIS. The MIS manager also starts developing procedures for various other activities such as evaluating and selecting hardware and buying or developing required software.

(iv) User Training: For successfully implementing MIS, the MIS manager must arrange training for the users according to the user's requirement.

(v) Acquisition of Hardware and Software: Immediately after deciding the MIS design specifications, the process of purchasing or developing the required hardware and software starts. The MIS manager should ensure that the prerequisite such as computer room, electric connections and communication lines, required to install the hardware are fulfilled. The MIS manager should also ensure that other consumables such as papers and optical media are available as required.

(vi) Creating Forms and Database: Database is used to store data, and forms are used for transmitting data. Forms are used to input data to MIS also receive the output data from the MIS. Therefore, database and forms must be generated for the MIS and these database and forms are generated in context of the entire MIS.

(vii) Testing: Testing is a process that is performed to find out whether or not each and every element of MIS such as equipments, programs and forms, are working according to their design specifications. The testing also calculates accuracy, range of inputs, frequency of inputs, operating conditions and reliability factors of the MIS.

(viii) Change Over: after performing the testing, the last step is to put the MIS at the user's workstation. The process of placing the newly developed MIS at the workstation differs depending on the following two situations:

(a) Placing only the new MIS system.
(b) Replacing an existing MIS system by the new one.

This is the one process for implementation of MIS. For better understanding the differentiated process of MIS implementation, here we have another one process. In which implementation plan for which consist of the following steps:

- Prepare organizational plans.
- Planning of flow of work.
- Training of personnel.
- Software development.
- Acquiring computer hardware.
- Design the format for data collection.
- Data files construction.
- Parallelization of common operation of new and old system.
- Phasing out the old system and inducting the new system.
- Testing of new system.
- Evaluation of new system.
- Maintenance and control of new system.

15.8 Impact of MIS

The impact of MIS on the functions is in its management. With a good MIS support, the management of marketing, finance, production and personnel becomes more efficient, the tracking and monitoring the functional targets becomes easy. The functional managers are informed about the progress, achievements and shortfalls in the activity and the targets. The manager is kept alert by providing certain information indicating the probable trends in the various aspects of business. This helps in forecasting and long-term perspective planning. The manager" attention is brought to a situation which is exceptional in nature, inducing him to take an action or a decision in the matter. A disciplined information reporting system creates a structured database and a knowledge base for all the people in the organization. The information is available in such a form that it can be used straight away or by blending and analysis, saving the manager's valuable time.

The MIS creates another impact in the organization which relates to the understanding of the business itself. The MIS begins with the definition of a data entity and its attributes. It uses a dictionary of data, entity and attributes, respectively, designed for information generation in the organization. Since all the information systems use the dictionary, there is common understanding of terms and terminology in the organization bringing clarity in the communication and a similar understanding of an event in the organization.

The MIS calls for a systemization of the business operations for an effective system design. This leads to streamlining of the operations which complicate the system design. It improves the administration of the business by bringing a discipline in its operations everybody is required to follow and use systems and procedures. This process brings a high degree of professionalism in the business operations.

Since the goals and objective of the MIS are the products of business goals and objectives, it helps indirectly to pull the entire organization in one direction towards the corporate goals and objectives by providing the relevant information to the people in the organization.

A well designed system with a focus on the manager makes an impact on the managerial efficiency. The fund of information motivates an enlightened manager to use a variety of tools of the management. It helps

him to resort to such exercises as experimentation and modeling. The use of computers enables him to use the tools and techniques which are impossible to use manually. The ready-made packages make this task simpler. The impact is on the managerial ability to perform. It improves the decision making ability considerably.

15.9 Evaluation of MIS

The Management Information System Evaluation Process assesses the maturity of a given Management Information System, that is, the degree to which they are defined, implemented, evaluated and continuously improved. It takes time for a system to be developed and *fully* deployed – the point at which behavioral and performance results are realized. The life cycle of a Management Information System consists of five phases of maturity:

- **Development:** documentation of policies and procedures
- **Implementation:** Policies and procedures are put into use
- **Verification:** Demonstrated wide-spread use and acceptance
- **Behavioral Impacts:** Change in culture, attitudes, and work habits
- **Performance Results:** Improved operational performance

Management Information Systems are evaluated against three criteria:

- Definition,
- Implementation,
- Planning,
- Assessment & Improvement.

Definition

The Development Phase of system maturity is captured primarily in the Definition criteria; the other phases are captured jointly by the Implementation and Planning, Assessment & Improvement criterion. Definition refers to how the MIS is designed. What processes/functions are included, are all roles and responsibilities defined and assigned; are responsible personnel properly trained and educated? Approaches should respond to all internal and external drivers, be consistent across similar activities, reflect a systematic response to changes in requirements, and be aligned with other MIS and operations. The Sub-elements of Definition are Documentation, Requirements Management, and Alignment.

- **Documentation:** This refers to the degree to which the MIS Processes, Responsibilities, Controls and related procedures are codified/published and periodically reviewed and updated to reflect changing requirements. The point of this sub element is that whatever the format of the control, the document is reviewed and kept current in a systematic manner.
- **Requirements Management:** This refers to the degree to which the MIS responds to applicable changes in internal and external requirements. There should be a defined process for reviewing potential and pending changes, analyzing their impact and implementing appropriate changes in the operation of the MIS.
- **Alignment/Integration:** This refers to the degree to which the MIS is aligned with the other MIS programs. References and links to other MIS need to be correct. Processes of one MIS should not conflict with those of other MIS. Also, a MIS should use to processes of other MIS and Programs to avoid duplication of activities.

Implementation

Implementation refers to how well the processes and functions of the system are being followed/used, and how the MIS gathers information from users and stakeholders about the processes and functions. Are all Departments/Divisions working within the MIS? If not, what parts/programs are not, and why? Also included is information about feedback – what kind of feedback is being received regarding the MIS? Are planning and decision making processes being affected appropriately to meet the requirements of the MIS? The Sub-elements of Deployment/Implementation are Awareness, Implementation/Integration, and Feedback.

- **Awareness:** This refers to the degree to which employees, guests and visitors are aware of the functions of the MIS and their role in working within the system.
- **Implementation:** This refers to the degree to which employees, guests, and visitors are performing activities and following the processes of the MIS.
- **Acceptance Indicators:** This refers to how the MIS gather information about the awareness and implementation of the processes. What do they do with that information? How is it incorporated into the MIS? What is the satisfaction level of the users and stakeholders with those processes? Is the system effective, are some things "falling through the cracks", are the requirements/paperwork/ controls too onerous or inefficient? Do users have the training to get the most out the system, as well as work within its expectations?

Planning, Assessment & Improvement

This criterion refers to the planning, assessment and improvement processes used to continually monitor/ improve the MIS. What operational performance information is used and how improvements are made. Again, the focus is on a consistent process for accomplishing these tasks. One goal/benefit of having a robust Planning, Assessment and Improvement process is to use that to work for a reduction in external assessments. The Sub-elements of this criterion are Assessment/ Operational Performance, and Improvement.

- **Planning:** This element refers to the degree, scope and regularity of the planning process. Is planning both for the short and long term? Does it take into consideration Lab level goals/initiatives as well as Critical Outcomes, stakeholder input and external drivers? How are resource needs considered?
- **Assessment:** This refers to the degree to which there is a periodic review of the processes, functions and activities within the MIS. The term assessment should be interpreted very broadly to include any activity that provides information about the performance of the MIS – from formal audits and assessments to facility walk-through, to the review of performance metrics, to discussions with stakeholders, to customer satisfaction surveys. Also included is Operational Performance - quantitative data indicating how the MIS is performing and includes items such as Critical Outcome performance, customer satisfaction ratings, training and qualification statistics, trends based on assessment results/ findings and corrective actions. It also includes operational metrics, as applicable.
- **Improvement:** This refers to how improvements are made based on assessment results, operational performance indicators, and feedback from stakeholders. What is the process for determining appropriate improvements and/or corrective actions, prioritizing improvements? How is the implementation of improvements tracked to closure and evaluated for effectiveness? Is worker and customer input solicited in the development and implementation of improvements? Are lessons learned from the experiences of other organizations, both on-site and off-site reviewed/applied as appropriate? Are lessons learned from the operation of this MIS shared as appropriate?

15.10 Summary

Organizations have three levels of management: top, middle and bottom. The information requirements vary across different management levels. So, different types of information systems are needed at different management levels. MIS is also applied across different functional areas like sales and marketing; manufacturing and production; finance and accounting and human resources. To facilitate the management decision making at all levels of company, MIS must be integrated.

There are some factors which make the MIS a success and some others, which make it a failure. Factors responsible for success are: integration of MIS into managerial functions, appropriate information processing technology, keeping MIS under continuous surveillance etc. Factors responsible for failure are: underestimating the complexity of business processes, inadequate attention to quality control, lack of training etc.

MIS is not just about implementing a system but it is all about providing the right information to the recipient either it is derived from a system or otherwise. In order to make sure that the systems are analyzed and designed efficiently and effectively, it is essential to adopt a suitable model. In a system development effort, the goal is to produce high quality software.

With a good MIS support, the management of marketing, finance, production and personnel becomes more efficient, the tracking and monitoring the functional targets becomes easy. The functional managers are informed about the progress, achievements and shortfalls in the activity and the targets. The manager is kept alert by providing certain information indicating the probable trends in the various aspects of business. This helps in forecasting and long-term perspective planning. The manager" attention is brought to a situation which is exceptional in nature, inducing him to take an action or a decision in the matter. The MIS creates another impact in the organization which relates to the understanding of the business itself. The MIS calls for a systemization of the business operations for an effective system design.

Management Information Systems are evaluated against three criteria: Definition, Implementation, and Planning, Assessment & Improvement. The Development Phase of system maturity is captured primarily in the Definition criteria; the other phases are captured jointly by the Implementation and Planning, Assessment & Improvement criterion.

15.11 Self Assessment Questions

1. How do the information requirements vary at different management levels? Explain in detail.
2. Explain the importance of MIS within an organization.
3. Discuss the factors responsible for the success and failure of an organization.
4. Discuss the various approaches to MIS development.
5. What are the various steps that are followed for designing an MIS?
6. What are the various steps that are adopted to implement an MIS?
7. Discuss the impact of MIS on organizational performance.
8. Explain in detail the criteria that can be used to evaluate MIS.

15.12 Reference Books

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Unit - 16 : Decision Support System and Decision Making

Structure of Unit:

16.0 Objectives
16.1 Introduction
16.2 Decision Analysis
16.3 Organizational Decision Making
16.4 DSS, MIS and Decision Making
16.5 Concept of Decision Support System
16.6 Knowledge Management
16.7 Summary
16.8 Self Assessment Questions
16.9 Reference Books

16.0 Objectives

After completing this unit, students would be able to:

- Understand the concept of decision making and decision support system;
- Categories different components and relations of DSS with MIS and different aspects of information systems;
- Recognize process, application and advantages of DSS;
- Focus towards the information systems and their applications in real world situations;
- Identify knowledge management (KM) and application of it in knowledge management system;
- Learn differentiated technological terms and their usage of the era;

16.1 Introduction

As we are aware of there are different levels in an organization. Each of these levels has different information requirements for decision support and responsibilities for different type of decisions (see Figure 16.1). Decisions are classified as structured, semi structured, and unstructured.

Unstructured decisions are those in which the decision makers must provide judgment, evaluation, and insight to solve the problem. Each of these decisions is novel, important, and non routine, and there is no well-understood or agreed-on procedure for making them.

Structured decisions**,** by contrast, are repetitive and routine, and they involve a definite procedure for handling them so that they do not have to be treated each time as if they were new. Many decisions have elements of what type of decisions and are *semi structured*, where only part of the problem has a clear-cut answer provided by and accepted procedure. In general, structured decisions are more prevalent at lower organizational level; whereas unstructured problems are more common at top levels of the firm organization.

Senior executives face many unstructured decision situations, such as establishing the organization five- or ten- year goals or deciding new markets to enter. Answering the question "should we enter a new market?" would require access to news government reports, an industry views as well as high-level summaries of firm performance. However, the answer would also require senior managers to use their own best judgment and poll other managers for their opinions.

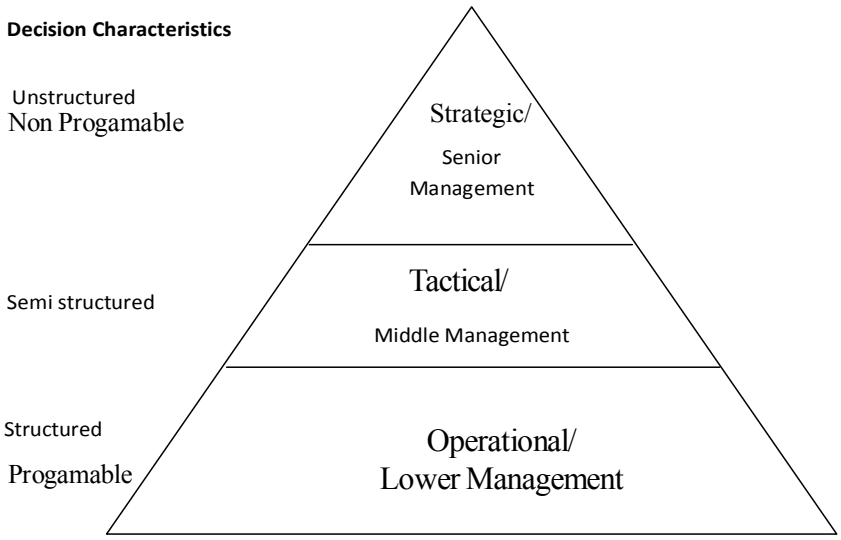


Figure 16.1 : Information Flow in Key Decision Making Groups

Middle management faces more structured decision seniors but their decisions may include unstructured component. A typical middle-level management decision might be "Why is the reported ordered fulfillment report showing a decline over the past six months at a distribution center in Minneapolis?" This middle manager could obtain a report from the funds enterprise system or distribution management system on order activity and operational efficiency at the Minneapolis distribution center. This is the structured part of the decision. But before arriving at an answer, this middle manager will have to interview employees and gather more unstructured information from external sources about local economic conditions or sales trends.

Operation management and rank-and-file employees tend to make more structured decisions. For example, a supervisor on an assembly line has to decide whether an hourly paid worker is entitled to overtime pay. If the employee worked more than eight hours on a particular day, the supervisor would routinely grant overtime pay for any time beyond eight hours that was clocked on that day.

A sales account representative often has to make decisions about extending credit to customers by consulting the firm's customer database that contains credit information. If the customer met the firm's pre-specified criteria for granting credit, the account representative would grant that customer credit to make a purchase. In both instances the decisions are highly structured and are routinely made thousands of times each day in larger firms. The answer has been preprogrammed into the firm's payroll and accounts receivable systems.

16.2 Decision Analysis

Making decisions a multistage process. Simon (1960) described four different stages in decision making: Intelligence, design, choice and implementation (see figure 16.2). These stages correspond to the four steps in problem-solving used throughout this book.

Intelligence consists of discovering, identifying, and understanding the problems occurring in the organization-why there is a problem, where, and what effects it is having on the firm.

Design involves identifying and exploring various solutions to the problem.

Choice consists of choosing among solution alternatives.

Implementation involves making the chosen alternative work and continuing to monitor how well the solution is working.

What happens if the solution you have chosen does not work? Figure 16.2 shows that you can return to an earlier stage in the decision-making process and repeat it if necessary. For instance, in the face of declining sales, a sales management team may decide to pay the sales course. A higher commission core making more sales to spur all the sales on the sales effort. If this does not produce sales increases, managers would need to investigate whether the problem stems from poor product design, inadequate customer support, or a host of other causes that call for a different solution.

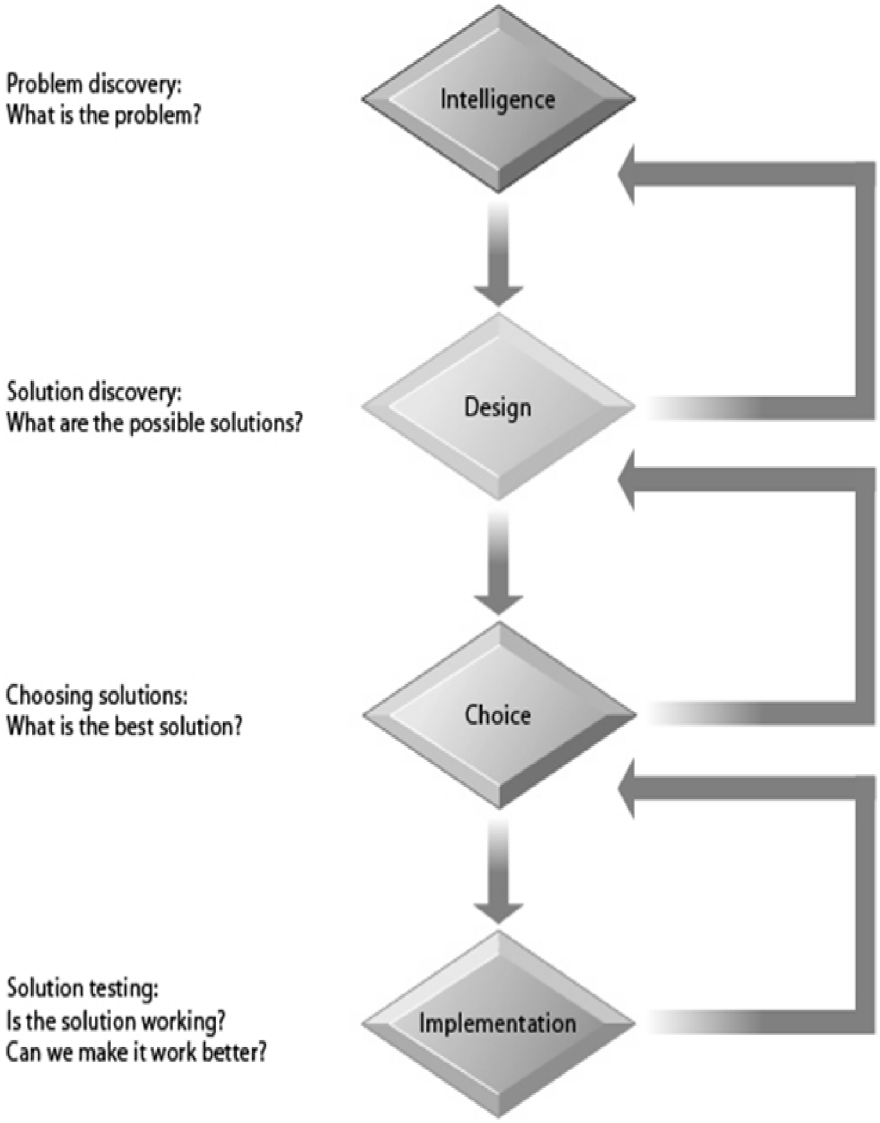


Figure 16.2 : Stages in Decision Making Process and Analysis

Decision analysis refers to the broad quantitative field, overlapping operations research and statistics, which deals with modeling, optimizing and analyzing decisions made by individuals, groups and organizations.

The purpose of decision analysis is to assist decision makers in making better decisions in complex situations, usually under uncertainty. The quality of the decisions is measured by their expected consequences and the stated preferences of the decision maker(s). The decision analytic framework helps the decision maker think systematically about his or her objectives, preferences, and the structure and uncertainty in the problem, then model quantitatively these and other important aspects of the problem and their interrelationship.

Applications of Decision Analysis:

Decision analysis is widely used in business and government decision making. Following is a non-exhaustive list of most common applications:

1. Business
   - Airline and hotel yield management
   - Oil exploration
   - Quality assurance and control
   - Reliability and maintenance
   - Crop protection
   - Credit and loan portfolio management
   - Project selection
   - New product development
   - New venture launching
2. Government
   - Emergency management
   - Environmental risk management
   - Choice of new energy sources
   - Research and development programs
3. Common
   - Medical diagnosis and treatment
   - Bidding and negotiation
   - Litigation

Main Elements of a Decision Model

All complex decision problems include the following main elements:

- Decisions, to be made by the decision maker;
- Uncertain events, whose outcomes determine the state of nature;
- Consequences, which result from the decisions and the outcomes of the uncertain events;
- Objectives and preferences, which determine how the decision maker feels about the consequences.

16.3 Organizational Decision Making

Real-World Decision Making: we now can see that information systems are not helpful for all managerial roles. And in those managerial roles where information systems can improve decisions, investments in information technology do not always produce positive results. There are three main reasons: information quality, management filters, and organizational culture.

Information Quality: High-quality decisions require high-quality information. Table 16.1 describes information quality dimensions that can affect the quality of decisions.

If the output of information systems does not meet these quality criteria, decision-making will suffer. Chapter shown that corporate database and files have varying levels of inaccuracy and incompleteness, which in turn can degrade the quality of decision making.

Table 16.1: Dimensions of Information Quality

Quality Dimensions	Description
Accuracy	Do the data represent reality?
Integrity	Are the structure of data and relationships among the entities and attributes consistent?
Consistency	Are the data elements consistently defined?
Validity	Do data values fall within defined ranges?
Timeliness	Area data available when needed?
Accessibility	Are the data accessible, comprehensible and usable?

Management Filters: Even with timely, accurate information, some mangers make bad decisions. Mangers (like all human beings) absorb information through a series of filters to make sense of the world around them. Managers have selected attention, focus on certain kinds of problems and solution, and have a variety of biases that reject information that does not confirm to their prior conceptions.

For instance, Cisco Systems Corporation, one of the most advanced users of online decisions-support systems, nevertheless was forced to write off as a loss $3.4 billion in excess inventory in 2001 because management had not interpreted the information from systems correctly. The company's online sales order entry system throughout 1999 and 2000 showed exceptionally strong orders. However, customers, perceiving a shortage of routers and other networking equipment, were placing orders with multiple manufacturers, awarding the business to the first one who could deliver, and canceling other orders. Cisco's systems were also recorded high levels of order cancellation, but management ignored this "bad news" and emphasized the "good news": new orders were piling up (Laudon and Laudon, 2003).

Organizational Inertia and Politics: Organizations are bureaucracies with limited capabilities and competencies for acting decisively. When environments change and businesses need to adopt new business models to survive, strong forces within organizations resist making decisions calling for major change. Decisions taken by a firm often represent a balancing of the firm's various interest groups rather than the best solution to the problem.

Studies of business restructuring find that firms tend to ignore poor performance until threatened by outside takeovers, and they systematically blame poor performance on external forces beyond their control such as economic conditions (the economy), foreign competition, and rising prices, rather than blaming senior or middle management for poor business judgment.

Activity A:

1. Form a organization of your choice and list the factors which you see at the time of decision making.

16.4 DSS, MIS and Decision Making

Decision-Support Systems (DSS):

Whereas MIS primarily address structured problems, DSS support semi structured and unstructured problem analysis. The earliest DSS were heavily model-driven, using some type of model to perform "what-if" and other kinds of analyses. Their analysis capabilities were based on a strong theory or model combined with a good user interface that made the system easy to use.

Some contemporary DSS are data-driven, using online analytical processing (OLAP), and data mining to analyze large pools of data. The business intelligence applications are examples of these data-driven DSS, as are the spreadsheet pivot table applications we describe in this section. Data-driven DSS support decision making by enabling users to extract useful information that was previously buried in large quantities of data.

Management Information System (MIS):

Management information system (MIS), which be introduced in 16 unit, help managers monitor and control the business by providing information on the firm's performance. They typically produce fixed, regularly scheduled reports based on data extracted and summarized from the firm's underlying transaction processing systems (TPS). Sometimes, MIS reports are exception reports, highlighting only exceptional conditions, such as when the sales quotas for a specific territory fall below unanticipated level or employees have exceeded their spending limits in a dental care plan. Today, many of these reports are available online through an intranet, and more MIS reports can be generated on demand.

Decision Making:

The English word '**Decision**' originated from the Latin word '*decisio*' which means "*to cut from*." **To decide** means "*to come to a conclusion*" or "*to pass a resolution*."

According to James Stoner "Decision making is the process of identifying and selecting a course of action to solve a specific problem."

According to Trewartha and Newport "Decision making involves the selection of a course of action from among two or more possible alternatives in order to arrive at a solution for a given problem."

Components of Decision Making: Decision making in management has following three components for systemize the concepts:

1. **Alternatives**: There are two or more alternatives. Decision making means to select the best alternative.
2. **Choice**: Decision making involves a choice. It means to choose the best solution for solving the problem.
3. **Objectives or Problem:** Decision making is objective oriented. It is done to achieve an objective or to solve a problem.

Models of Decision Making:

1. Rational Model:

- Economic rational actor - obtains all the facts, weighs likelihood of all the alternative outcomes, and chooses the one with the highest probable value.
- Expected monetary value satisfying
- Less than optimization
- More realistic
- Limited number of alternatives

2. Organizational and Political

- Sub-units or members with own "goals" and "resources"
- Power struggle
- Bargaining and negotiation

16.5 Concept of Decision Support System

A **decision support system** (**DSS**) is a computer-based information system that supports business or organizational decision-making activities. DSSs serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing and not easily specified in advance.

According to Gorry and Scott-Morton (1971) "Management Decision Systems – Interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems."

According to Keen and Scott-Morton (1978) "Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision makers who deal with semi-structured problems."

DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, personal knowledge, or business models to identify and solve problems and make decisions.

Typical information that a decision support application might gather and present are:

- Inventories of information assets (including legacy and relational data sources, cubes, data warehouses, and data marts),
- Comparative sales figures between one period and the next,
- Projected revenue figures based on product sales assumptions.

There are four kinds of systems for supporting the different levels and types of decisions we have just described. We introduced some of the systems in previous chapter. Management information systems (MIS) provide routine reports and summaries of transactions-level data to middle and operational level managers to provide answers to structured and semi structured decision problems. Decision-support systems (DSS) provide analytical models or tools for analyzing large quantities of data for middle managers who face semi structured decisions situation. Executive support systems (ESS) are systems that provide senior management, making primarily unstructured decisions, with external information (News, Stock analysis, and industry trends) and high-level summaries of firm performance.

In this chapter, you will also learn about systems for supporting decisions-makers working as a group. Group decision-support systems (GDSS) are specialized systems that provide a group electronic environment in which managers and teams can collectively make decisions and design solutions for unstructured and semi structured problems.

History of DSS:

According to Keen (1978), the concept of decision support has evolved from two main areas of research: The theoretical studies of organizational decision making done at the Carnegie Institute of Technology during the late 1950s and early 1960s, and the technical work on interactive computer systems, mainly carried out at the Massachusetts Institute of Technology in the 1960s. It is considered that the concept of DSS became an area of research of its own in the middle of the 1970s, before gaining in intensity during the 1980s. In the middle and late 1980s, executive information systems (EIS), group decision support systems (GDSS), and organizational decision support systems (ODSS) evolved from the single user and model-oriented DSS.

According to Sol (1987), the definition and scope of DSS has been migrating over the years. In the 1970s DSS was described as "a computer based system to aid decision making". Late 1970s the DSS movement started focusing on "interactive computer-based systems which help decision-makers utilize data bases and models to solve ill-structured problems". In the 1980s DSS should provide systems "using suitable and available technology to improve effectiveness of managerial and professional activities", and end 1980s DSS faced a new challenge towards the design of intelligent workstations.

In 1987 Texas Instruments completed development of the Gate Assignment Display System (GADS) for United Airlines. This decision support system is credited with significantly reducing travel delays by aiding the management of ground operations at various airports, beginning with O'Hare International Airport in Chicago and Stapleton Airport in Denver Colorado.

Beginning in about 1990, data warehousing and on-line analytical processing (OLAP) began broadening the realm of DSS. As the turn of the millennium approached, new Web-based analytical applications were introduced.

The advent of better and better reporting technologies has seen DSS start to emerge as a critical component of management design. Examples of this can be seen in the intense amount of discussion of DSS in the education environment.

DSS also have a weak connection to the user interface paradigm of hypertext. Both the University of Vermont PROMIS system (for medical decision making) and the Carnegie Mellon ZOG/KMSsystem (for military and business decision making) were decision support systems which also were major breakthroughs in user interface research. Furthermore, although hypertext researchers have generally been concerned with information overload, certain researchers, notably Douglas Engelbart, have been focused on decision makers in particular

Components of DSS:

Figure 16.3 illustrates the components of a DSS. They include a database of data used for querying and analysis; a software system with models, data mining, and other analytical tools; and a user interface.

The DSS database is a collection of current or historical data from a number of applications or groups. It may be a small database residing on a PC that contains a subset of corporate data that has been downloaded and possibly combined with external data. Alternatively, the DSS database may be a massive data warehouse that is continuously updated by major corporate TPS (including enterprise applications) and data generated by Web site transactions). The data in DSS databases are generally extracts or copies of production databases so that using the DSS does not interfere with critical operational systems.

The DSS user interface permits easy interaction between users of the system and the DSS software tools, Many DSS today has Web interfaces to take advantage of graphic displays, interactivity, and ease of use.

The DSS software system contains the software tools that are used for data analysis. It may contain various OLAP tools, data mining tools, or a collection of mathematical and analytical models that easily can be made accessible to the DSS user. A model is an abstract representation that illustrates the components or relationships of a phenomenon. A model can be a physical model (such as a model plane), a mathematical model (such as an equation), or a verbal model (such as a description of a procedure for writing an order).

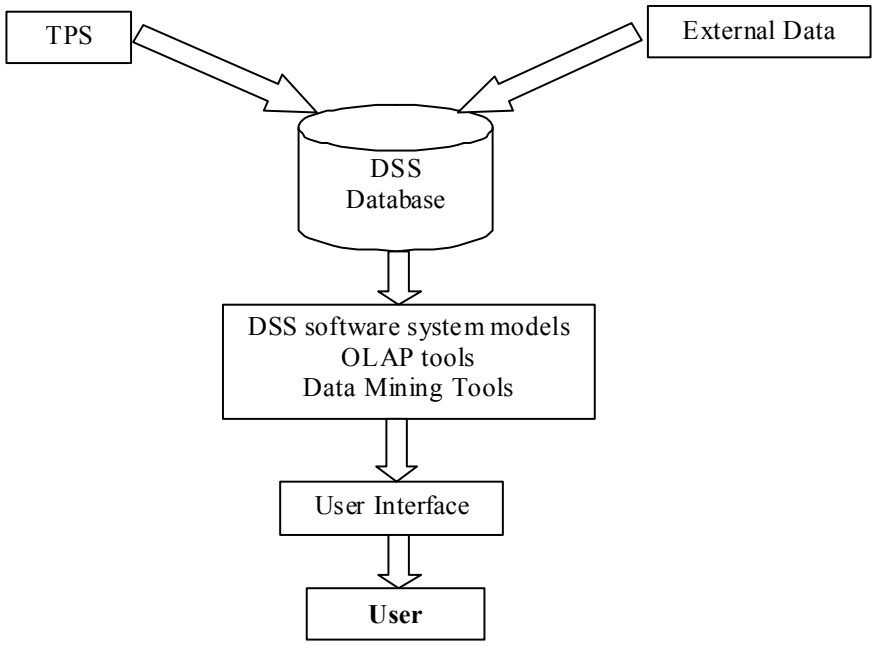


Figure 16.3 : Framework of Decision Support System

Statistical modeling helps establish relationships, such as relating product sales to differences in age, income, or other factors between communities. Optimization models determine optimal resource allocation to maximize or minimize specified variables, such as cost or time. A classic use of optimization models is to determine the proper mix of products within a given market to maximize profits. The chapter-opening case illustrates P&G's use of optimization models to determine how to maximize its return on investment in its supply chain.

Forecasting models often are used to forecast sales. The user of this type of model might supply a range of historical data to project future conditions and the sales that might result from those conditions. The decision maker could vary those future conditions (entering, for example, a rise in raw materials costs or the entry of a new, low-priced competitor in the market) to determine how new conditions might affect sales.

Sensitivity analysis models ask "what-if" questions repeatedly to determine the impact on outcomes of changes in one or more factors. What-if analysis working forward from known or assumed conditions-allows the user to vary certain values to test results to better predict outcomes if changes occur in those values. What happens if we raise product prices by 5 percent or increase the advertising budget by $100,000? What happens if we keep the price and advertising budgets the same? Desktop spreadsheet software, such as Microsoft Excel, is often used for this purpose. Backward-sensitivity analysis software helps decision makers with goal seeking: If I want to sell 1 million product units next year, how much must I reduce the price of the product?

Characteristics and Capabilities of DSS:

Different scholars and executives have defined the characteristics and capabilities of DSS differently. Following are the major points to study:

(i) Support is provided for various managerial levels, ranging from top executives to line managers.

(ii) Support is provided to individuals as well as to groups.

(iii) DSS provide support to several interdependent and/or sequential decisions. The decision may be made once, several times, or repeatedly.

(iv) Effective problem solving is interactive and is enhanced by a dialogue between the users and the system.

(v) DSS provide support for decision makers mainly in semi-structured and unstructured situation by bringing together human judgments and computerized information.

(vi) DSS support all phases of decision making process like intelligence, design, choice and implementation.

(vii) DSS supports a variety of decision making process and styles.

(viii) DSS must support the manager but not replace their judgment.

(ix) The DSS are adapted over time. DSS are flexible, and so user can add, delete, combine, change, or rearrange basic elements.

(x) Users must feel user-friendliness environment with maximum graphical capabilities and chart representation.

(xi) A DSS usually utilizes models for analyzing decision making situations.

(xii) End users should be able to construct and modify simple systems by themselves. Larger systems can be built with assistance from information system specialist.

Application of DSS

One example is the clinical decision support system for medical diagnosis. Other examples include a bank loan officer verifying the credit of a loan applicant or an engineering firm that has bid on several projects and wants to know if they can be competitive with their costs.

DSS is extensively used in business and management. Executive dashboard and other business performance software allow faster decision making, identification of negative trends, and better allocation of business resources.

A growing area of DSS application, concepts, principles, and techniques is in agricultural production, marketing for sustainable development. For example, the DSSAT4 package, developed through financial support of USAID during the 80's and 90's, has allowed rapid assessment of several agricultural production systems around the world to facilitate decision-making at the farm and policy levels. There are, however, many constraints to the successful adoption on DSS in agriculture.

DSS are also prevalent in forest management where the long planning time frame demands specific requirements. All aspects of Forest management, from log transportation, harvest scheduling to sustainability and ecosystem protection have been addressed by modern DSSs.

A specific example concerns the Canadian National Railway system, which tests its equipment on a regular basis using a decision support system. A problem faced by any railroad is worn-out or defective rails, which can result in hundreds of derailments per year. Under a DSS, CN managed to decrease the incidence of derailments at the same time other companies were experiencing an increase.

DSS applications often report on or consolidate data that OLTP operations have captured over time. These applications provide information that is often used for accounting, strategic planning, and decision making. Data in the database is typically queried but not updated during DSS operations. Typical DSS applications include payroll, inventory, and financial reports.

Advantages of DSS

1) **Time Savings:** For all categories of decision support systems, research has demonstrated and substantiated reduced decision cycle time, increased employee productivity and more timely information for decision making. The time savings that have been documented from using computerized decision support are often substantial. Researchers have not however always demonstrated that decision quality remained the same or actually improved.

2) **Enhance Effectiveness:** A second category of advantage that has been widely discussed and examined is improved decision making effectiveness and better decisions. Decision quality and decision making effectiveness are however hard to document and measure. Most research has examined soft measures like perceived decision quality rather than objective measures.

3) **Improve Interpersonal Communication:** DSS can improve communication and collaboration among decision makers. In appropriate circumstances, communications-driven and group DSS have had this impact. Model-driven DSS provide a means for sharing facts and assumptions. Data-driven DSS make "one version of the truth" about company operations available to managers and hence can encourage fact-based decision making. Improved data accessibility is often a major motivation for building a data-driven DSS. This advantage has not been adequately demonstrated for most types of DSS.

4) **Competitive Advantage:** Vendors frequently cite this advantage for business intelligence systems, performance management systems, and web-based DSS. Although it is possible to gain a competitive advantage from computerized decision support, this is not a likely outcome. Vendors routinely sell the same product to competitors and even help with the installation. Organizations are most likely to gain this advantage from novel, high risk, enterprise-wide, inward facing decision support systems. Measuring this is and will continue to be difficult.

5) **Cost Reduction:** Some research and especially case studies have documented DSS cost saving from labor savings in making decisions and from lower infrastructure or technology costs. This is not always a goal of building DSS.

6) **Increase Decision Maker Satisfaction:** The novelty of using computers has and may continue to confound analysis of this outcome. DSS may reduce frustrations of decision makers, create perceptions that better information is being used and/or create perceptions that the individual is a "better" decision maker. Satisfaction is a complex measure and often researchers measure satisfaction with the DSS rather than satisfaction with using a DSS in decision making. Some studies have compared satisfaction with and without computerized decision aids. Those studies suggest the complexity and "love/hate" tension of using computers for decision support.

7) **Promote Learning:** Learning can occur as a by-product of initial and ongoing use of a DSS. Two types of learning seem to occur: learning of new concepts and the development of a better factual understanding of the business and decision making environment. Some DSS serve as "de facto" training tools for new employees. This potential advantage has not been adequately examined.

8) **Increase Organizational Control:** Data-driven DSS often make business transaction data available for performance monitoring and ad hoc querying. Such systems can enhance management understanding of business operations and managers perceive that this is useful. What is not always evident is the financial benefit from increasingly detailed data. Regulations like Sarbanes-Oxley often dictate reporting requirements and hence heavily influence the control information that is made available to managers. On a more ominous note, some DSS provide summary data about decisions made, usage of the systems, and recommendations of the system. Managers need to be very careful about how decision-related information is collected and then used for organizational control purposes. If employees feel threatened or spied upon when using a DSS, the benefits of the DSS can be reduced. More research is needed on these questions.

Activity B:

1. How DSS is helpful at the time of decision making in 'certainty' and 'uncertainty' situations? Make a list in two columns.

16.6 Knowledge Management

Enterprises are realising how important it is to "know what they know" and be able to make maximum use of the knowledge. This knowledge resides in many different places such as: databases, knowledge bases, filing cabinets and peoples' heads and are distributed right across the enterprise. All too often one part of an enterprise repeats work of another part simply because it is impossible to keep track of, and make use of, knowledge in other parts. Enterprises need to know:

- What their knowledge assets are?
- How to manage and make use of these assets to get maximum return?

Most traditional company policies and controls focus on the tangible assets of the company and leave unmanaged their important knowledge assets.

Success in an increasingly competitive marketplace depends critically on the quality of knowledge which organisations apply to their key business processes. For example the supply chain depends on knowledge of diverse areas including raw materials, planning, manufacturing and distribution. Likewise product development requires knowledge of consumer requirements, new science, new technology, marketing etc.

The challenge of deploying the knowledge assets of an organisation to create competitive advantage becomes more crucial as:

- The marketplace is increasingly competitive and the rate of innovation is rising, so that knowledge must evolve and be assimilated at an ever faster rate.

- Corporations are organising their businesses to be focused on creating customer value.
- Staff functions are being reduced as are management structures. There is a need to replace the informal knowledge management of the staff function with formal methods in customer aligned business processes.
- Competitive pressures are reducing the size of the workforce which holds this knowledge.
- Knowledge takes time to experience and acquire. Employees have less and less time for this.
- There are trends for employees to retire earlier and for increasing mobility, leading to loss of knowledge.
- There is a need to manage increasing complexity as small operating companies a re trans-national sourcing operations.

A change in strategic direction may result in the loss of knowledge in a specific area. A subsequent reversal in policy may then lead to a renewed requirement for this knowledge, but the employees with that knowledge may no longer be there.

Definition

Knowledge assets are the knowledge regarding markets, products, technologies and organisations, that a business owns or needs to own and which enable its business processes to generate profits, add value, etc.

Knowledge management is not only about managing these knowledge assets but managing the processes that act upon the assets. These processes include: developing knowledge; preserving knowledge; using knowledge, and sharing knowledge.

Therefore, **Knowledge management** involves the identification and analysis of available and required knowledge assets and knowledge asset related processes, and the subsequent planning and control of actions to develop both the assets and the processes so as to fulfil organisational objectives.

Techniques to Manage Knowledge

We believe that the knowledge modeling techniques that exist to support the use of the knowledge, along with traditional business management techniques, provide a starting point to manage the knowledge assets within a company. Therefore the techniques we employ for managing knowledge within the organisation are drawn from these two distinct areas:

- The techniques that have been used previously from business management, for example, SWOT (Strengths Weaknesses Opportunities Threats) analysis, balanced scorecards, modelling languages such as: IDEF (Process Flow and Object State Description Capture Method) and RADs (Role Activity Diagrams).
- The knowledge techniques that have been used previously for the disciplined development of knowledge-based applications.

Our recommended approach is a multi-perspective modelling approach. Several models need to be developed, each of which represents a different perspective on the organisation which can be characterised as "How, What, Who, Where, When and Why"

- How the organisation carries out its business - modelling the business processes
- What the processes manipulate - modelling the resources
- Who carries out the processes - modelling capabilities, roles and authority

- Where a process is carried out - modelling of the communication between agents
- When a process is carried out - this specifies the control over processes

Knowledge Management System

Knowledge Management System (KM System) refers to a (generally generated via or through to an IT based program/department or section) system for managing knowledge in organizations for supporting creation, capture, storage and dissemination of information. It can comprise a part (neither necessary nor sufficient) of a knowledge management initiative.

The idea of a KM system is to enable employees to have ready access to the organization's documented base of facts, sources of information, and solutions. For example a typical claim justifying the creation of a KM system might run something like this: an engineer could know the metallurgical composition of an alloy that reduces sound in gear systems. Sharing this information organization wide can lead to more effective engine design and it could also lead to ideas for new or improved equipment.

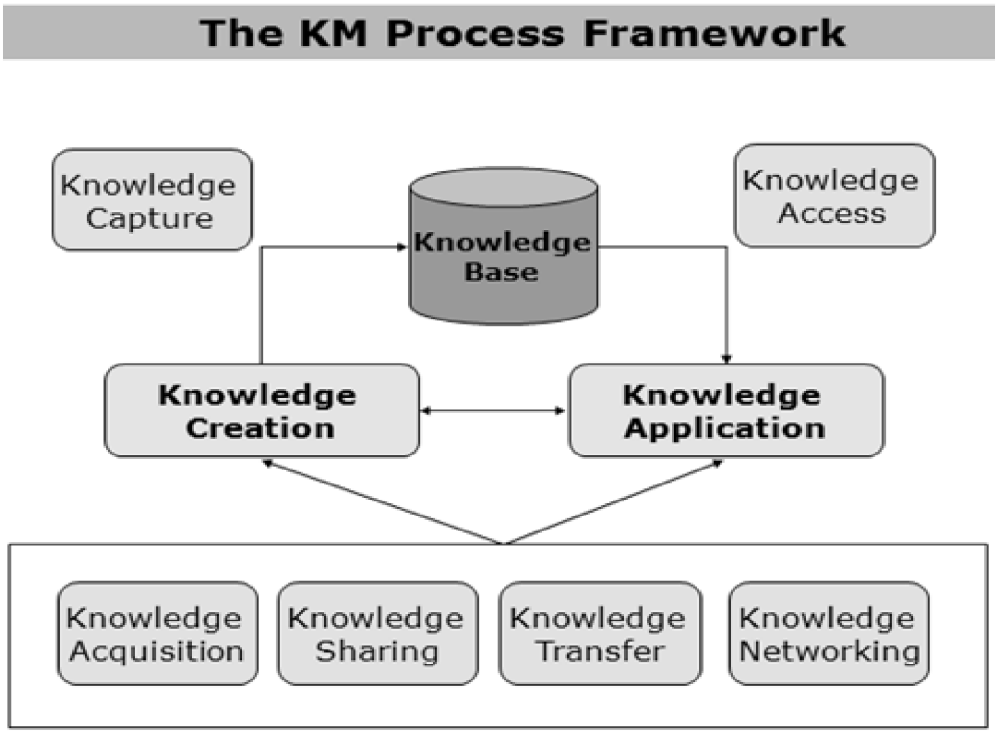


Figure 16.4 : Knowledge Management Framework

A KM system could be any of the following:

1. Document based i.e. any technology that permits creation/management/sharing of formatted documents such as Lotus Notes, SharePoint, web, distributed databases etc.
2. Ontology/Taxonomy based: these are similar to document technologies in the sense that a system of terminologies (i.e. ontology) are used to summarize the document e.g. Author, Subject, Organization etc. as in DAML & other XML based ontologies.
3. Based on AI technologies which use a customized representation scheme to represent the problem domain.
4. Provide network maps of the organization showing the flow of communication between entities and individuals.

5. Increasingly social computing tools are being deployed to provide a more organic approach to creation of a KM system.

KMS systems deal with information (although Knowledge Management as a discipline may extend beyond the information centric aspect of any system) so they are a class of information system and may build on, or utilize other information sources.

Features of KMS:

Distinguishing features of a KMS can include:

1. **Purpose:** a KMS will have an explicit Knowledge Management objective of some type such as collaboration, sharing good practice or the like.
2. **Context:** One perspective on KMS would see knowledge is information that is meaningfully organized, accumulated and embedded in a context of creation and application.
3. **Processes:** KMS are developed to support and enhance knowledge-intensive processes, tasks or projects of e.g., creation, construction, identification, capturing, acquisition, selection, valuation, organization, linking, structuring, formalization, visualization, transfer, distribution, retention, maintenance, refinement, revision, evolution, accessing, retrieval and last but not least the application of knowledge, also called the knowledge life cycle.
4. **Participants:** Users can play the roles of active, involved participants in knowledge networks and communities fostered by KMS, although this is not necessarily the case. KMS designs are held to reflect that knowledge is developed collectively and that the "distribution" of knowledge leads to its continuous change, reconstruction and application in different contexts, by different participants with differing backgrounds and experiences.
5. **Instruments:** KMS support KM instruments, e.g., the capture, creation and sharing of the codifiable aspects of experience, the creation of corporate knowledge directories, taxonomies or ontologies, expertise locators, skill management systems, collaborative filtering and handling of interests used to connect people, the creation and fostering of communities or knowledge networks.

A KMS offers integrated services to deploy KM instruments for networks of participants, i.e. active knowledge workers, in knowledge-intensive business processes along the entire knowledge life cycle. KMS can be used for a wide range of cooperative, collaborative, adhocracy and hierarchy communities, virtual organizations, societies and other virtual networks, to manage media contents; activities, interactions and work-flows purposes; projects; works, networks, departments, privileges, roles, participants and other active users in order to extract and generate new knowledge and to enhance, leverage and transfer in new outcomes of knowledge providing new services using new formats and interfaces and different communication channels.

The Nature of KM as a Type of Activity or a Set of Processes

Earlier we presented a three-tier framework (see figure 16.5) of business processes and outcomes, distinguishing operational business processes, knowledge processes, and processes for managing knowledge processes. Operational processes are those that use knowledge but, apart from routinely produced knowledge about specific events and conditions, don't produce or integrate it. Examples of outcomes are Sales Revenue, Market Share, Customer Retention and Environmental Compliance.

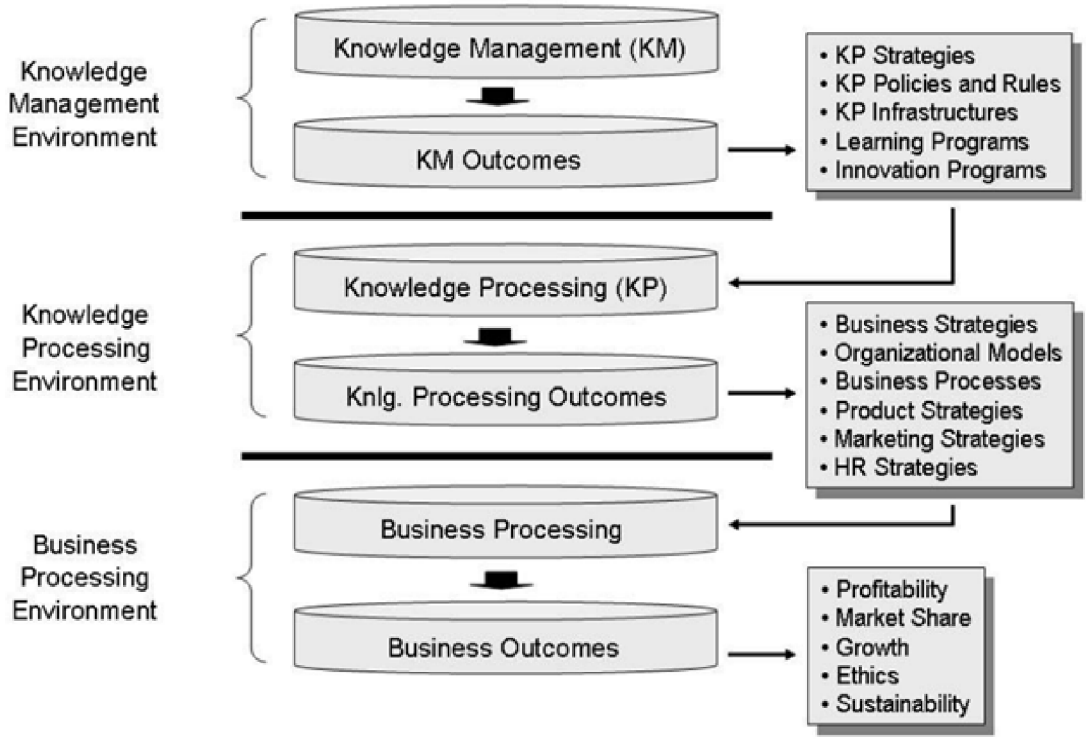


Figure 16.5 : The Three-Tier Framework of Business Process

Knowledge Management Systems in the Age of the Internet

For anyone new to knowledge management systems, the idea may seem dauntingly complex and technical. But if you break it down, it's simple. When a company or organization needs a way to organize their knowledge, whether it's digitized or in some other form, and share it rationally among many individuals, they need a knowledge management system.

In today's increasingly technology-driven business world, a knowledge management system is more and more becoming an indispensible part of any competitive company's organizational infrastructure. Without one, data gets lost or sent to the wrong places, there is no framework for sharing and restricting information, and people end up relying on comparatively sloppy ways of sharing information. Drawers of documents, fax, and even email are rapidly becoming modes of the past. Today, more organized, high-tech solutions are needed, and a few old nondigitial standbys are still useful.

There are many models widely used for knowledge management systems. Because there are many types of organizations with a wide diversity of needs, the world of knowledge management systems has developed into a thriving and creative field with many innovators continually coming up with novel new solutions for information sharing and processing. Let's look at a few of the more common types of knowledge management systems used in today's business world.

1. **Document Sharing:** One of the most widely used types of knowledge management systems includes those that enable multiple people in an organization to share documents such as word processing files and spreadsheets through a network. There are a few major tech companies that provide easily accessible types of document sharing. Google Docs, for instance, is used by many businesses to share and collaborate on documents.

   Several issues often arise with this type of knowledge management system. First, companies often must deal with different levels of permission for types of documents and for individual documents. Especially when it comes to larger companies with a large pool of lower-level employees, it is often important to make sure that only individuals with a certain degree of authority can alter and save

documents. Fortunately, permissions are usually pretty easy to set up, but such top-down organizational structures do have downsides. For one, when lower-level employees are blocked and don't feel their ideas or contributions are welcome, it can hurt morale.

Another issue that arises with document sharing is how to handle collaboration. When multiple people are working together on a document, it is easy for things to get confused, especially when two or more people try to edit a document at the same time. Meanwhile, edit tracking can quickly drown the document in markup. These, too, have relatively simple solutions, however, and most of the top document sharing platforms have built-in solutions.

Another issue with document sharing is the way a shared directory of documents can quickly become chaotic. With directories, subdirectories, overlapping documents, and multiple versions of the same thing, such systems often require someone to keep things organized.

2. **Community Knowledge Databases:** There is a reason why Wikipedia, despite its flaws, has grown into not just one of the most trafficked sites online but also a go-to source for basic information about practically anything. The fact that it makes virtually everyone in the world a potential contributor and editor gives it unprecedented potential. And indeed, it's living up to this potential with nearly 4 million articles now live on the English site, a good portion of which actually contain reliable information. Such a large information cache has never been possible in the history of the world.

   Seeing the success of Wikipedia and similar projects, many organizations are seeking to replicate that success, albeit on a much smaller scale. Many companies have established large Wikis for customer reference, and while these can be helpful, there is usually little incentive for anyone to voluntarily contribute. As a result, many such Wikis languish and provide poor customer service. Much more effective are internal Wikis for use within large companies. Many companies are secretive about these projects, but it's well known that many of the largest corporations in the world have user-generated communal knowledge databases, and they can be great resources for employees.

   Of course, it can be difficult to get people within an organization to set time aside to share their knowledge on the centralized knowledge database. That's why many companies incentivize this work. Although no immediate benefits of doing so may be apparent, the knowledge database inevitably becomes more useful as it grows. It's helpful, for example, for orienting new employees who are unfamiliar with company procedures. And it can be great for employees whose jobs involve complex and manifold procedures that are difficult to remember. In this sense, it's a sort of flexible, digitized policies and procedures manual.

3. **Expert-run Systems:** While vast libraries of information can be built through community systems like the ones described above, some companies desire a more centralized approach, with one or more individuals compiling information and putting it into an accessible form for all the members of the organization to use according to their needs. The obvious disadvantage of expert-run systems is that they require a great deal of work on the part of the experts who run them. But the advantage is that all users know the information is reliable because it has been vetted by a knowledge authority.

   Companies that have expert-run knowledge management systems typically must have the resources to be able to a support a staff of multiple individuals tasked with doing nothing but running the knowledge system. For this reason, organizations usually try to minimize this aspect of their business during lean times. This raises all sorts of issues when company employees perceive that work that should rightly be left to the experts is now being asked of workers whose jobs and expertise lie elsewhere.

4. **Hybrid Knowledge Management Systems:** To achieve a balance between community-generated knowledge systems and expert-run systems, many companies have sought hybrid models. In such systems, all members of the community are asked or encouraged to share their knowledge freely through the central system—which can take any number of forms—where it is moderated by an expert. It's similar to the typical setup at a major newspaper, where journalists and other contributors are given assignments or submit their own ideas for stories, and all stories must pass through the editor before going to publication. The editor has the power to approve pieces or send them back for revision, and he or she can make appropriate changes.

   In a hybrid knowledge system, an individual or a small team of people serves in the editorial role, acting as a sort of hub through which all the knowledge must pass before becoming accessible to all. The main advantage of this system is that all knowledge is vetted and polished before it goes live for others to access. The main disadvantages are that it can be a little clunky and that it can cause tensions that may lead to some employees becoming disengaged from the process.

5. **Mentor-Student Knowledge Sharing:** When it comes to jobs that are complex or have a steep learning curve, new arrivals into an organization often feel in over their heads and do not get off to a good start. If not managed correctly, these situations can have bad results down the road. One way to subvert this problem and to make sure new employees gain all the knowledge they need is to set up a mentor-mentee system in which newcomers are formally attached to a veteran and encouraged to go to that person for all questions.

   An added benefit of this type of system is that it can foster a sense of community within an organization. Conflicts between veterans and newcomers are common sources of tension inside organizations, and the mentor-mentee system sets up a spirit of cooperation right off the bat. The only disadvantage of this system is that the mentee's experience with it can only be as strong as the mentor's commitment to the process. When a newcomer gets paired with a veteran who doesn't believe in the process or simply doesn't have the motivation to participate, the system is worthless.

   Another important characteristic of a good mentor-student system is that it should be long term. It's not merely a training program that lasts a few days or weeks and then wraps up. The mentor-student relationship continues as long as both individuals are still with the company. Interactions between the two typically start off frequent and eventually taper off as the student becomes more comfortable. Even after that, however, the mentee always knows where to go if he or she needs some knowledge or wisdom about company operations.

6. **Fostering Ideas:** Google famously allows its employees to devote 20 percent of the work week (or one full day per week) to working on special projects of their own devising. The only catch is that employees must be open about what they're working on, and the project officially falls under the Google umbrella. Many of Google's now-popular products and services developed this way.

   While this type of policy may seem somewhat outside the concept of knowledge sharing, what's relevant here is its openness. When Google employees develop interesting new technologies in their special projects, Google can then harness those technologies toward other large-scale projects. And when you have a company full of innovative people like Google has, it turns the organization into a virtual think tank, with everyone bouncing around ideas and feeding off each other in incredibly productive ways.

   In other words, when people are given free rein to pursue projects they are passionate about, it assists in the development of knowledge that can be shared in the company. And perhaps equally

important is the fact that this type of policy helps create happy employees. Of course, it is inevitable that many of these small projects falling under the Google umbrella will not succeed, but Google's overall strategy of trying everything and sticking with what works has obviously done well for it so far. Other organizations should consider adopting similar models.

7. **Social Computing:** In a large company, it is simply not practical for everyone to spend inordinate amounts of time chatting with coworkers. Social networking technologies make employee interactions quicker and more efficient, however. Consider a social network such as Twitter, and imagine that everyone within a company is following a company-related hashtag on the side of their computer screens. If someone has a question or needs a piece of data, all he or she has to do is post a quick tweet, and within seconds the answers will come in.

   Of course, most companies don't actually use Twitter or other mainstream social networks, but many are beginning to implement similar systems that enable companywide, instantaneous sharing of knowledge. The disadvantage of this type of system, of course, is that the interactions can be a little messy. Plus, the knowledge tends to fall out of the conversation stream as quickly as it arrives. So social networking systems are not solutions for gathering knowledge and giving everyone access to it, but one can certainly imagine hybrid models that harvest knowledge from the collective social brain and put it into permanent and accessible formats.

8. **AI-Based Knowledge Sharing:** Artificial intelligence is still a futuristic technology in many people's eyes, but innovators around the world have made great strides in recent years. Computer learning, for instance, has come a long way in a short period. To once again use Google as an example, over the last few years Google has gradually phased into its search algorithm elements that could fairly be described as artificial intelligence. Its machines follow user behavior and determine which search results please people and which do not. And since this is an ongoing process, the algorithm is no longer set in stone, but rather automatically updates on a continuous basis.

   Of course, AI technologies are still far outside the realm of what most companies can implement, but watch for new developments in the coming years. Before long, AI-driven technologies will be serving as hubs for information processing and sharing within companies and organizations of all varieties and sizes.

Activity C:

1. Analyze KMS is useful in what kind of businesses. Like – Library, Music Store etc.

16.7 Summary

This unit primarily goes through the concepts like decision analysis, organizational decision making, DSS, MIS, decision making and knowledge management. The beginning of the unit describes how decisions can be analyzed for organizational decision making process. Afterward unit described relationship between decision support system, management information system and decision making. Decision Support System followed by history, components, characteristics, capabilities, needs and applications of its. It also explained advantages of decision support system. Then comes Knowledge Management System with techniques to manage it, its features, nature and as type of activity or a set of process. Unit also deals with most new and relevant for today's concept, that is, KMS in the age of Internet.

16.8 Self Assessment Questions

1. What is decision analysis? Explain its application.

2. What are elements of decision analysis?

3. How organizational decision making takes place?

4. 'DSS, MIS and KM are interrelated concepts' – write a detailed comment on it.

5. Discuss the history of DSS.

6. What are components of DSS? Explain its characteristics and needs.

7. How DSS's applications are possible? Discuss its advantages also.

8. Write short notes on –
   i) Techniques of knowledge management
   ii) KMS and its features
   iii) KMS in the age of internet

16.9 Reference Books

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Unit - 17 : Information Technology Outsourcing

Structure of Unit:

17.0 Objectives
17.1 Introduction
17.2 What is Information Technology Outsourcing?
17.3 Benefits of Information Technology Outsourcing
17.4 Drawbacks of Information Technology Outsourcing
17.5 Making an Outsourcing decision
17.6 Human Management in Information Technology Outsourcing
17.7 Mitigating the Risk of Information Technology Outsourcing
17.8 Cost of Information Technology Outsourcing
17.9 Summary
17.10 Self Assessment Questions
17.11 Reference Books

17.0 Objectives

After completing this unit, you would be able to:

- Understand the concept of Information Technology Outsourcing
- Critical factors for successful outsourcing
- Benefits & Drawbacks of Information Technology Outsourcing
- Make an outsourcing decision.
- Various cost involved in Information Technology Outsourcing.
- Mitigate the risk of Information Technology Outsourcing

17.1 Introduction

Information Technology Outsourcing takes place when a business subcontracts a service provider to perform information technology function or functions instead of performing these functions itself. IT outsourcing is a set of activities that subcontracts a business. For instance, your company fetched a project from a client and assigned it to another company or individual for completion - that's outsourcing. It seems quite simple; however, it could be tougher when it comes to management. Information technology (IT) systems are expected to meet high standards of operation and processing integrity, while offering round-the clock availability, security, and good performance. In today's environment, organizations must deal with rapid and regular changes in IT, the performance demands of the e-economy, and pressure to deliver competitive IT functionality. To meet these challenges, organizations are increasingly considering outsourcing of their information systems activities as an attractive option. In fact, many organizations already use outsourcing in one form or another.

17.2 What is Information Technology Outsourcing?

IT outsourcing occurs when an organization contracts a service provider to perform an IT function instead of performing the function itself. The service provider could be a third party or another division or subsidiary of a single corporate entity. Increasingly, organizations are looking offshore for the means to minimize IT service costs and related taxes. Many times, the outsourcing decision results in a transfer or sale of the information processing assets and the people who performed the in-house function to the service provider. Outsourcing is also a common option for start-up operations and for organizations entering new business

lines. Rather than devoting time, energy and capital to the creation of IT processing services, organizations feel they can minimize the start-up time required to enter new markets by contracting a third party to provide those services immediately.

Outsourcing is more than a simple purchase decision based upon economic or financial criteria. It is a strategic decision that encompasses the transfer of service delivery of selected activities to a third party and the establishment of a long-term relationship that can create new sources of value for an organization. Key to the understanding of outsourcing is that while service delivery has been transferred, accountability has not. Additionally, outsourced service delivery is, or should be, transparent to the users of the service and the customers of the organization.

Many types of IT services can be outsourced, the most prevalent being data centre operation, desktop support, help desk services, network management, software development and support, disaster recovery and, more recently, web hosting and application management. An organization can choose to outsource only selected IT services or opt to outsource all of its IT services.

Definitions

According to Information Technology Outsourcing definition, when a company outsources its computer or Internet related tasks to other companies, it is going through the process of IT Outsourcing. IT outsourcing is often used in reference to Business Process Outsourcing which is the outsourcing of activities that do not require technology functions or specialized technical skills.

In the present day, it is difficult for every organization to keep updated with the changes in IT and to deliver competitive IT solutions. But with help of outsourcing, a number of companies can meet these challenges in the most efficient manner. A variety of businesses are involved in the process of business and IT outsourcing which helps them respond to the demands of e-economy.

Information Technology Outsourcing definition states, IT Outsourcing takes place when a business subcontracts a service provider to perform information technology function or functions instead of performing these functions itself. The service provider could be a freelancer, a third party company or a large conglomerate. With the passage of time, companies are opting for offshore outsourcing so as to reduce costs and taxes associated with a particular assignment or project. Several times, outsourcing efforts result in the transfer of business processes, assets and people who performed the in-house functions to a third party company. However, this can be controlled if you keep an eye on the communication between your managers and service provider.

Outsourcing helps not only large firms, but it also serves the needs of the new entrants in business lines. These young companies don't have to invest time and money on headhunting the right permanent human resource and do capital management. Instead, they can simply minimize the start-up time to enter new markets by simply outsourcing projects to a talented service provider or an experienced company.

Examples

IBM Global Services: Being the top IT outsourcing company in the world, IBM Global Services has captured more than 15.5 percent of the global IT outsourcing market as of 2008. The company offers a diverse range of products and services which include software application development, application management services, system integration, hosting services, networking, maintenance and support services, security services and storage services.

EDS: EDS comes number two in the information technology outsourcing market. It has a market share of 11.7 percent and provides a wide array of IT outsourcing services namely application development, network management, and storage and data center services.

Hewlett Packard - HP: HP is one of the most successful Information Technology Outsourcing Companies in the world. The company experienced rapid growth among the top ten sellers in the world in 2004 and earned higher revenues. Hewlett Packard's IT outsourcing services include application development and management, end-user workplace management, help desk services and software supply chain.

Computer Sciences Corp (CSC): Computer Sciences Corp is another reputed IT outsourcing company in the world. It had a market share of 5.5 percent in year 2004 which rose to 8.7 percent in 2006. CSC has over 30,000 application developers, techies and professionals who are working in 13 different countries. The company's IT outsourcing services include system integration, application development and IT infrastructure outsourcing.

Similarly, we have a number of other successful Information Technology Outsourcing Companies from all over the world that are contributing to the accomplishment of the outsourcing market.

17.3 Benefits of Information Technology Outsourcing

Management can decide to outsource IT services for several reasons. The most important reasons for reaching such decisions involve the operational, technological and financial benefits to be derived.

Operational Benefits

Despite the pervasive presence of IT in modern business, the operation of increasingly sophisticated data processing environments is often not a core competency for many organizations. The need to improve service quality, attract and retain competent IT personnel, and develop and maintain robust systems can severely strain management's resources and reduce the effort devoted to the real business value drivers of the organization. The operational benefits of outsourcing, then, support achieving business value by transferring service delivery of IT activities to a "specialist," thereby allowing management to focus on the organization's core activities. By minimizing the resources devoted to non-core activities, a business might be able to improve its performance through restructuring or reengineering business processes.

IT outsourcing can also reduce time to market. Rather than devoting time and capital to the development and implementation of suitable IT processes in support of new businesses, processes or products, businesses can take advantage of the ready solution outsourcing offers. In this same fashion, outsourcing can support mergers and acquisitions by offering a scalable solution for the integration of newly-acquired organizations. Outsourcing is also a common option for minimizing start-up times and avoiding the high costs of entering new markets.

Technological Benefits

Achieving IT efficiencies may be an organization's major expectation from outsourcing. By outsourcing, an organization may have access to people, processes and technology that it might not otherwise economically obtain. Outsourcing often provides access to advanced technology that can result in distinct technical leadership. It can be a way of keeping up to date with changing technology and gaining access to IT expertise and, through this, improving the quality of IT services delivered to the business and to customers.

Financial Benefits

An important benefit often sought by management in IT outsourcing decisions is financial in nature. Outsourcing offers the possibility of bringing IT costs under control through the efficiencies that might be delivered by the

service provider or the sharing of common costs among the service provider's customer base. In addition, outsourcing can reduce the risk of investing in the wrong technology or significantly limit the required capital investment, making financial resources available for more strategic activities.

Other Benefits

- You receive access to extra resources, including high-class IT specialists. Due to constant growth and the complexity of innovational solutions in the IT business, the cost of work of highly skilled specialists steadily increases. Outsourcing makes the resources more affordable for many companies.
- You can react quickly and adapt to the changes in the marketplace.
- Along with getting high quality software adapted for your specific needs, you receive support and maintenance by the software outsourcing company.
- You can cut your investments in non-capital assets. Outsourcing allows you to redistribute your investments and move the funds into strategically promising directions, saving on secondary ones.
- Your overhead costs are decreased. Hiring an outsourcing company for your IT projects means you do not have to hire your own professionals - no salary, no salary-related taxes, no extra working places, no employee training.
- You can take advantage of someone else's experience. Outsourcing companies have experience of solving similar tasks, so they can apply most modern technologies and highly qualified personnel to complete your project.
- Advanced technologies. A specialized IT company always is abreast of new developments on the IT market.
- An outsourcing company gives you a guarantee of professional responsibility.

17.4 Drawbacks of Information Technology Outsourcing

Although IT outsourcing often seems attractive, it can have pitfalls. A study of 85 outsourcing deals over the period 1992 - 2000 showed that, while in 60% of these deals the client benefited, nearly 36% of clients experienced problems. The following paragraphs examine some noteworthy problems that can occur when outsourcing IT.

Operational Problems

Threats to availability, integrity of systems and resources, confidentiality of information and regulatory compliance failure of the systems, a lack of data integrity, or unauthorized access to data can jeopardize an organization's ability to make sound business decisions using reliable system-generated information and to conduct its operations in compliance with regulations. These situations can lead to a loss of business and reputation, and financial losses, as well as lawsuits, fines and penalties. Threats exist in any processing environment, but they are increased, at least in the short term, when changes are introduced. In an outsourcing arrangement, an organization's processing is performed by different personnel, with different management, using different techniques and methods, in a changed operating environment.

A further difficulty may arise in that an organization may not, despite its best efforts, be able to identify that operational problems exist, or their severity, should they be suspected. Typically, the organization requests the service provider to prepare the same reports as the ones produced prior to outsourcing. In many cases this will be adequate and appropriate. In other cases, however, the reporting arrangements will not anticipate all the needs that arise in the outsourcing situation and are not sufficient to identify problems in time to take corrective, defensive action.

Loss of Competencies:

In many outsourcing arrangements, the IT assets and personnel are transferred to the service provider. This action results in the transfer of knowledgeable staff who previously contributed to the intellectual capital of the organization. Through outsourcing, an organization therefore risks losing its competencies or its otherwise deep knowledge of its systems and operations in relevant domains. This loss could, in turn, compromise its ability to operate and manage effectively.

Outsourcing creates a need for new management skills. No longer does the organization have direct control over IT resources. Instead, it must exercise indirect control through effective management of the contract. The needed new management competencies may be unavailable within the organization, at least in the short term, for implementing effective governance, monitoring and problem resolution processes. Lack of these competencies may compromise its ability to make decisions on changes to the IT services, manage the governance relationship or liaise with the customer base inside the organization.

Service Problems

The IT service does not meet the organization's expectations or needs. One challenge in outsourcing is bridging the gap between the standard of service the organization expects from its service provider and the services actually delivered. The following are common problems contributing to the gap. First, the organization may be accustomed to a certain standard and style of performance that was provided by its internal IT department prior to outsourcing. This same standard and style may not, however, be continued by the service provider. The degree of difference can be a point of contention, at least in the short term, until both parties grow accustomed to the new operating environment.

A second problem is that the service provider may not fully appreciate the organization's operational priorities or other key expectations. Again, this may be a short-term problem that is resolved through the evolution of the changed environment. On the other hand, it can be symptomatic of a lack of management or governance clarity, a problem that can be much more difficult to resolve. A third, and more significant problem, involves the service provider failing to meet defined standards of performance quality. Finally, the outsourcing arrangement may not be sufficiently robust to implement timely and cost-effective changes that are needed to support business initiatives. Many factors underlie these problems, not the least of which are the organization's inability to define its IT outsourcing objectives and needs or to communicate them adequately, the service provider's inability to understand those needs and objectives as well as the business processes and systems, the failure to predetermine performance metrics, the non-assignment of roles and responsibilities for monitoring performance, and the failure to commit all parties to remedying operational deficiencies.

Cost Problems

Unanticipated costs in outsourcing contracts. When the outsourcing is not adequately planned, the organization may incur unforeseen costs related to transition and management, which can significantly affect the profitability of the outsourcing decision. Research shows that lack of clarity and understanding of the costs related to the many aspects of outsourcing service delivery are the biggest problems of outsourcing. The organization's and the service provider's understanding of which services are included in the contract and which represent additional, and thereby chargeable, services are often very different. Service providers may charge extra for services the organization assumed to be included in the base price, such as training or personal computer support. Additionally, pricing in the contract can be based on qualitative measures, such as performance and degree of difficulty, rather than quantitative metrics, which makes objective determination of costs difficult and leaves uncertain the amount that will be charged.

Lastly, services, processing volumes and technologies change over the life of an outsourcing arrangement. These changes directly impact the base service levels of an outsourcing contract and, ultimately, the amounts charged by the service provider. Unless attention is directed to identifying the costing consequences of each of these changes, the accuracy of and justification for billing can become the source of significant dispute.

The costs of terminating a contract, switching back to an in-house solution, or finding another service provider sometimes, unexpected situations leave an organization no other choice than to terminate an outsourcing contract. Such a decision could be justified by the closing of a unit, a change in the organization's business mission or strategy, poor service quality or insolvency of the service provider. Terminating a contract can involve high costs, particularly if the contract did not contain any opting-out provisions. Switching service providers or even going back to an in-house solution also involves high costs. Organizations may feel trapped in their outsourcing deals and perpetuate bad relationships to avoid switching or termination costs. These lock-in situations are more likely when there are few providers competing to deliver these services.

Costs Related to Disputes and Litigation:

A poorly written contract or a chronically bad relationship between the organization and the service provider increases the risk of disputes and litigation, which distract management from important activities and may involve high costs.

17.5 Making an Outsourcing Decision

An outsourcing decision is not one that should be made lightly. It is a decision that can have a significant, long-lasting influence on the reputation and the performance of an organization. Like any significant decision-making process, the outsourcing decision progresses through a predictable life cycle that might be described as follows.

Objectives - The organization defines its business objectives and how best to meet them through the most appropriate use of information technologies.

Feasibility - The organization examines its alternatives in pursuing an outsourcing option and their related benefits and risks. During this stage, the answers to many "What do we need to worry about?" and "What happens if…?" questions are sought. The organization needs to agree on such things as:

- The importance of the IT activity or function to the business and to the organization as a whole.
- The potential impact of the outsourcing arrangement on the organization's customers and/or its reputation.
- Its ability to replace the service provider at a reasonable cost and in a timely manner.

Requirements - This is the stage when the detailed needs of the organization are itemized. The organization must not only define its obvious performance criteria, but must also ensure that it identifies its requirements for activities and internal working relationships that have been assumed or taken for granted in the previous operating environment.

Selection of a Service Provider - During this stage, the organization evaluates the credentials of potential service providers to determine if they are able not only to meet its requirements but also to maintain the long-lasting strategic relationship that is to be created.

Transition - This stage initiates profound changes to the status quo. Careful and detailed project planning is essential to the success of migrating functions, equipment and people to the service provider. Not only do the cultural and procedural differences between the organization and the service provider become appar-

ent, but new management and governance structures also arise. People within an organization who were previously responsible for performance of technical tasks may now be placed in the roles of managing the delivery of those functions. Some people cannot make the transition. Many organizations, however, dismiss the significance of this stage.

Steady State - This stage typically consumes the greatest part of the outsourcing life cycle. It is how business is conducted throughout the duration of the arrangement.

Renewal/Termination - The final stage is the decision whether or not to continue with the existing outsourcing arrangements. Many factors influence this decision, including satisfaction with the current outsourcing relationship, projections of the service provider's capability to maintain the outsourcing relationship, and the future plans of the organization itself. In many cases, repatriating the outsourced services is not a viable option and the decision may only be to seek a new outsourcing supplier as a replacement.

17.6 Human Management in Information Technology Outsourcing

Man Management is one of the most critical factors of Information Technology Outsourcing. Effective People Management lead to success of the project and poor management results in project failure. People management is important in every project but it is of vital importance when the projects are outsourced because the management shifts towards another company, with different culture, standards and procedures. Information Technology is all about human computer interaction. Human interact with computers, every time discovering a new way, and creates spectacular wonders. So it is necessary to manage them in the best possible way to achieve maximum success.

Some of the factors that need to be considered in People Management of Information Technology Outsourcing are listed below.

1. Choose the Right People: Most important task in People Management is to hire the right people for the right job. In early evaluation Of Information Technology Outsourcing, People roles and responsibilities should be explicitly identified.

2. Choose the Right Mix: After choosing right people, next step is to build the best team out of them. Best team is of heterogeneous nature. Skills of all kinds, which are required for a project, should be gathered in one team. Size of the team depends on the nature of project. Usually small teams are recommended for effective utilization of resources.

3. Consider Every Stakeholder: Stakeholders are people who are directly or indirectly affected by a project. Managers should take into account effect of Information Technology Outsourcing, on every stakeholder which includes customers, suppliers, and employees.

4. Manage the People Issues: When the decision of Information Technology Outsourcing is made, all people issues regarding it should be considered. The foremost of which, is communication. Communication Gap is a major factor of project failure. When the requirements will not be gathered and explained correctly, no good can come out of it. People should be provided with all the communication resources so that they can share information from time to time.

5. People Evaluation: All the people involved in a project should be evaluated time to time, on the basis of their performance. One's who achieve their targets should be provided with incentives. Acknowledgement of work motivates the employees which reflect in the work. Evaluation also gives rise to healthy competition which is beneficial for the overall project.

6. Poor Management: Poor People Management increases the hidden cost of the project, which includes the cost of failure due to poor selection of new employees. According to a research, US lose $105 billion every year due to poor people management.

Outsourcing should be a need, not an excuse to get rid of poorly managed and costly service. Outsourcing for a wrong reason can lead to loss of control of resources and personnel, who are a part of organization family and are trained for a specific business practice.

17.7 Mitigating the Risk of Information Technology Outsourcing

Organizations and business units that have successfully outsourced IT operations adopt a number of "best practices" that balance the complexity and the demands of the life cycle of the decision process. Various outsourcing strategies are possible, and suitable contracts vary accordingly. While management will select the options that serve it the best, there are no perfect deals; these decisions therefore involve risks trade-off. The following paragraphs identify some of the risk mitigation strategies that have proven effective.

Establish an IT Outsourcing Strategy

The first step in IT outsourcing is to understand well, and document, the business' objectives and how best to meet them with supporting technologies. This lets management form realistic expectations, communicate its needs effectively to service providers, develop sound performance measures with which to benchmark the costs and benefits of outsourcing, and evaluate service proposals objectively, using established criteria.

Without understanding its outsourcing objectives, an organization may use cost reduction as its only yard-stick. If so, there is a high likelihood that expectations will not be met, since other important strategic or technological values derived from outsourcing might be overlooked.

Maintain in-house IT Expertise

Among the most important steps taken by successful organizations is to get help. They draw upon the expertise of many contributors to the outsourcing process, including consulting firms specializing in IT outsourcing agreements, legal services, auditors, human resources, finance, IT, and others as needed. They also appoint a senior executive or a senior committee to oversee all the outsourcing activities in the life cycle. This action ensures that the outsourcing decisions remain aligned with the organization's strategy, goals and objectives and that the organization remains focused on the benefits it seeks from the outsourcing. Sufficient in-house IT expertise is needed to elaborate the IT strategic plan, monitor its progress, and keep abreast of changing business needs and new technology. A negotiating team should also be formed when an organization decides to outsource; it should include a variety of IT specialists who understand the organization's requirements, and a contract lawyer who can optimize the contract's legal provisions.

Ascertain that the Service Provider Understands the Needs of the Organization

A common understanding of the organization's business processes and systems, and of its IT objectives and expectations, constitutes the foundation of a satisfying outsourcing experience. The organization should ensure that service providers understand well its business needs and that proposal under consideration are based on appropriate assumptions.

Evaluate the Financial and Operational Well-Being of the Service Provider

Selecting the right service provider is crucial, so it is important to develop a thorough understanding of the provider's financial and operating conditions. It is vital to undertake a due diligence review of the service provider's processes before entering into a binding agreement. This review should examine the service provider's operational and financial ability to meet the organization's needs and objectives, and can include a review of audited financial statements, audit reports on internal control, insurance coverage (fire, liability, data losses, etc.) and meetings with management, as well as an on-site visit.

When the outsourcing arrangement results in services being provided in a foreign jurisdiction, the organization's due diligence review should be extended to consider the economic and political backdrop, technological sophistication, and the legal and regulatory risk profile of the foreign jurisdiction(s). Regulatory and other issues related to cross-border processing of data must be considered.

Determine the Experience, Expertise and Sufficiency of the Service Provider's Resources

The organization must be diligent in evaluating the service provider's experience and ability in the anticipated operating environment and with the types of systems and applications to be used, its familiarity with the industry's business processes, and its ability to maintain the systems in operation and respond to service disruptions. Meeting with the service provider's staff and its other clients may aid in evaluating the provider's qualifications and experience, and an on-site visit can help assess how well the service provider operates and supports its clients.

Evaluate the Adequacy of the Service Provider's Internal Controls

The responsibility for the protection, integrity and quality of corporate data and IT processes rests with management. It is therefore essential to examine and assess the internal control framework that the service provider will enforce in the outsourced environment, notably its policies and procedures relating to the protection and preservation of systems, data and software, and controls over security, business continuity and IT recovery, systems development and maintenance. The service provider should demonstrate adequate knowledge of laws and regulations relevant to the service, notably those specific to the organization's industry. If available, the review of an audit report on the service provider's internal control may help assure the organization of the design, existence and effective operation of internal controls.

Consider the Use of Third Parties

It is not unusual for service providers to engage third parties to help deliver services to their clients. The organization should understand the degree to which such third parties will be engaged to support the delivery of the outsourced services and the impact, if any, that the third party participation may have on service, control or regulatory requirements.

Draft an Adequate Agreement between Parties

A comprehensive contract should be documented. Legal counsel is always advisable. The organization should seek the services of a lawyer who specializes in such contracts. Some of the issues that organizations should consider including in IT outsourcing agreements are examined in the following paragraphs.

Scope of Service :

The scope of the service, its duration, renewal terms, and the rights and responsibilities of both parties to the contract should be clearly described and supported, where appropriate, with addenda or schedules that define all relevant performance metrics, fees and responsibilities for the services to be performed. The agreement should also define the processes by which changes can be made to current services or new services added to the agreement.

Fees :

The contract should address the fees charged for services, including those based on volume or other variables, and fees for additional services, the costs of purchasing and maintaining hardware and software, developing and converting systems, and so on. Duration, renewal terms, the right to raise fees, and limits on fee increases should also be specified. Issues such as invoicing and pay-

ment, refunds and credits, disputed charges, sharing of unanticipated gains or shortfalls, and any incentives to reduce costs, should also be addressed.

Performance Measurements:

Setting performance measurements on service levels (for example, metrics for systems security, availability, privacy and confidentiality, as well as processing integrity and time) will ensure that the organization's requirements are met.

Ownership of Intellectual Capital:

Development ownership and licensing are important issues. Parties should specifically state in the contract the rights and privileges related to the ownership or licensing of intellectual property, as well as acceptance criteria for any work product, such as software development or web site designs.

Controls and Audit:

The contract should specify the responsibility of the service provider to maintain adequate internal controls that comply with applicable operational and regulatory requirements, such as privacy legislation, the Sarbanes-Oxley Act, and securities commissions requirements. In addition, the audit rights of the contract should permit the organization and its management to fulfill their legal obligations; for example, the public company CEO's and CFO's certification of internal controls, as required by the Sarbanes-Oxley Act and by the Ontario Securities Commission, and the audit requirements of regulatory third parties.

The contract should define each party's responsibilities in the implementation and maintenance of internal controls. It should specify what is to be protected, which party has responsibility for protection mechanisms, which party has the power to change control procedures and requirements, which party may be liable for losses that result from a control breach, and what the notification requirements are if there is a breach of control. It should define the records and audit trails to be maintained, the right of the organization to access these records, and the service provider's responsibility to ensure their availability and preservation through the creation of back-up copies and disaster recovery plans. In sensitive control environments, the contract could even include provisions whereby the organization has the right to specify staffing requirements, or to approve of, or change, staff members delivering the service.

A common requirement in many outsourcing contracts is for the service provider to provide independent audit reports on financial statements or on the existence and the effectiveness of the service provider's internal controls. In cases when information security is a high risk issue, such as in e-business operations, the organization may require periodic security testing; for example, penetration testing, intrusion detection testing, network or firewalls scanning, or disaster recovery plan testing. The audit scope, timing and frequency, the right to obtain the audit and testing results, the obligation to act upon any deficiencies reported and the bearing of the costs should be included in the contract.

Responsibility of the Primary Service Provider:

The contract should clearly hold the service provider responsible for the agreed service, whether the service is provided directly or through the use of a sub-contracted party. Notification and approval requirements covering the use of subcontractors by the service provider should be specified.

Dispute Resolution Process:

A dispute resolution process should be included in the contract. It should define what constitutes a dispute, and identify remedies, escalation procedures, and means of dispute resolution, as well as the jurisdiction and rules under which the dispute will be settled. This provision will aid in resolving problems in a timely manner and ensure there is no disruption in service during the resolution period.

Insurance Coverage:

The service provider should be required to notify the organization about significant changes in insurance coverage and disclose general terms and conditions of its insurance coverage.

Limitation of Liability:

Liability is an important issue in outsourcing agreements. The respective liability for losses or injury of each party to the contract should be clearly defined.

Termination:

The condition under which the parties may terminate the contract is a crucial provision. It is essential that both parties define the circumstances that would warrant termination of the contract. Putting termination rights, terms and conditions (for example, notification timeframe, penalty provisions, and transition assistance provided) into the agreement might provide acceptable options in problematic situations.

Expect a Transition Period:

Management should expect a transition period, effectively a learning period for both the organization and the service provider. It will take some time before either organization incorporates the cultural change that results from outsourcing and before the service provider masters the organization's systems and business processes and it is able to deliver expected service improvements. Users should be adequately informed of this transition period and of any inconvenience it may entail.

Set and Track Performance Measurements:

It is important to set performance measures to benchmark the service provider's performance and assess the quality of the service delivered. These measures assure the organization of a minimum service level, and should be agreed on between the parties as part of the contract.

Establish a Contract and Relationship Management Team:

Good communication between the parties, mutual understanding of business needs, and timely resolution of problems are essential to ensuring service quality. To satisfy these requirements, the organization needs a relationship management team of people and processes to manage the outsourcing contract and the overall relationship with its service provider. The size and composition of this team will vary with the type of IT service outsourced and its importance for the organization. The duties of this team should include monitoring service quality and assessing the service provider's performance, monitoring the adequacy of its internal control and compliance with applicable rules and regulations, and resolving service or performance problems as they arise.

Establish a Business Continuity Plan:

An organization should ensure that its business continuity plan addresses situations (either temporary or permanent) in which the service provider fails to continue providing service. In particular, the

plan should ensure that the organization has ready access to all records necessary to allow it to sustain business operations and to meet its legal or regulatory obligations in the event the service provider is unable to provide the service.

17.8 Cost of Information Technology Outsourcing

There are two types of costs that are involved in Information Technology Outsourcing. One which is estimated in the planning phase of the project while the other is hidden cost. Estimated cost, spent On Information Technology Outsourcing is visible, prior to designing phase of the project. While the hidden cost arise during the implementation phase of the project.

Estimated Cost

Estimated Cost, spent On Information Technology Outsourcing includes:

- Cost spent on searching a dependable outsourcing partner.
- Cost required for training the staff for outsourced services.
- Outsource Management Cost.
- Cost of incentives and pays of employees.
- Cost of contract between two companies.

Hidden Cost

Hidden cost cannot be estimated initially in the planning phase. It is the cost that arises due to some uncertainties in the planned project. Scott Noble, co-founder and director of Global Sourcing Insights LLC (GSI) once said, "While there are very real benefits to be gained from IT outsourcing, there are many hidden costs that can easily reduce or even negate many of these expected benefits," When Outsourcing, hidden cost is often missed or skipped and the estimation of overall cost becomes hard to predict. Hidden Cost, spend On Information Technology Outsourcing includes:

- Cost of Renewal of contracts in case of any misunderstood clause or change configuration.
- Cost of Change Management.
- Cost of failure due to poor selection of employees
- Cost of hiring new employees.
- Cost of retraining management and employees.
- Cost of time lag issues.

17.9 Summary

IT outsourcing occurs when an organization contracts a service provider to perform an IT function instead of performing the function itself. IT outsourcing is an attractive option for many organizations. IT outsourcing should be an integral part of an organization's overall business strategy, involving senior executives and key IT staff. The rationale for pursuing outsourcing options involves the strategic, financial and technological benefits to be gained. A number of problems may also be encountered related to the service quality, its costs, or its overall effect on business operations. A thorough risk assessment of the factors involved in these potential problems is a useful tool for avoiding them in the first place. While there are no perfect deals, a number of measures can mitigate the risks of IT outsourcing. A well thought-out IT strategy, due care in the service provider selection, a carefully drafted contract and good monitoring of the services delivered under the IT outsourcing contract will help the organization reap the benefits it expects. When IT outsourcing is already being employed, a review of strategy, existing relationships, and contracts would be beneficial to

ensuring they continue to deal with rapid changes in IT governance and controls expectations relevant to regulatory authorities and best practices.

17.10 Self Assessment Questions

1. What do you mean by Information Technology Outsourcing? Support your answer with suitable examples.
2. How to make an outsourcing decision? Also explain benefits & drawbacks of outsourcing.
3. Examine the various aspect of mitigating the risk of Information Technology Outsourcing?
4. What are the various costs involved in Information Technology Outsourcing?

17.11 Reference Books

- Brian.K.Williams & Stacey C.Sawyer (2005) 'Using Information Technology' ; Tata McGraw Hill Publication company limited, Delhi.
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