S.G.INFOTECH

Computer Overview

STUDY MATERIAL

PREFACE

Dear Students,

Computers are extremely versatile and it has found their way into every business, industry and research today. The uses of computer are diverse and encompass entertainment, education, problem solving, decision making, personal management, data banks etc. In short, now a days learning about computers has become mandatory for us.

This E-Book has been designed especially keeping in mind the learners and we have tried our-best to make this E-Book simple as possible, to make it easy for the learner and also elaborate the point to be handful for anyone using the computer.

If this E-Book helps anyone to learn and to use the computer effectively, it will be of great success.

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INTRODUCTION TO COMPUTERS

INTRODUCTION

A Computer is a programmable machine. The two principal characteristics of a computer are:

- It responds to a specific set of instructions in a well-defined manner.
- It can execute a prerecorded list of instructions (a program).

Modern computers are electronic and digital. The actual machinery - wires, transistors, and circuits - is called hardware; the instructions and data are called software.

All general-purpose computers require the following hardware components:

- *Central processing unit (CPU)* The ‘‘heart’’ of the computers instructions.
- *Memory* Enables a computer to store, at least temporarily, data and programs.
- *Input device* Usually a keyboard or mouse, the input device is the conduit through which data and instructions enter a computer.
- *Output device* A display screen, printer, or other such devices that let you see what the computer has accomplished.
- *Mass storage device* Allows a computer to permanently retain large amounts of data. Common mass storage include disk drives and tape drives.

In addition to these components, many others make it possible for the basic components of a computer to work together efficiently. For example, every computer requires a bus that transmits data from one part of the computer to another.

History of Computer

Since the present and the future are best understood in terms of the past, it will be valuable to review the history of computers.

The first major development came in 1812 when Charles Babbage invented a mechanical device called the difference engine, which could carry out a sequence of mathematical op-erations, one at a time. Thus he is widely regarded as the father of the computers. He later conceived an analytic engine which could execute an arbitrary sequence of operations and could have internal storage for data.

The Mark I Computer (1937 – 44)

This computer is also known as automatic sequence controlled calculator, which was de-signed by Howard a. Aiken of Harvard University. The machine was huge in size and very complex in design, controlled by electro-mechanical device. Although it could perform addi-tion, subtraction, division, multiplication and table referencing, it was very slow. The input was via punched paper.

The Atanasoff – Berry Computer (1939 – 42)

This electronic machine was also known as abc, as it was named after its founder Dr. John Atansoff and his assistant Clifford Berry. It uses 45 vacuum tubes for internal logic and capacitor for storage.

The Eniac (1943 – 46)

Eniac stands for electronic numerical integrator and calculator. It was the first electronic computer, designed by team of members from U.S.A. headed by Professor J. Presper Eckert and John Mauchly. The need behind the development of eniac was military. Though it was much faster than previous computers, it could store only a limited volume of information and its programs were difficult to read.

The Edvac (1946 – 52)

Dr. John von Neumann designed the electronic discrete variable automatic computer. The device could store both the instructions and the data in the binary form instead of decimal number or human readable words.

The Edsac (1947 – 49)

Electronic delay storage automatic calculator was developed by the Britishers, headed by Professor Maurice Wilkes at the Cambridge University mathematical laboratory. It was much faster than edvac.

Manchester Mark I (1948)

This machine was designed by a group of scientists headed by Professor M. H. A. Newman. It could not be used practically as it had a very small storage capacity. Its storage capacity was only 32 words, each of 31 binary digits.

The UNIVAC I (1951)

UNIVAC stands for Universal Automatic Computer. It was the first digital computer, which was installed by General Electric Corporation in 1954 for business use. Further, International Business Machines (IBM) Corporations improved these models and 700-series machines were introduced. In 1953, IBM produced IBM-650. Thus these machines were used for busi-ness as well as scientific applicatons.

Generations of Computers

Since the computers were invented, they have gone through a long phase of evolution. This rapid developmental phase of growth is termed as computer generations. There are in total five computer generations till date since its inception.

First Generation Computers (1942-47)

In mid-forties ENIAC, EDVAC, EDSAC Vacuum tubes were being used as components in computers. Though the vacuum tube computers were the faster calculating devices at that time, but unreliable and too huge in size.

Mercury lines for storage, paper tapes and punched cards were also used. Electronic time per operation ranged from 0.1 to 1' millisecond, whereas memory access time was I millisecond. Vacuum tube computers were called first generation of computers.

Second Generation of Computers (1947 – 60)

In 1947 transistors were found to be replacing vacuum tube computers. The transistors were more efficient, reliable and smaller in size. This became the second generation. But it had one main disadvantage; there was the problem of commercial production and expen-sive. The electronic time per operation was 1 to 10 milliseconds. Magnetic tapes, drums and punched cards were all employed as secondary storage.

Third Generation of Computers

In early sixties, a dramatic change occurred in the field of information technology. With the discovery of " micro –electronics " hundreds of transistors were replaced on a single silicon chip. This intregrated chip (ic) became the basis for the growth of computers for the third generation. Though it was designed for general purpose use all over the world. It required high technology for production of the integrated chips.The electronic time per operation of integrated circuit was almost 0.1 to 10 microseconds.

Fourth Generation Computers (1975 – 80)

With the introduction of VLSI (very large scale integration) in 1975, thousands of transistors were replaced on a single chip. Thus the era came for large scale integration (lsi). This lsi technology led to the development of small but extremely efficient computers, leading to the birth of fourth generation of computers. This technology also demanded highly sophisticated technology for producing lsi chips.The revolution brought about the microprocessor gave rise to the following developments

1. Large computers that are much faster, less expensive and much greater capacity than equivalent sized third generation computers.
2. Micro computer that are equally capable but less expensive.
3. Microcomputers which are even further miniatured computers.

Fifth Generation Computers (yet to come)

Scientist are working towards the fifth generation of computers, which will be altogether new and unique of its kind. They are trying to infuse intelligence into computers, the ability to reason logically and with real knowledge of the world altogether which can be termed as artificial intelligence.

Classification of Digital Computer Systems

INTRODUCTION

Computer systems are classified as Microcomputers, Minicomputers, Mainframes and Super computers.

MICROCOMPUTERS

The most familiar kind of computer is the microcomputer. In the past, microcomputers have been considered to be of two types - Personal Computers and Workstations. Let use see what these are.

Personal Computers (PCs)

Until recently, PCs were desktop or portable machines. These machines ran comparatively easy-to-use applications software such as the word processors, spreadsheets, etc. They were usually easier to use and more affordable than workstations. However, they had less sophisticated video display screens, operating systems and networking capabilities. Examples of personal computers are Acer's Aspire, Compaq Presario, etc.

Workstations

Workstations are, again, until recently, expensive, powerful machines used by engineers, scientists, and other professionals who processed a lot of data. People who need to run complex programs and display both work in progress and results graphically also use workstations. Workstations use sophisticated display screens featuring high-resolution colour graphics and operating systems such as UNIX that permitted multitasking. Workstations also use powerful networking links to other computers.

MINICOMPUTERS

Minicomputers, also known as mid range computers were first developed as special purpose mainframe computer. They were used, for instance, to control machines in a manufacturing unit. However, now they are widely used as general-purpose computers. Thus the line between minis and mainframes has blurred and is constantly changing. Indeed, the more powerful minicomputer models are called superminis.

An example of such a computer architecture is the Client/Server model, in which end users can process at their own microcomputers. End users can also access and share the resourcesof the server, which usually is a minicomputer.

MAINFRAMES

Mainframe computers can process several million-program instructions per second. Large organizations rely on these room-size systems to handle large programs with lots of data.

Mainframes are mainly used by insurance companies, banks, airline and railway reservation systems, etc. An advanced mainframe made by IBM is S/390.

SUPERCOMPUTERS

Supercomputers are the fastest calculating devices ever invented. A desktop microcomputer processes data and instructions in millionths of a second, or microseconds. A supercomputer, by contrast, can operate at speeds measured in nanoseconds and even in picoseconds - one thousand to one million times as fast as microcomputers.

Most supercomputers are used by government agencies. These machines are for applications requiring very large programs and huge amounts of data that must be processed quickly. Examples of such task are weather forecasting, oil exploration, weapons research, and large-scale simulation. The chief difference between a supercomputer and a mainframe is that a supercomputer channels all its power into executing a few programs as fast as possible, whereas a mainframe uses its power to execute many programs concurrently.

Characteristics of Computer

There are certain features, which has made computer an indispensable element in the proper functioning of our life.

- Speed
  Computers work at a very high speed. It can perform any work within its defined scope in a few seconds, as compared to human.
- Accuracy
  Computers hardly makes any mistakes. There is a high consistency of accuracy within computers. Errors do occur in a computer, but due to human negligence.
- Diligence
  Computers can perform all day long resulting in quality output. The reason is it does not get tired or bored as any other human being. Thus the monotony of work does not effect computers.
- Versatile
  Computers can perform all type of tasks, depending on its scope. It can range from designing a dress to that of designing nuclear weapons. Hence it is regarded versatile.
- Memory
  Computers can store and recall any amount of data whenever required. It depends upon the user to decide which information is required and is stored in the secondary storage device for later use. The information is real and accurate, which is not possible for a human brain.

Binary Number System

The binary number system is similar to decimal system, but the base is two. Two symbols or digits 0 and 1 are used in this number system. Each position in a binary number represents a power of the base 2.

Binary digits is often referred to as bit. Thus a bit means either 0 and 1. A binary number consisting of number bits is called – bit numbers. The data; numbers, letters and other spe-cial characters are stored in the form of binary system.

- Converting from decimal to binary number system
- Converting of a decimal number into its binary equivalent consists in expressing the decimal number as the sum of the ascending power of 2 and collecting the coefficient of each term.
- Converting from batch to decimal number system
- To convert a number from binary to decimal we will just reverse the process what we have done previously.

Binary Coded Decimal (BCD)

This is one of the oldest codes being used in computer system. It converts each digits of decimal number into equivalent binary number, which facilitates the conversion process to a great extent. In the 6 – bit bcd code, the four bcd numeric place positions are retained, but two additional zone positions are added that helps in coding the alphanumeric letters and other special characters.

American Standard Code for Information Interchange (ASCII)

The widely used American standard code for information interchange (ASCII) is another form of computer code. This code is popular for data communication. There are two types of ASCII code. ASCII – 7 and ASCII – 8. Apart from the zone value difference, ASCII – 8 are identical with previous one.

Anatomy of a Digital Computer

FUNCTIONS AND COMPONENTS OF A COMPUTER

To function properly, the computer needs both hardware and software. Hardware consists of the mechanical and electronic devices, which we can see and touch. The software consists of programs, the operating systems and the data that reside in the memory and storage devices.

A computer does mainly the following four functions :

- Receive input - Accept information from outside through various input devices like the keyboard, mouse, etc.
- Process information - Perform arithmetic or logical operations on the information.
- Produce output - Communicate information to the outside world through output devices like monitor, printer, etc
- Store information - Store the information in storage devices like hard disk, floppy disks,etc.

CENTRAL PROCESSING UNIT (CPU)

The part of the computer that executes program instructions is known as the processor or central processing unit (CPU). In a microcomputer, the CPU is on a single electronic component, the microprocessor chip, within the system unit or system cabinet. The system unit also includes circuit boards, memory chips, ports and other components.

The CPU has two parts - the control unit and the arithmetic-logic unit (ALU).In a microcomputer, both are on the microprocessor chip.

Control Unit

The control unit tells the rest of the computer system how to carry out a program's instructions. It directs the movement of electronic signals between memory - which temporarily holds data, instructions and processed information - and the ALU. It also directs these control signals between the CPU and input/output devices.

Arithmetic - Logic Unit (ALU)

Arithmetic-Logic Unit, usually called the ALU, performs two types of operations - arithmetic and logical. Arithmetic operations are the fundamental mathematical operations consisting of addition, subtraction, multiplication and division. Logical operations consist of comparisons. That is, two pieces of data are compared to see whether one is equal to, less than, or greater than the other.

MEMORY

Memory - also known as the primary storage or main memory - is a part of the microcomputer that holds data for processing, instructions for processing the data (the program) and information (processed data).

Registers

The main function of a CPU is to interpret and execute instructions. This involves a movement of data within the various units of a computer system. To carry a smooth and faster process of transferring data, a number of special memory unit known as registers are used in computer system. The registers do not form apart of the primary memory and the data are stored temporarily. There are different types of registers, which can be classified according to the function

No	Name of register	Function
1	Memory Address (MAR)	To hold the address of the active location
2	Memory Buffer (MBR)	To hold the information on its way to and from memory
3	Program Control (PC)	To hold the address of the next instruction to be executed
4	Accumulator (A)	To accumulate result and data to be operated upon
5	Instruction (i)	To hold an instruction while it is being executed
6	Input /output (i / o)	To communicate with the input / output devices.

Memory Units

INTRODUCTION

Memory units are the internal storage areas in a computer. The term ‘‘memory’’ indentifies data storage that comes in the form of chips and the word ‘‘storage’’ is used for memory that exists on tapes or disks. Moreover, the term memory is usually used as a short form for physical memory, which refers to the actual chips capable of holding data. Some computers also use virtual memory, which expands physical memory onto a hard disk.

Every computer comes with a certain amount of physical memory, usually referred to as the main memory or the RAM. You can think of the main memory as an array of boxes, each of which can hold a single byte of information. A computer that has 1 megabyte of memory, therefore, can hold about 1 million bytes (or characters) of information.

There are several different types memory.

RAM (random-access memory) This is the same as the main memory. When used by itself, the term RAM refers to read and write memory; that is, you can both write data into RAM and read data from RAM. This is in contrast to ROM, which permits you only to read data. Most RAM is volatile, which means that it requires a steady flow of electricity to maintain its contents. As soon as the power is turned off, whatever data was in RAM is lost.

ROM (read-only memory) Computers almost contain a small amount of read-only memory that hold instructions for starting up the computer. Unlike RAM, ROM cannot be written to.

PROM (programmable read-only memory) A PROM is memory chip on which you can store a program. But once the PROM has been used, you cannot wipe it clean and use it to store something else. Like ROMs, PROMs are non-volatile.

EPROM (erasable programmable read-only memory) An EPROM is a special type of PROM that can be erased by exposing it to ultraviolet light.

EEPROM (electrically erasable programmable read-only memory) An EEPROM is a special type of PROM that can be erased by exposing it to an electrical charge.

FLASH MEMORY

Flash memory is a special type of EEPROM that can be erased and reprogrammed in blocks instead of one byte at a time. Many modern PCs have their BIOS (Basic Input Output System) stored on a flash memory chip so that it can easily be updated if necessary. Such a BIOS is sometimes called a flash BIOS. Flash memory is also popular in modems because it enables the modern manufacturer to support new protocols as they become standardized.

Auxiliary Storage Devices

INTRODUCTION

Auxiliary storage also known as auxiliary memory or secondary storage, is the memory that supplements the main storage. This is a long-term, non-volatile memory. The term non-volatile means it stores and retains the programs and data even after the computer is switched off. The most common types of auxiliary storage devices are magnetic tapes, magnetic disks, floppy disks, hard disks, etc.

There are two types of auxiliary storage devices. This classification is based on the type of data access: sequential and random. Based on the type of access they are called sequential-access media and random-media. In the case of sequential-access media, the data stored in the media can only be read in sequence and to get to a particular point on the media you have to go through all the preceding points.

Input Devices

INTRODUCTION

An input device is any machine that feeds data into a computer. For example, a keyboard is an input device, whereas a display monitor is an output device. Input devices other than the keyboard are sometimes called alternate input devices. Mice, trackballs, and light pens are all alternate input devices.

KEYBOARD

Keyboard is an input device consisting of a set of typewriter -like keys that enable you to enter data into a computer. Computer keyboards are similar to electric-type writer keyboards but contain additional keys. The keys on computer keyboards are often classified as follows :

- Alphanumeric keys - letters and numbers
- Punctuation keys - comma, period, semicolon, and so on.
- Special keys - function keys, control keys, arrow keys, Caps Lock key, and so on.

MOUSE

Mouse is a device that controls the movement of the cursor or pointer on a display screen. A mouse is a small object you can roll along a hard, flat surface. Its name is derived from its shape, which looks a bit like a mouse, its connecting wire that one can imagine to be the mouse's tail, and the fact that one must make it scurry along a surface. As you move the mouse, the pointer on the display screen moves in the same direction. Mice contain at least one button and sometimes as many as three, which have different functions depending on what program is running.

Types of Mice

There are three basic types of mice.

Mechanical Has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors within the mouse detect the direction the ball is rolling and move the screen pointer accordingly.

Optomechanical Same as a mechanical mouse, but uses optical sensors to detect motion of the ball.

Optical Uses a laser to detect the mouse's movement. You must move the mouse along a special mat with a grid so that the optical mechanism has a frame of reference. Optical mice have no mechanical moving parts. They respond more quickly and precisely than mechanical and optomechanical mice, but they are also more expensive.

Scanners

Scanners are used for direct data entry into the computer system and are capable of recognizing marks or characters. Situations might arise when some image that is available on paper is re-quired for further editing on the computer disk. The easiest way out would be to take a photo-graph of the image directly from the source, and scan it and save it on the disk. If required print out can be taken. Scanners are used for scanning text and graphics files together.

A scanner scans an image and transforms the image to the code that is used by the computer to represent the characters of the keyboard. These can be edited, manipulated and printed.

Scanners are of two types : the flat – bed type and the roller feed type. While in a roller feed scanner, the image is passed over a roller where it is captured. The flat bed scanner works like a photocopier.

Output Devices

INTRODUCTION

Output is anything that comes of a computer. Output can be meaningful information or gibberish, and it can appear in a variety of forms - as binary numbers, as characters, as pictures, and as printed pages.

An output device is any machine capable of representing information from a computer. Output devices include display screens, loudspeakers, printers, plotters, etc.

MONITOR

Monitor is another term for the display screen. The term monitor, however, usually refers to the entire box, whereas display screen can mean just the screen.

In addition, the term monitor often implies graphics capabilities.

CLASSIFICATION OF MONITORS - BASED ON COLOUR

There are many ways to classify monitors. The most basic is in terms of colour capabilities, which separates monitors into three classes:

Monochrome

Monochrome monitors actually display two colours, one for the background and one for the foreground. The colours can be black and white, green and black, or amber and black. Gray-scale

A Gray-scale monitor is a special type of monochrome monitor capable of displaying different shades of gray. Colour

Colour monitors can display anywhere from 16 to over 1 million different colours. Colour monitors are sometimes called RGB monitors because they accept three separate signals-red, green, and blue. This differs from colour televisions, for example, which use composite video signals, in which all the colours are mixed together. All colour computer monitors are RGB monitors.

Refresh Rate

Display monitors must be refreshed many times per second. The refresh rate determines how many times per second the screen is to be refreshed (redrawn). The refresh rate for a monitor is measured in hertz (Hz) and is also called the vertical frequency or vertical refresh rate. The old standard for monitor refresh rates was 60Hz, but a new standard developed by VESA sets the refresh rate at 75Hz for VGA and SVGA monitors. The faster the refresh rate, the less the monitor flickers.

- Printer

The output generated in the CPU cannot be stored for permanent use. Printers are the most widely used output devices. Print out can be taken for permanent use. There are several types of printers that are classified depending on speed, cost and the quality of the printing. They are as follows:

a. Character printer
b. Line printer
c. Page or leaser printer

Character Printer

These type of printers print one character at a time. Example is typewriter. Two types of printers fall under this category.

1) Dot – Matrix Printer

Each character as printed out appears as a pattern of dots. The print head is comprised of a matrix of tiny needles. They do not have any fixed font. The print quality is inferior to that of daisy wheel printer but is much faster. The speed ranges from 40 to 250 characters per seconds.

2) Ink – Jet Printer

Based on new technology, these printers are non impact character printers. Small amount of ink is sprayed onto the paper to print the characters. The ink contains high amount of iron. It can print any character of any size and shape and also different colored inks can be used. Line Printer

These printers are impact printers and used with most medium and large computer systems for producing voluminous print outs. Generally these printers have a speed of printing 300 to 2500 lines per minute. There are two important printers that can be grouped under this category.

Drum Printer

The printer is a solid, cylindrical drum like structure that accepts characters in bands on its surface. The number of bands is equal to the number of printing positions. All the possible characters to be printed are contained by each band. The speed of drum printer range from 300 to 2000 lines per minutes.

1) Chain Printer

This printer use a fast moving chain called a print chain. Each link of the chain is a character font. To enhance the speed of this printers, characters set goes on repeating. The speed of these printers range from 400 to 2500 characters per minutes.

Page or Laser Printer

The printer falling under this category are non – impact printer. They have a very high speed of over 20000 thousand lines per minute. This has been possible by using electro-photo-graphic technique. As it is so efficient where thousands of pages can be printed at a time, it can not be used in small concern as it is too expensive.

Plotter

Another output device, plotter is used to produce hard copies of graph and design. There are basically two types of plotter – drum and flatbed. In case of a drum plotter, the paper to be designed is placed on the drum and a vertical motion is produced when the drum moves to the front and back. Also pens with different inks can be used. A flatbed plotter plots on papers that are spread and fixed over a rectangular flatbed table similarly like the photocopier. The area is fixed as that of the plot size.

Plotters now in the market are used with personal computer. This are generally very slow as a lot of mechanical movement is involved in the process.

Introduction to software

What is software?

A computer cannot perform on its own. It needs to be exclusively instructed on what it has to do. A set of instructions written in computer language is known as program and two or more programs are known as software. The main objective of software is to enhance the capabili-ties of the computers.

Classification of software

Computer software is generally classified into two broad categories.

1. System software
2. Application software

Application software

This software is also known as application package. It is a set of one or more programs designed to carry out specific operation depending on the application. The programs that constitute an application package are known as application software. As there has been the expansion of the software industry many specific markets special purpose application pack-ages have been developed such as in the field of banking, insurance, medicine, manufactur-ing, designing, entertainment and so on.

System software

This software is also known as systems package. It is a set of one or more programs, de-signed to control the operation of a computer system. The system package are not meant for solving specific problems. Generally, the system packages support the running of the other

software; communicate with other peripheral devices; support the development of other type of software; and supervise the use of various hardware resources. Without system software, application packages could not be run on the computer system. System programmers de-sign the system packages. It is an indispensable part of a total computer system.

Procedural Oriented Language

Procedure is nothing but a sequence of statements, which performs some value after per-forming that function. Some languages follow or work procedures like Basic, Pascal, C etc.

Object Oriented Programming Language

Before discussing object oriented programming, let us first define an object. An object is a package of information together with the operation that can be performed on the information. In other words, an object supports data abstraction , and can be considered as an entity, which encapsulates or hides the object data, and provide the use with a set of predefined operations to manipulate and access the object data. The object data can only be accessed by the operations defined on the object. Some programming languages like c++, java falls under this category.

Difference between Object Based and Object Oriented Programming Language

1. Object oriented programming language follow encapsulation, polymorphism and inheritance but an object based programming language does not support these features.
2. In object oriented programming language we can create an object and we can work with that object, but in case of object based programming language its not possible to create object but we can use some predefined or in built object.

Computer Language

A computer language is a means to communicate between people and computer. Computer languages have their own vocabulary. Each symbol of a computer language is used to guide the computer to perform a specific function. The symbols of a particular computer language are used as per set rules known as syntax rules of the language. All computer languages can be in the following three broad categories :

- Machine Language

Although computers can be programmed to understand many different computer languages, there is only one language understood by the computer without using translation program. This language is called the machine language or the machine code of the computer. Ma-

chine

code is the fundamental language of a computer and normally written into binary format of 1s and 0s. Then the binary format is change to electrical signals. Machine codes can also be written in decimal digits.

Machine language differ from computer to computer. It is determined by the design of the ALU, the control unit and the size of the memory unit. It might not be reusable. The program-mer of machine language has to be an expert about the hardware structure of a computer. A machine language is time consuming and difficult to write.

- Assembly Language

Assembly language or symbolic language substitutes letters and symbols for the numbers in the machine language program. A program written in symbolic language that uses symbols instead of numbers is called an assembly code or a symbolic program. The function of an assembler is to translate an assembly code into the computer machine code. The assembler is a system program, which is supplied by the computer manufacturer. Besides translating codes, it also assembles the machine code in the main memory of the computer and makes it ready for execution. A source program written by a programmer in the assembly language. After the source program has been converted into machine language by the assembler is referred to as an object program.

- High Level Language

High level languages were developed in order to facilitate the programmers to use comput-ers without the need to know the detailed internal structure of the computer. High level lan-guages, instead of being machine based are oriented more towards the problem to be solved. These languages enable programmer to write codes in English language and mathematical symbols. Every instruction, which the programmer writes in a high level language, is trans-lated into machine language instructions. These languages are also known as problem – oriented languages.

These languages are machine independent and are easy to learn as it involves English and common mathematical symbols. It requires less time and effort to code programs, which results in low cost. But programs takes longer time to execute. Fortran, Cobol, Basic, Pascal etc are the examples of high level languages.

Compiler, Assembler and Interpreter

Compilers , assemblers , and interpreters belong to systems software to translate a source program to an object program . These translators are known as assembler language proces-sors they are used for processing language .

Operating System

What is an Operating System ?

The operating system (OS) is an integrated set of programs that is used to manage the various resources and overall operations of a computer system. Its prime objective is to improve the performance and efficiency of a computer system. The operating system is responsible for the smooth and efficient operation of the entire computer system. The memory, disk space, processor time, and peripheral devices such as keyboard, mouse, monitors, printers, modems etc. that are required by a computer system to operate are provided by the operating system.

Evolution of Operating System

The main aim behind the evolution of the operating system was to use the computer system in the most efficient and economic way.

In early days the function of the operating system was to clear the main memory to remove any data remaining from the previous job, then load the next program and data from the input devices, set the appropriate switches and finally run the job to obtain the results from the output devices. The same process was repeated for other jobs, which involved a lot of time. A new method of automatic job-to-job transition was designed. This operating system re-duced the idle time of the computer system. But the CPU time also needed some enhance-ments. More than one program was run at a time, that is while one program carries out the input output operation, the CPU was involved in another operation.

Functions of an Operating System

The operating system perform the following functions:

- Processor management: it is the operating system that allocates processor time to complete the tasks as being performed by the computer system.

Memory management: primary memory and other storage devices are to be assigned to the system programs as well as the user programs and input, which are done by the operating system.

- Input / output management : in cases where different programs are running, various input and output are generated which is kept track by the operating system.
- File management : the storing and transferring of files from a storage device to another includes within the task list of the operating system.

- Priority management : a computer is desired to do things a lot of jobs at one time. It is the operating system which determines which needs to be executed first.
- Switching between programs : various applications can be run at a time. The switching over from an application to another is also the task of operating system.
- Interpretation : computer only understands machine language in the form of electrical signals. To make any application run, the commands has to be interpreted by the operating system and send for processing and once the output is generated it has to be transferred to readable language.
- Co ordination and assignment of software : there are software such as compiler, assembler and utility programs needed for a user computer. Operating system allocates all these software.
- Security and integrity of data : all the data and programs are protected by the operating system. And also security is maintained so that the user cannot change them.
- Error detection : in case a program is not running properly, error supports for debugging and error detecting.
- User friendly : operating system makes life easy to work on a computer by provid-ing information all the time.

Concept of Job Control Language (JCL)

There is more than one program to be managing by the operating system. Some set of control information is required to execute a program as it involves the compiler to be loaded, the hardware device, sequencing of the jobs. Thus with every programs a set of statements are written in a language known as the job control language (JCL). The JCL is essential part to be feed into the computer before execution. The JCL instruction helps the operating system to identity the program as well as the requirement. The JCL instruction include the name of the job, the user's name and the account numbers, the input and output device to be used while processing, the compiler or assembler is required or not. The job control language varies from computer to computer.

Concept of Batch Processing

It is one of the oldest methods of executing the programs. It is based on the concept of automatic job – to job transition facility that is provided by all the operating systems. The input data are stored within the computer and are processed automatically. All the program are executed one after another, or at the same time without user interaction. Ideal time of the computer system is reduced by this method. The jobs to be executed have to wait at each step, which result in overall delay in the execution of the program. Batch processing doesn't accept job priority.

Classification of Operating System

Operating system is mainly classified based on interface basis that is CUI and GUI and user basis, which compromise of the single – user and multiple users.

CUI stands for command user interface, the user has to type commands at the command prompt, which acts as the input to execute and program. Disk operating system (DOS), Unix are examples of CUI based operating system. And user can access dos in windows via start + program + ms dos prompt. One user can use this type of operating system at a time; hence they are single user operating system.

GUI is a user – friendly interface, where the user doesn't have to type lengthy complex commands to execute a program. A user is able to select files, programs, or commands by pointing to graphical representations on the screen. Windows is such an example, where the application program are executed with the help of pop – up menus, dialog box, scroll bar, a different icons on the menu bar. Examples are Windows 95, 98, 2000. Many users can use this operating system, hence it is known as multiple user interfaces.

Concept of Multi Programming, Multi Processing and Time - Sharing

The concept of executing two or more programs at the same time is known as multiprogram-ming. This concept involved as a solution to the problem of underutilization of the main memory and the CPU. In multiprogramming, the two or more programs are stored in the main memory and are executed simultaneously.

There can be three states of the programs stored in the main memory: running, blocked and ready. The program is said to be in the running state when the CPU is using the programs, which are busy in input/output operations is in the blocked state and finally the program that is waiting for the CPU is in the ready state.

To make a computer work simultaneously on various tasks, there is a requirement of additional

hardware and software features. They are:

- Large memory : the main memory requires enough space to accommodate various users programs as well as large storage devices and fast CPU.
- Memory protection : prevention is provided by computer system to the memory, to prevent a program in one memory partition from changing information or instruction of a program in another memory partition . This feature is known as memory protec-tion feature.
- Program status preservation : As two or more programs run at the same time, a portion of one program is executed, to a segment of another. This requires the stopping of a program execution and then restarting its execution after some time. Thus, before suspending a program and passing the control to another one, the values of the CPU should be stored in the memory of that program and then re-stored when the control ultimately returns to the first program. This is known as program status preservation.
- Proper job mix : the main memory should contain some CPU related programs and some input/output programs in order to utilize the idle time. This is known as proper job mix.

The term multiprocessing is used to describe interconnected computer configurations or computers with two or more independent CPUs that have the ability to simultaneously execute several programs. In such a system instructions from different and independent pro-grams can be processed at the same instant of time by different CPUs or the CPU s may simultaneously execute different instruction from the same program.

The main advantage of multiprocessing is that it provides a built-in-backup. If one of the CPUs breaks down, other CPU will take over its job. The performance of a computer system is improved as a result of parallel processing of segments of programs.

In order to support multiprocessing feature, a very sophisticated operating system is required to schedule, balance and coordinate the input, output and processing activities of multiple CPUs. A large memory is also desired. The regular maintenance and functioning of such system is very expensive.

Timesharing refers to the allocation of computer resources in a time-dependent fashion to several programs simultaneously. The main aim of this concept is to provide a large number of users' direct access to the computer for problem solving. A separate terminal is provided to

each user. All main terminals are connected to the main computer system. In timesharing the CPU time is divided among all users on a scheduled basis. The short period of time when a user gets the attention of the CPU is known as time slice, time slot or quantum. All the users who are using the time-sharing system will fall in one of the following three status groups:

- Active: when users program is in control of CPU, it is said to be in the active state. Only one user can be active at a time.
- Ready: when the users program is ready to continue but is waiting for its turn to get the attention of the CPU. More than one user can be in this state.
- Wait: when the user has made no request for the execution of his/her job or the user program is waiting for some input/ output operation. More than one user can be in this state.

Though the time-sharing system reduces the idle time of the CPU, and offers small users to directly access the main computer. There are some disadvantages of this system. The pass-word facility is not enough to provide security to hundreds of users. As most of the online peripheral devices or software are with the main CPU the question of reliability occurs.

Data Communications and Computer Networks

What is the meaning of Data Communication?

Communication is the process of sending and receiving information from one person to another. This process involves three basic components: the sender, who is sending the information, a media, to carry the information and the receiver, who accepts the information

. For example, Mr. A is the sender, Mr B is the receiver Mr. . Batch is the receiver and the media used is the phone line .

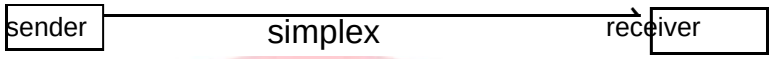
The same phenomenon is followed by the data communications . The exception in this case is that the sender and the receiver usually are computers . The transmission can include telephone lines , satellite links , microwave links etc , where the data remains unchanged . Different types of Data Transmission Modes

Data can be transferred from one computer to another using one of the following methods

- Simplex
- Half-duplex
- Full-duplex.

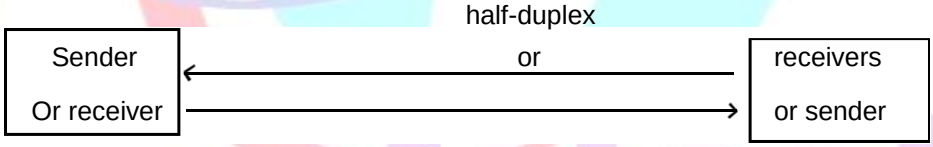
Simplex

This type of data communication takes place in one direction . The information flow is unidi-rectional . This means data can be send from one point only . As this type of communication is limited , it is rarely used .



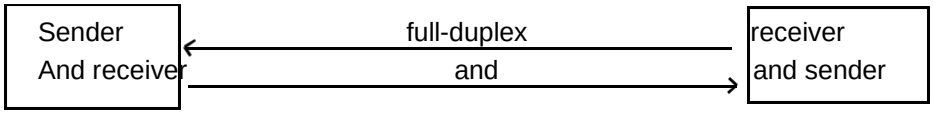
Half-Duplex

This type of communication can transfer data in both directions , but one direction at a time . Two wires are required , as alternatively data can be send and received . Generally this type of method is used to connect a computer with a terminal .



Full- Duplex

This type of data communication allows simultaneous transmission of data in both directions . It improves efficiency of sending and receiving data in a much faster way . Four wires are required in this type of transmission .



The data handing capacity of a communication system is known as bandwidth .

Data Transmission Media

Communication of any sort cannot take place without a media . When two persons are talking to each other , face-to face , the media is the most commonly used medias are:

- Wire pairs
- Coaxial cable
- Microwave system
- Communication satellite
- Optical fibers

Wire Pairs

Generally , local telephone communication and short distance digital data transmission rang-ing up to one km uses wire pairs . They are usually made up of copper and a pair of twisted wires to decrease interference by adjacent wires . These are mainly used where the termi-nals are connected to the main computer at a short distance .

Data transmission speed is 1200 bits per second . These are affordable , useable , and easily installed . One main disadvantage of this media is , if the connection line extends beyond 100mts , noise signals are caught by them easily , which results in high error rates . Coaxial Cable

Data can be transmitted from one point to another at a high rate using coaxial cables . These are a group of wrapped and insulated wire lines . They consist of a central copper wire , PVC insulation , copper mesh and an outer PVC shield . Signals are transmitted by the inner copper wire .

Data transmission speed is 10 mega bytes per second . These are used in long distance telephone lines , cables for closed circuit television . They are immune to noise and error free data are transmitted .

Microwave System

This is another popular media for data transmission . The system uses very high frequency radio signals to transmit data through space . Very high towers are required to transmit data as it supports line-of-sight . Long distance transmission is not possible because it requires power amplification .

Microwave system uses repeaters at interval of 25 to 30 kms in between the transmitting and receiving stations . Data transmission speed is16 Giga bytes per second . Thousands of voice transmission is carried on through this system . However these are very expensive . Communication Satellite

Satellites are new form of data transmission media that are more efficient as compared to microwave . This is a microwave relay station placed in outer space . The transmission and reception can be between any two randomly chosen places in that area . A major drawback of satellite transmission is its cost effectiveness . And also the security matters .

Optical Fibers

The system based on laser technology , basically consists of fiber optic cables that are made up of tiny threads of glass or plastic. Electrical signals are converted to light signals by a converter at one end at the receiving point the converter again converts the light signal to electrical signals .

Data transmission speed is 1 giga bytes per second . This type of media can be used to communicate both analog and digital signals . They are immune to noise and distortion . They provide security and are mainly used for point-to-point one way communication . They provide an alternative solution to communication satellite . But there is one shortcoming; currently these optical fibers cannot allow complete switching of light signals .

Computer Networks

When a group of computers are connected to each other through cables , then they form a network . The main reason behind forming a network is to communicate as well as share resources among computers that reduce the cost of the company and also saves time .

Network Topologies

There are different types of network configurations that determine how the computers should be linked to each other in a network . There can be more than one network depending on the requirement . Network topologies determine the data path from one point to another . Choosing a topology involves various factors like the reliability of the system , flexibility , cost , speed of data communication . Keeping in mind all the factors topologies can basically be categorized under three major heads:

- Star network
- Ring network
- Completely connected network

In this type of network all the local computers are connected to a host computer through several cables . The local computers cannot communicate between each other , they need to use host computer as the medium . The host computer centrally controls all the communica-tion between local computers and establishes a logical path .
Star topology requires minimal cables for communication ; new computers can easily be added to the network , which does not increase the network traffic . In case one of the computers is not functioning , the network remains unaffected . But if the host computer fails in any case , the whole network is dead .

In this type of network there is no centrally controlling computer . All the computer are con-nected to each other through cables . For example , there are computer1 , computer2 , computer3 and computer4 on a ring network . Computer 1 has sent some data for com-puter4 . The data will pass in a circular motion from the source computer to computer2 ; later one will check the address and pass it on to the next . This way finally , the destination computer will receive the data . Though it is more reliable , it is time consuming and compli-cated in structure .

In this type of network there is a separate physical link for connecting each computer to any other computer . Each computer has a direct link called point-to-point link with every com-puter on the network . Each computer has its own communication priorities . It is reliable and there is fast data transmission between computers . But it is very costly as a huge amount of cables are required .
Apart from the above-mentioned network topologies there are two more whose mention must be made of :

- Hybrid Network
- Multipoint Network

Hybrid Network

The literal meaning of 'hybrid' is a mixture . In technical sense , a combination of star , ring and completely connected network , forms a fourth topology referred to as "hybrid network"

. An organization may need to combine all or two of the topologies to suit the organizational structure. A typical hybrid topology is a combination of star , ring and completely connected network .

Multipoint Network

In this type of network , all the computers share a single transmission medium . They are attached to a single line . The message sent by a computer is broadcasted in the communication line , if it is free then the computers check the address and right computer thus picks up the message . An acknowledgement is sent to the sender and the line is made available to others. This topology is also known as "broadcasting" network .

The cables used are simple ; the reliability is also high and new computers can be easily added to the network . But if the communication line fails , the whole network stops functioning. Concept of Local Area Network and Wide Area Network

A local area network (LAN) is digital communication system , interconnecting a large number of computers and other resources within a limited geographical area .

Normally LAN operates within a compact area such as office building . The configuration of LAN can be a star , a ring of simple devices . In LAN, transmission is carried on using coaxial cables . It uses a special device as interface for transmission .

The main function of LAN is to link all the computers so that they can share the resources and communicate between themselves . The data transmission speed is fast . There are few error problems .

Examples of LAN are Ethernet developed by Xerox corporation , omni net by corvus system A wide area network (wan) is a digital communication system , which is developed to operate on a greater scale :nationwide or worldwide . There is no physical connection between various computers . It interconnects different computers , different sites as well as LANS to transfer data among each other . The transmission medium used by WAN are leased lines such as telephone line , satellite lines and also microwave .

The data transmission rate is slow as compared to LAN. The error rate is not negligible .

Example of WAN is the Arpanet , Indonet .

Introduction to Communication Protocols

Data communication software manages the transmission of data from one computer to an-other and holding all the communication systems together . The methods of carrying out the process are embedded within the software known as protocols .

The protocols consists of the rules and procedures that are required to control the transmis-sion of data . It results in efficient exchange of data between the sender and the receiver . The examples of protocols are http , TCP /IP , FTP , and SMTP etc .

TEST YOURSELF

1. What are the different generations of computers?
2. Which was the technological breakthrough that made the second-generation computers?
3. What are the features of the third-generation computers?
4. The name of the first digital computer is _____.
5. _____ designed the Electronic Discrete Variable Automatic Computer (EDVAC) .
6. The second-generation computer contained _____ in place of vacuum tubes.
7. The use of operating systems in computer was introduced in the _____ generation computers.
8. In 1981 _____introduced its personal computer (PC) for use in the home, offices and schools.
9. What are the different categories of digital computers?
10. Distinguish among the four kinds of computer systems.
11. How is a PC different from a workstation?
12. What are the different types of portable computers?
13. What is the difference between a minicomputer and a microcomputer?
14. What is a mainframe and what are its typical applications?
15. What are supercomputers and where are they used?
16. What do you mean by the decimal number system?
17. Explain the binary number system?
18. How will you convert a binary number to the decimal form?
19. What are complements?
20. What is the significance of 2' compliment in binary arithmetic?
21. What is a CPU and explain how it works?
22. What are registers and how are they important?
23. Computers have several additional storage locations called _____.