UNIT 4 SOFTWARE

Structure **Page Nos.**

4.0 INTRODUCTION

Computer system combines software and hardware to provide a mechanism to solve some specific tasks. In the previous unit, we had discussed some hardware devices i.e. input and output devices and their functions. In this unit, we will discuss topics related to software and their types such as systems software, applications software, utility software etc. Without software, a computer will remain just like a metal box. With software, a computer can store, retrieve, solve different types of problems, create friendly environment for software development.

Now, let us understand the term software.

In Computer Science, the term software means a **sets of instructions in the form of a program to control the processing of computer.** These programs are used for various purposes in the computer system. A series of instructions that performs a particular task is called **"program"**. The process of software development is also called **programming.**

Computer software can be broadly classified into two categories according to its purpose. **Systemes software** and **Applications software**

System software supports a general programming environment for development and security of different units of programs by programmers. Such environment is not supported at hardware level. Operating system is a part of system software.

Application software is used for solving a specific problem for inventory, payroll, spreadsheet, word processor and presentation software etc.

There is a common misconception amongst individuals that software is data (or set of data). But it is not. Software tells the hardware how to process the data. Computer software provides instructions that tell the computer how to operate.

Both hardware and software are necessary for a computer to do useful job. Both are complementary to each other. To take an analogy, a cassette player and the cassettes purchased from the market are hardware. However, the songs recorded on the cassettes are a form of software. The software and hardware are necessary components of computer. To understand a computer software it is desirable to understand programming language. Programming languages constitute the vehicle for understanding the operations of computer hardware and software. In this unit you will learn about softwre.

4.1 OBJECTIVES

After studying this unit you should be able to understand:

- the basic concepts of software;
- differentiate between application software and system software;
- various categories of software;
- batch processing system, multiprogramming system; and
- development stages in operating system.

4.2 CLASSIFICATION OF SOFTWARE

The term software in computer science can be compared as the life of any living organism without which it has no significance. If you use a player piano as an analogy, the piano can be thought of as the hardware and the roll of music as the software.

A computer can neither think nor make any judgment on its own. Also it is impossible for any computer to independently analyze a given data and follow its own method of solution. It needs a program to tell it what to do. **A program is a set of instructions that are arranged in a sequence that guides the computer to solve a problem.** These instructions are written in programming languages (like; BASIC, PASCAL, C...) to help simplify the development of applications. Computer software provides instruction that tells the computer how to operate. Software is also called programs. Programs are usually developed using some language called **"programming language"**.

Computer software can be categories into two main categories. These are **system software** and **application software**. Function of system software are:

4.2.1 System Software

System software is that category of software, which manages all the resources of computer, and is loaded in the beginning or booting of computer. These are designed to make the computer easier to use. System software controls the operation of input/output devices, memory and processor etc. Windows operating system such as Windows 95, Windows 98, Windows 2000, Windows XP Windows Vista etc, are some examples of system software. Some functions of system software are:

- Used by the computer to accomplish a task.
- Manages all the resources of computer
- Create database and keeps it update after every transaction
- Arrangement of files in alphabetical order
- Controls the internal functions of computer
- Controls other devices connected to the CPUs

System software can be further compared as a type of program that acts like a conductor in an orchestra. It directs all the activities and **sets all the rules for how the hardware and software work** together. MS DOS and Microsoft Windows are examples of system software or operating system software.

Some System Software are inbuilt into the computer. Examples of such software can be given as ROM chips. This software helps to setup the computer and start it.

Types of System Software

System software can be classified into following categories:

1. Operating system
2. Translator and
3. Utility programs

From the application programmer's point of view, system software should initialize hardware timely and efficiently and also provide better programming environment. For example the libraries may consist of math library (for performing mathematical functions), input/output library, graphics library (to draw different kinds of images etc.).

Let us now discuss various types of system software's in detail to have basic idea about them.

1. Operating System

The operating systems (OS) are most important system software to run the computer system. Every system must have an operating system. It directly interacts with all kinds of hardware to provide an interface to other system software and application software whenever it wants to access system resources such as CPU, memory, I/O devices.

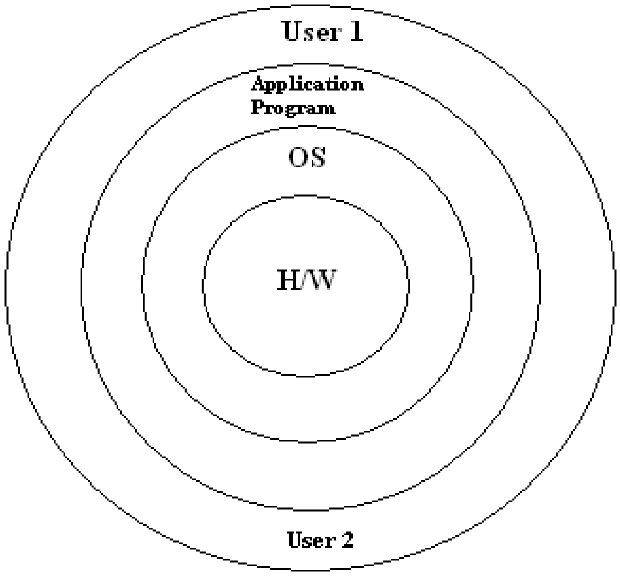

Figure 1: Layers of Operating system

The fundamental objectives of operating system is to optimize, utilize and control various kinds of resources: CPU, memory, I/O devices etc. so that the executions of user' programs become easier.

Components of operating system are shown in Figure 1: The innermost layer is Hardware Layers, followed by operating software, and application software. The last layer of this diagram is user layer where user is connected.

The operating system must be loaded into main memory which is also called booting from the system. One part of an operating system also called supervisor program, which remain in the primary memory all the time. Other part of the program are loaded into primary memory whenever it is required, otherwise it resides on hard disk. Commonly used operating systems are MS-DOS, MS-WINDOWS, UNIX, LINUX, XENUX etc.

History of Operating System

In the early 1900s there were no operating systems. The lack of any operating system meant that only one person could use a computer at a time. Even in the research lab, there were many researchers competing for limited computing time. The first solution was a reservation system, with researchers signing up for specific time slots, for performing computing.

The high cost of early computers meant that it was essential that the rare computers be used as efficiently as possible. The reservation system was not particularly efficient. If a researcher finished work early, the computer remained unused until the next time slot or next user comes. If the user time ran out, the researcher might have to pack up his or her work in an incomplete state at an awkward moment to make room for the next user.
Let us now discuss the idea of common operating system which came into existence by the computer researchers in early 1900s.

Common Operating System

Originally the operating system was created by each company that manufactured a processor and motherboard. So each operating system was **proprietary**, that is, unique to each manufacturer.

Problem: changing to a new computer meant your software had to be replaced? Not good marketing. So there was pressure early on to standardize things so that software could be transferred to the new computer (other computer). This required more standardization in operating systems.

The winner in the PC market was **MS-DOS**, Microsoft's **Disk Operating System**, and its twin at IBM, PC-DOS, also **OS** written by Microsoft. Now it's hard to recall those days when each computer had its own unique operating system.

An operating system is system software which may be viewed as an organized collection of software, consisting of procedures for operating a computer and providing an environment for execution of programs. Operating system manages resources of the computer system, such as memory, processor, file system and I/O devices. Other programs rely on facilities provided by the operating system to gain access to computer system resources.

An operating system may process its task serially (sequentially) or concurrently (several tasks simultaneously). It means that resources of the computer system may be dedicated to a single program until its completion or they may be allocated among several programs in different stages of execution.

Functions of Operating System

The operating system resides in the main memory of the computer system. Following are the basic functions performed by an operating system

(i) Resource Management : Operating System is responsible for allocating various resources such as I/O devices, memory etc. to the user effectively. It schedules the processes by time management and memory management. It also keeps track of all the I/O devices and CPU so that there would be no wastage of time and all the devices remain busy all the time.

(ii) File Management : File Management Program makes it easier to manage your files and folders. Many programs were written to help the user find files, create and organize directories, copy, move, and rename files.

(iii) Disk Management : Programs involve formatting and de-fragmenting disks. The term de-fragmenting means, putting files on the disk, so that the whole file is in sequence. This reduces the time to access the file. Some disk management programs even let you specify the files that are accessed often, like the operating system itself and other frequently used programs.

(iv) Memory Management: Memory management software handles where programs put their current data in RAM. They move certain memory-resident items out of the way. This can effectively increase the memory available by getting all the unused pieces together in one spot.

(v) Security of data: The operating system handles different programs and data in the memory, so that they do not mix or interfere with each other. It protects your computer and data from attacks and damage from outside. Only trusted websites and programs could be allowed to access your computer with security software.

2. Translator

The translators are the system software's. They are used for translating the instructions into computer readable form i.e., binary form. The instructions are written in any computer programming language such as C or some other programming language and are converted to computer readable form. There are many programming languages such as machine language, assembly language, high level language. These languages allow a person to write the software programs for system maintenance as well as applications. These instructions are converted to binary form by translator software such as assembler, compilers and interpreters. Let us now discuss these translator software one by one to understand the need of language translators in programming.

(i) Assembler

The first step in the evolution of programming language was the development of assembly language. In an assembly language mnemonics are used to represent operation codes and strings of characters to represent address.

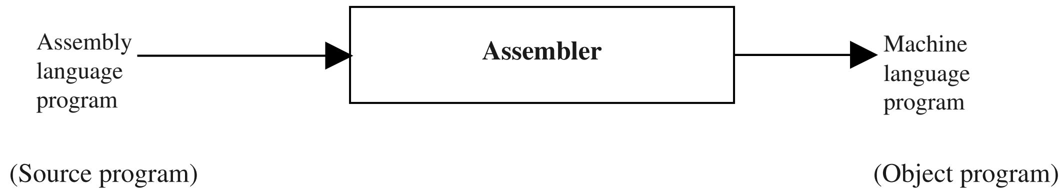

Figure 2: Assembler

It is the translator program which is used to translate the assembly language instructions in binary form. As shown in figure 2, assembler converts the symbolic instructions code of assembly language into machine language.

In order to execute an assembly language program on a computer, it should first be translated to its equivalent machine language program. The translator which does this is known as assembler. The input to an assembler is the assembly language program and is known as source program. Its output is the equivalent machine language program and is known as the object program.

The assembler is a system program which is supplied by the computer manufacturer. Assembly language programs are also called low level language programs.

The main advantage of using an assembly language programming is the efficiency of the machine language programming resulting from it. Some of the commands which are used in assembly language program are READ, ADD, STO & HLT and the function of these commands are read, add, stop and halt of the execution of instruction of a program.

The main disadvantages of an assembly language are:

(i) It is machine dependent i.e., the programs written for one model of computer can't be executed on another model.
(ii) It is very difficult to write programs in assembly language and needs rigorous training and expertise.
(iii) Assembly language programming is time consuming in comparison to high level language programming.

Now let us see some code of the Assembly language program: following assembly language program code is explained as:

Code		**Explanation**
LDA, 12	:	Load register A with 12
LDB, 15	:	Load register B with 15
ADD A, B	:	A ← A + B
LD (200), A	:	Save the result in the location address 200
HALT	:	Halt the process

You can see in the above assembly language program LD, ADD and HALT commands makes readability of program simpler for programmer.

(ii) Compiler

Since, computer doesn't directly understand high level language programs, written in English language to which it has to process. There is need of translators to translate the high level language into machine language called compiler. Compilers take input as high level language programs and produces output the machine language code of the machine on which it is executed.

These high level language programs must be translated first into machine language and the software which is used to convert high level language programs into machine language (in the form of binary number, 0 & 1), is called compiler.

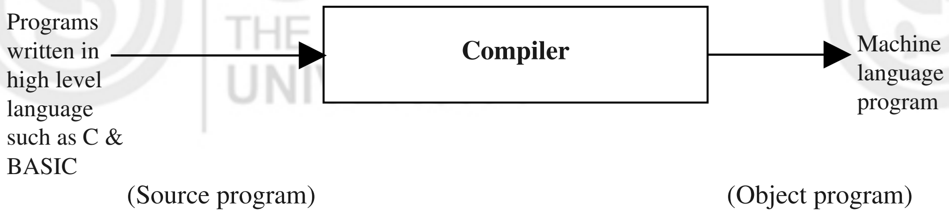

Figure 3: Compiler

Compiler scans the entire program first and then checks for syntax (grammatical) errors. If there is any error, the computer generates a print-out of the errors it has detected. Process of detecting and removing errors from a high level language program is called debugging.

Now let us see code of a high level language program: In the following BASIC (Beginners all purpose symbolic instruction code) language program two numbers are added.

```
10      LET     X    =   12
20      LET     Y    =   15
30      LET     SUM  =   X + Y
40      PRINT   SUM
50      END
```

This BASIC program adds two numbers *X* and *Y* and gives output as their sum. This program is much simpler than assembly language program written for adding two numbers.

(iii) Interpreter

It is another translator program for high level language. It analyzes and executes high level language program statement line by line without looking entire program at one go (as in the case of compiler). Each time of the program is executed; every line is checked for syntax errors and then, is converted to equivalent machine code. It is slower than the compiler.

Difference between Compiler and Interpreter

Compiler	Interpreter
1) Scans entire program first and then converts it into machine code.	Scans program line by line.
2) Translates the entire program to machine code, after debugging the program and execution takes place in the end.	After each execution every line is checked for syntax errors and then converted to object code.
3) Program execution time is less.	Program execution time is more.
4) Debugging process is slow. (Step by step execution checking)	Debugging process is fast. (Step by step execution checking)
5) Suitable for large programs.	Suitable for small programs.
6) Programs produced by compilers run much faster than interpreter.	Programs produced by interpreters run slower than compilers.

3. Utility Programs

A utility program performs tasks related to the maintaining of your computer's hardware or data. Some utility programme are included with the operating system and some is updated every year/time you become online with internet. By updating it becomes better equipped to handle the needs and security of computer systems. A few examples of utility programs are:

1) Software to convert a **.pdf** file format into a **.doc** format and ***vise versa.***

2) Multimedia converter software to convert mp3 file format to mp4 or mpeg etc and *vise versa.*

3) SORT/MERGE software for sorting and merging large volume of business data into single sorted list.

4.2.2 Application Software

Although system software is essential for the running your computer and manage all the resources of it. You need application software to enable the computer to solve a specific data processing task such as payroll processing, inventory control, and insurance company data. A software package is a group of programs for solving a specific task.

A number of powerful application software packages, **which does not require significant programming knowledge,** have been developed. These are easy to learn and use as compared to the programming languages. Software can be used by people to solve general problems. It can be used to do more than one task such as:

- Planning
- Writing
- Record keeping
- Calculating
- Communicating
- Drawing
- Painting etc.

There is no limitation of activities can be done by this softwares.
What can be done with general purpose application software is only limited by the imagination of the user. Use of variety of software depends upon the requirement of the type such as letter typing, making presentation, making tables and storing data in a databases. Some examples of such application software are:

1. Word Processing Package
2. Spreadsheet Package
3. Graphics Software, and
4. Database Management Software

1. Word Processing Package

The word processing means typing, editing and formatting the documents such as letters, documents, books, and balance sheets etc. In general word, processing refers to the processing of words i.e., simple text. A word processor is such a software package that allows the user to create and edit the documents.

Creating the documents involves typing text in the internal memory of the computer system and saving it on the disk. Editing a document involves correction of spelling mistakes and deleting or moving words, sentences or paragraph, i.e., arranging text at appropriate place in the document.

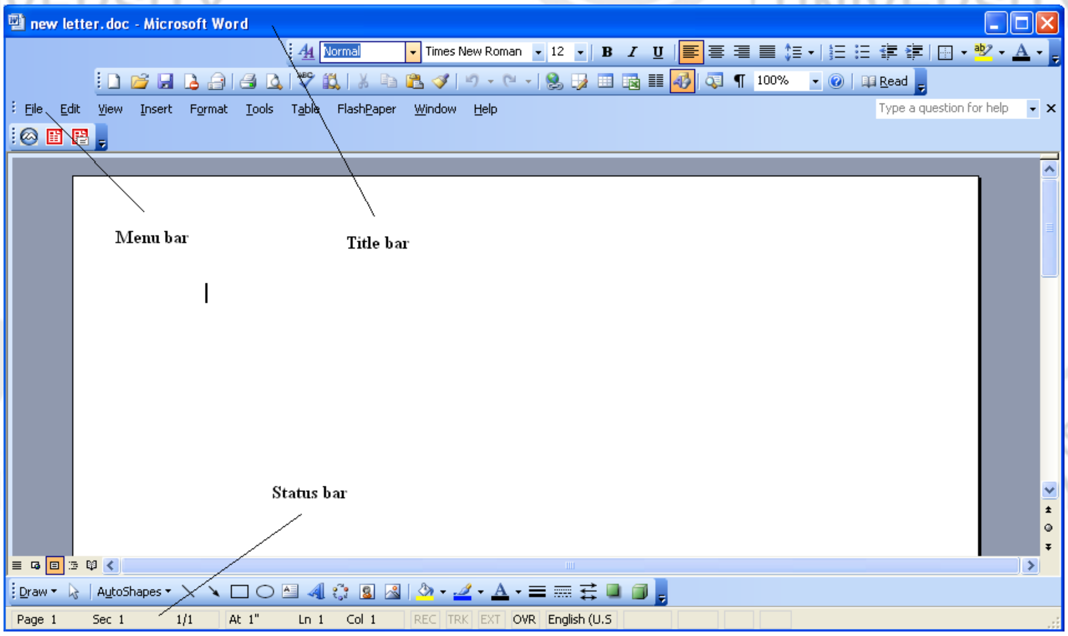

Figure 4: Screen shot - MS-Word

Microsoft Word is a word processing software which can be used to create, edit save and print documents. A window of MS-Word software is shown above for illustrating the various menus present in this software. Let us now discuss the menus of this software.

Title bar: It displays the name of the program, name of the currently active word document and control button etc.

Menu bar: It is placed below the title bar and is used for performing various tasks, such as open, close, format etc. of the document.

Status bar: It displays information about the active task on which user is currently working. This includes page number, line number etc. on which the user is currently working.

Advantage of MS-Word

MS-Word processor software allows us to do following tasks:

(1) Type a document through the keyboard and save it on the disk.
(2) Correct, delete and insert characters, words, lines anywhere in the document.
(3) Retrieve documents from the disk as and when required.
(4) Move or copy paragraphs from one place to other or from one file to other.
(5) Formatting of the document as per the need of the user.
(6) Searching of files in folders of the system.
(7) Save the edited document in the disk
(8) Print a letter or document

2. Electronic Spreadsheet Package

Although MS-Word is a very good software package for word processing task, but it is not convenient in entering data in tabular form, doing mathematical calculation and presentation of result in graphical form.

MS-Excel software package is used in place of paper sheet or ledger used by the people in management. It is used to store information in the memory of computer system, calculate the result, and display information on computer screen in a desired manner.

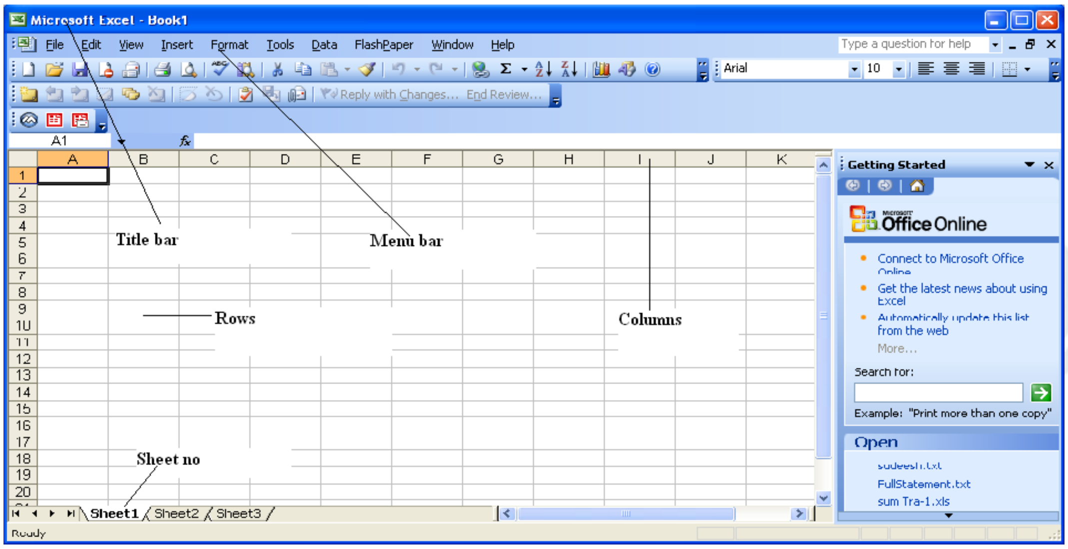

Figure 5: Screen shot- MS-Excel

Some, common applications of MS Excel worksheet are: Inventory control, Payroll, Income Tax calculation, Price list and invoice billing. Let us now discuss the menus of this software.

Title bar: It displays the name of the program, name of the currently active MS Excel worksheet and control button etc.

Menu bar: It is placed below the title bar and is used for performing various tasks, such as open, close, format etc. of the worksheet.

Status bar: It displays information about the active task on which user is currently working. This includes page number, line number etc. on which the user is currently working.

Features of Spreadsheet

The common features of MS Excel worksheets are:

(1) Worksheet contains rows & columns. There are 65536 rows and 256 columns in a worksheet of MS Excel.
(2) Intersection of rows & columns gives cell, which is used for data entry.
(3) Each cell of the worksheet has unique address.
(4) New rows and columns can be inserted in a worksheet.
(5) Cell address is used for defining the formula in any worksheet.
(6) Entry in worksheet may be numbers, character values or numeric values.
(7) Currently active cell is identified by the position of the cell pointer.
(8) The cursor can be moved from one cell to another by arrow keys.

Advantage of MS-Excel Spreadsheet

MS-Excel software allows us to do following tasks:

(1) Result of calculation is accurate and fast.
(2) Project reports can be prepared easily and quickly by the user.
(3) Worksheet is saved in electronic file and can be modified when required
(4) Mathematical formula's such as trigonometric formulas, statistical formula's are inbuilt along with this software and can be used for analysis of project results.
(5) Data can also be used to generate graphs for the comparison and analysis of project reports.
(6) Two worksheets can be merged for the purpose of report generation from two worksheets.

3. Graphic Software

Graphic software is used to create and manipulate presentation graphics, freehand graphics, charts etc. Some common graphic software's are MS Power point, Lotus-Graphics, Harvard Graphics etc. Image processors such as Photo-paint and Photoshop are also called graphic software.

In this section, we will discuss some components of graphics software, PowerPoint. PowerPoint is a complete presentation graphics package. It gives you everything you need to produce a professional looking presentation text handling, outlining, drawing, graphics, clip and art, and so on. It also offers rich speaker support and aids to help you create truly effective presentations.

PowerPoint makes you, the presenter and independent producer of your own high equality presentations.

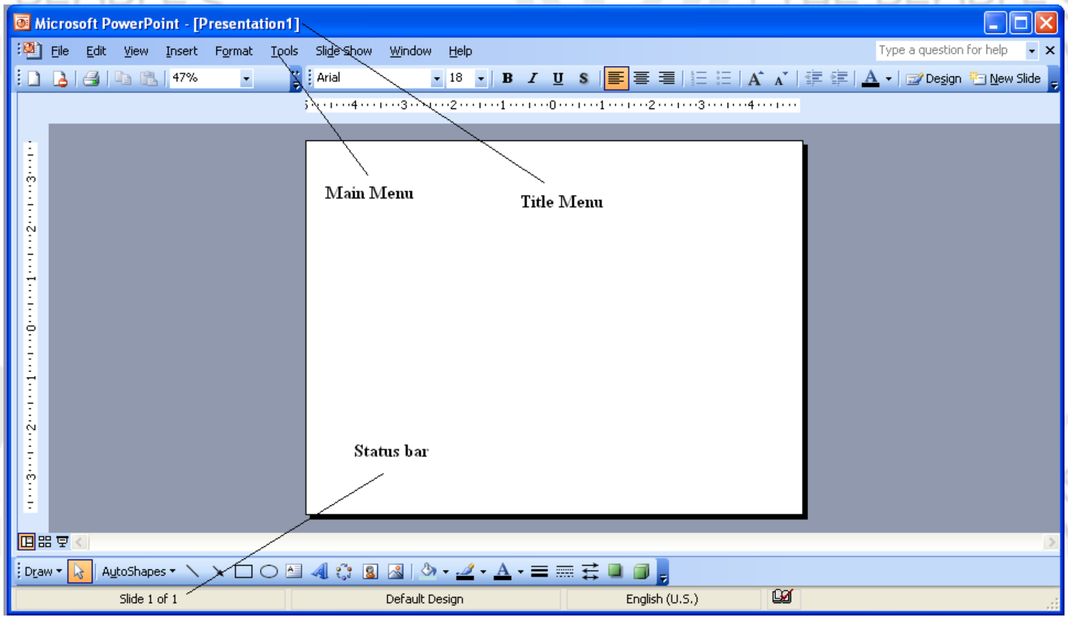

Figure 6: Screen shot - PowerPoint

Figure 6 shows the a window of PowerPoint. The features of PowerPoint Window are:

Title bar

It is located at the top of the screen, displays the name of the presentations.

Menu bar

It is located below the title bar and lists the options.

Status Bar

Used to display Messages regarding page number, slide number etc at the bottom of the window.

Advantage of PowerPoint

PowerPoint graphics software allows us to do following tasks:

Create a blank presentation
Text can be added by using text box
Change the fonts, size and color of the text
Add drawing objects
Presentations can be saved in the memory of the computer
Pictures and sounds files can be inserted at appropriate place in the presentation
Project reports can be presented by using PowerPoint

4. Data Base Management System (DBMS)

DBMS has its role in almost every field of our life such as school, office, industry etc. It allows storing and managing large amount of data. Various DBMS software's are FoxPro, Oracle, SQL, Sybase, MS Access etc.

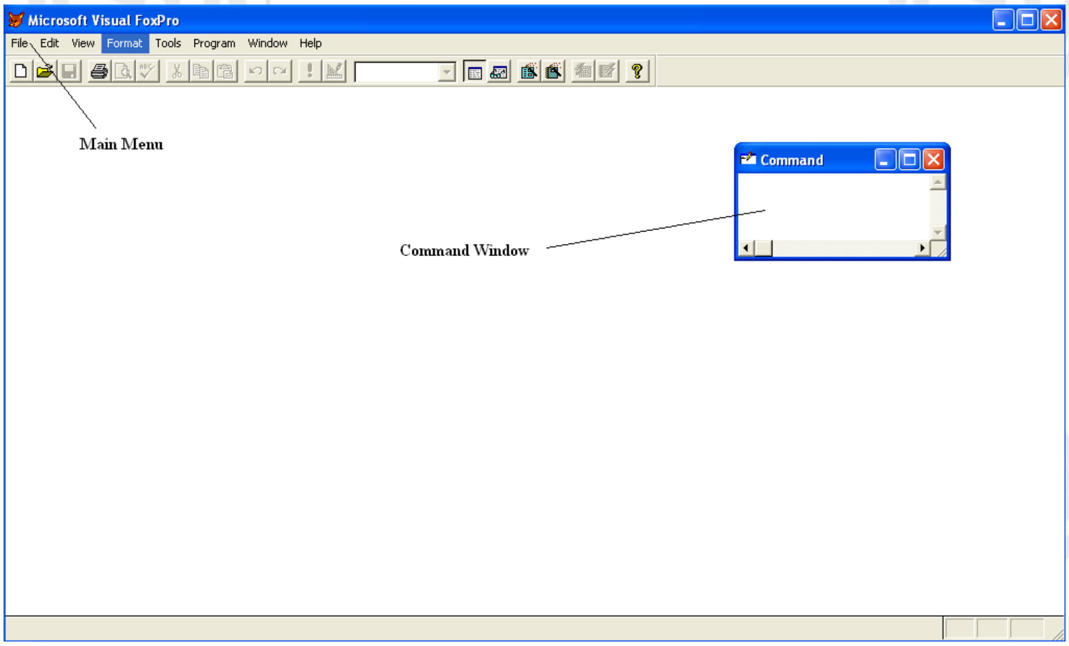

Figure 7: Screen shot - FoxPro

This is the window of FoxPro DBMS software. Command window is box in FoxPro and can be used to enter commands for the execution of the programs or for the preparation of the project report.

Features of DBMS

- Creating data files on a computer.
- Maintaining these file by adding, deleting, editing and updating a given set of data items
- Generating reports based on data files
- Querying on those data files and
- Generating reports.

☞ Check Your Progress 1

1) What do you mean by software?

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2) What do you mean by system software?

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3) What is application software?

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4) Give some example of system software and application software?

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5) What is GUI?

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6) What is utility Software? Explain its function.

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7) What is use of the MS-Word?

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4.3 EVOLUTION OF OPERATING SYSTEM

An operating system may process its task serially or concurrently. It means that the resources of the computer system may be dedicated to a single program until its completion or they may be allocated among several programs in different stages of execution. Due to different processing techniques, the operating systems are classified into different categories. Some basic categories of operating systems are explained briefly in coming subsections.

4.3.1 Serial Processing System

In early computer systems, the programming was performed in 1's and 0's, i.e., Machine language. The translators and data were needed to be fed into the computer system through the input devices.

The programs first loaded into the register of the computer system. Then address of the first instruction of the program is fetched. The result is examined by the contents of various registers and memory locations of the machine. This type of programming causes the low utilization of machine and user.

The program started being coded into the programming language are first changed into the object code by translator. Then this code is automatically loaded into memory by another program called loader. Now the execution of the program begins and the result is produced. This type of processing uses a fixed sequence of tasks to do, hence the name **Serial Processing System.**

4.3.2 Batch Processing System

The next logical stage after serial processing system was batch processing system. Before we discuss batch processing system, let us discuss single program operating system and multiple program operating systems.

Single program operating system allows only one program to run at a time. This implies that if you are working in a spreadsheet and want to write a letter, you must shut down the spreadsheet application and open up a word processor.

Gradually new operating systems were designed that allowed *multiple programs* to run at the same time. The simplest form of this is **multi-tasking**. It allows a single user to have the spreadsheet and the word processor open at the same time, and even more. Now the user can see to copy data from one to the other.

A **batch processing system** is one in which jobs are bundled together with the instructions necessary to allow them to be processed without intervention. Often jobs of a similar nature can be bundled together to further increase economy. Executing series of non-interactive jobs all at one time is called batch processing.

The term batch processing originated in the days when users entered programs on punch cards. A punched card is basically a piece of cardboard, which has holes in it to represent a set of machine code instructions in binary. They would give a batch of these programmed cards to the system operator, who would feed them into the computer.

Batch jobs can be stored up during working hours and then executed during the evening or whenever the computer is idle (free).

Batch processing is particularly useful for operations that require the computer or a peripheral - devices for an extended period of time. Once a batch job begins, it continues until it is done or until an error occurs. Note that batch processing implies that there is no interaction with the user while the program is being executed.

An example of batch processing is the way that credit card companies process their billing. The customer does not receive a bill for each separate credit card purchase but they get one monthly bill for all of that month's purchases. The bill is created through batch processing, where all of the data are collected and held until the bill is processed as a batch at the end of the billing cycle. At the end of month the operator has to feed the program into the computer. Remember that he/she may have a few programs to run, so what he/she will do is to wait until he/she has a **batch** of programs to run. Let us imagine that in the batch he has a FORTRAN program and a COBOL program to run from punched cards.

He/she will place the cards in a tray that feeds the cards into the computer. However the cards will not indicate which language program is in, so he/she places before the FORTRAN program several special cards that identify the program to the computer. He/She also puts cards at the end of the program to indicate that there is no more card left. This entire task is called a **job**.

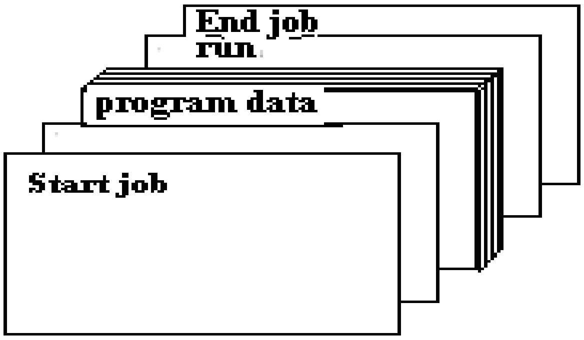

Figure 8: Job Processing in Batch Processing

The operator has ended up with is a **batch** of **jobs** to feed into the computer. The special cards that operator adds is part of another language that the computer understands is called the **Job Control Language** or **JCL** for short. The JCL has commands that indicate the start and end of jobs, which language program needs, what resources it requires (printers etc), who wrote the program, who needs to be billed and many more.

This process of creating jobs and feeding them one after each other into the system is called **batch processing** and is still common today. When the cards were fed into the system, the computer would then look at each card in turn and decide what action to take.

Advantage and disadvantage of Batch Processing System

1. Move much of the work of the operator to the computer.
2. Increased performance since it was possible for job to start as soon as the previous job finished.

Disadvantages

1. Turn-around time (total time taken in a job completion) can be long from user standpoint
2. More difficult to debug programs
3. Due to lack of protection scheme, one batch job can affect pending jobs (for example, read too many cards, etc)
4. A job could corrupt the monitor, thus affecting pending jobs
5. A job could enter an infinite loop

Spooling Batch Processing Systems

One difficulty with simple batch systems is that the computer still needs to read the deck of cards before it can begin to execute the job. This means that the CPU is unused (or nearly so) during these relatively slow operations.

Since, it is faster to read from a magnetic tape than from a deck of cards, it became common for computer centers to have one or more less powerful computers in addition to there main computer. The smaller computers were used to read decks of cards onto a tape, so that the tape would contain many batch jobs. This tape was then loaded on the main computer and the jobs on the tape were executed. The output from the jobs would be written to another tape which would then be removed and loaded on a less powerful computer to produce any hardcopy or other desired output.

Since, the computer can now perform IO in parallel with computation, it became possible to have the computer read a deck of cards to a tape, drum or disk and to write out to a tape printer while it was computing. This process is called **SPOOLING**: "***S**imultaneous **P**eripheral **O**peration **O**n-**L**ine"*.

Spooling batch systems were the first and are the simplest of the multiprogramming systems.

One advantage of spooling batch systems is that the output from jobs is available as soon as the job completed, rather than only after all jobs in the current cycle were finished.

4.3.3 Multiprogramming System

Multiprogramming Systems (1960s - present); Multiprogramming means sharing resources between more than one program's, device. It requires several programs to reside in memory at the same time. Since, several processes are to be kept in memory at the same time, these require some form of memory management.

As technology advanced, then serially processing the jobs soon became a handicap. What really was needed a mean by which more than one job (program) can be held in memory at a time, with the OS switching between them. This would then speed up the time a batch could be processed. The only real limitation would be the size of memory.

As machines with more and more memory became available, it was possible to extend the idea of multiprogramming as used in spooling batch systems to create systems that would load several jobs into memory at once and cycle through them in some order, working on each one for a specified period of time. The *Multiprogramming Operating System* was born for implementing such idea. Suppose three programs in memory, two are FORTRAN programs and the third is a COBOL program. The former requires a FORTRAN compiler and the latter a COBOL compiler. Instead of loading the FORTRAN compiler twice into memory, the OS only loaded it once and shared it between the two tasks. This is called *Multitasking* (different tasks being run by the same program). Such OS is called a *Multiprogramming-Multitasking Operating System.* However, the term *Multitasking Operating System* normally means the same thing nowadays.

4.4 TYPES OF OPERATING SYSTEM

In this section, we will discuss general properties, types of application advantages, disadvantages and basic requirements of different types of operating systems.

4.4.1 Batch Operating System

As discussed earlier, batch processing requires grouping of similar jobs, which consist of programs, data and system commands.

The advantage of this type of programming is in programs with large computation time, where need of interaction or involvement of programmer with system almost not required. For example, programs like payroll, statistical analysis of data, and calculation of large scientific numbers. They can submit their programs to the operators and return later after some time to collect the output.

Major disadvantages of this Operating System is:

(1) Non-interactive environment

(2) Off line debugging of the program by the operator

(3) No control over intermediate results of a program

(4) No flexibility in developing software

4.4.2 Real Time Operating System

A real-time operating system (RTOS) is an operating system that guarantees a certain capability within a specified time constraint. Primary role of real time operating system is to process data in quick time.

In other words a real time system is a system that reacts to events in the environment by performing predefined functions within specified given time period.

A real time system is a system which ensures the exact time requirements for a job. If a real-time system does not completed task in a certain time, it may cause a break down of the entire system it is running. Some applications require to be serviced within a time period:

- Industrial Control Systems
- Automobiles (Brake Control)
- Airplane Guidance

- Medical Devices

There are two types of real time systems:

1. Hard Real Time Systems

A hard real time system guarantees that a job will complete within a specified time period. This system must ensure that all delays on processing, input and output are bounded. The system cannot wait indefinitely so the hard time systems are usually very limited. There is generally no secondary storage such as disk drives as a disk request can take a variable time low process.

Some examples of a hard real time system are the software that run the autopilot in an jumbo jet or the imaging software on a missile.

2. Soft Real Time Systems

A soft real time system is a much less restrictive version of a hard real time system. A soft real time system does not guarantee that a job will complete within a specified time period, however, it tries its best to finish the job as soon as possible. If a critical real time job enters the system, the operating system may assign the highest priority to that task and execute it continuously until it completes.

The lack of a guarantee makes a soft real time system more limited in its application for industrial activities. Soft real time systems are used in the area of multimedia, virtual reality etc. Some of the operating systems that provide soft real time support are Windows NT/2000, Linux, Solaris.

4.4.3 Time-Sharing Operating System

With batch processing systems, there was no interaction between the user and his/her program in execution (process) while the program was being executed. The time sharing system allows multiple programs to simultaneously share the computer resources. In this everything is done under operator control. The job is submitted by the user and it is executed at some other time and the output is prepared. The delay between job submission and job completion is called the **turnaround time**.

Modern computer systems are interactive. The user asks for OS services directly and receives an immediate response. The user can easily experiment and do fast debugging.

4.4.4 Personal Computer Operating System

The more popular way that programmers and users got back at the machine was the advent of personal computers around 1980. Finally computers became small enough, inexpensive and even an individual could own them now a days. Modern era personal computers (PC) possess all basic features of computer and are very powerful in the term of CPU processing.

The operating system of PCs consists of two parts.

(1) Basic Input Output System (BIOS)
(2) Disk Operating System (DOS)

(1) Basic Input Output System (BIOS)

Basic Input Output Systems (BIOS) in PCs are stored in a non-erasable memory called Read Only Memory (ROM). When power is turned on BIOS takes control of the system in the beginning of booting.

(2) Disk Operating System (DOS)

Disk Operating System (DOS) is stored in a hard disk of the personal computer system. Features of DOS are:

(1) File management
(2) Directory management
(3) Memory management
(4) Utility program management, and
(5) Executive program management.

4.4.5 Network Operating System

The network operating system is the collection of software and protocols (set of rules). This collection allows the intercommunication of many computers over a computer network. Each computer on the network has its own operating system.

Features of network operating system are:

(1) Each computer has its own operating system instead of running part of global system wide operating system.
(2) Login mechanism is used to connect computer with remote server or system.
(3) Allows users to access the various resources of the network system.
(4) Users of network system are aware of where their files are kept and can move their file from one system to another.

4.4.6 Parallel Operating System

It is a multiprocessor operating system which **works with more than on CPU in close communication.** It is also called tightly coupled system because in this system processors share a common memory and a clock; communication usually takes place through the shared memory. Processors in the system are divided into two categories master and slave. Master processors, controls the slave processors.

Advantages of parallel system are:

(1) Increased throughput
(2) Economical
(3) Increased reliability
(4) Graceful degradation
(5) fail-soft systems
(6) Symmetric multiprocessing (SMP).
(7) Each processor runs an identical copy of the operating system.
(8) Many processes can run at a time without performance deterioration.
(9) Most modern operating systems support SMP.
(10) Each processor is assigned a specific task; master processor schedules and

allocated work to slave processors.

4.4.7 Distributed Operating System

A distributed operating system is one that looks to its users like an ordinary centralized operating system but runs on multiple independent CPU's. These systems are considered to be more reliable than uni-processor based systems. They are functional even if some of their hardware is not functioning or out of order.

Distributed operating systems are considered to be more reliable than single processor based systems. They perform even if some part of the hardware is malfunctioning.

Advantages of distrusted operating system are:

(1) Distributed operating system offers better price performance than centralized operating system.
(2) Total computing power of distributed operating system is better than centralized operating system.
(3) If one machine crashes the system as whole survives and keep on working.
(4) Computing power can be added in small increments.
(5) Allows many users to access common database.
(6) Allows many users to share expensive peripheral devices.
(7) Human to human communication makes easier through a wide network.

☞ Check Your Progress 2

1) What do you mean by flow control?

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2) List functions of operating system?

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3) What is real-time operating system?

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4.5 OTHER CRITERIA FOR CLASSIFICATION OF SOFTWARE

There are various methods to classify software into different categories. First method which is accepted by the computer researchers world wide which we have discussed in the section 4.2 of this unit.

However, on the basis of number of user's, piracy policy and authority of use, software can also be classified into following categories:

1. Public Domain Software

Public domain software are widely used now days. Features of public domain software are:

- Has no copyright - no one owns the right to control it and any ones can make copies of the software.
- Free to use or make copies by all.
- Can be copied, used in other programs, or changed by anyone.

2. Freeware

If small applications are developed without charging any cost it is known as freeware. Features of freeware are:

- Has a copyright - someone owns the right to determine who can make copies of the software.
- Free to use and make copies.
- Can only give away exact copies of the software.
- Can‘t be changed or used in another program without the copyright holder’s permission.

3. Shareware

The softwares of this category are given for some period on trial basis and later on users are charged for using it. Features of shareware software are:

- Has a copyright.
- Allowed to use the software before paying for it.
- Can be a demo - which limits some major features like the Save command.
- Can set an amount of time you can use the software.

4. Commercial Software

These software are developed by professionals for organizations for business purpose. Features of commercial software are:

- Has the most resistive copyright.
- Have to buy the software before you can use it.
- Can usually make one copy of the software as a backup copy.
- A backup copy is used in case something goes wrong with the original software.
- Can not give away or sell the backup copy.
- Can not copy look at the program’s code, change, or use the software in another program without the copyright holder’s permission.

It is necessary a computer user to know how a software is installed on computers (PCs). Let us see how software is installed on PCs. Software installation into the computer

Software can be installed into the computer by the following way:

1. Built into the computer's circuits, the ROM chips.
2. Loaded into the computer from a secondary storage device, like a floppy disk or hard disk drive.
3. Typed in from the keyboard.
4. From the Bluetooth Technology, Infrared Ray Technology and Wi-Fi Network Technology.
5. From the backup of LAN servers.

After copying finally **installation setup** is executed.

4.6 COMPUTER VIRUS

The world of computers and Information Technology is going through an era of electronic terrorism, in the form of virus. It is a problem that is potentially so dangerous that it threatens the proper functioning of the computer system in today information usage.

We need protection from viruses, because they destroy the contents of a file or a directory. Viruses copy themselves to other disks to spread to other computers. They can be less harmful and just eating up machine time or they can be vastly destructive to your files. There are more than thousands viruses known till today. Some of the category of them are given as:

1. Trojans: This virus hides inside something else to sneak in unwanted programs. You don't know that they are there, like the famous Trojan horse. These often capture the login and password of your computer.

2. Worms: These are unwanted programs that are transferred over network or Internet connections to your system and spread themselves quickly into your computer.

3. Spy ware : Spy-ware programs sneak on your computer to steal important information, like your passwords and logins and other personal identification information and then send it off to someone else.

4. Zombie : These programs take control of your computer and use Internet connection to attack other computers or networks or to perform criminal activities.

5. Phishing : Pronounced like the word 'fishing' is a message that tries to trick you into providing information like your social security number or bank account information or logon and password for a web site. The message may claim that if you do not click on the link in the message and log onto a financial web site then your account will be blocked, or some thing similar to this message.

6. Spam : It is email that you did not request and do not want. Spam of one person may be another's useful newsletter or sale advertisement. Spam is a common way to spread viruses such as Trojans, Black Friday etc. into other person's computer.

7. Browser hijacking: Hijacking occurs when one of the nastiest takes control of your browser, sending you to sites that you did not mean to go to. This may be a porn site or it may look like a real banking, sales, or credit card site. The purpose of this is to steal your personal and financial information.

4.6.1 How to protect your computer from viruses

To protect computers from unauthorised access firewalls are used.
A firewall is an integrated collection of security measures designed to prevent unauthorized electronic access to a network computer. To protect your computer from unauthorized access, viruses and spam you need to install anti-viruses and firewalls to your computer system.

Firewalls are frequently used to prevent unauthorized internet users from accessing private networks connected to internet. All messages entering or leaving to network are passed through the firewall, which examines each message, and blocks those which do not meet the specified security criteria.

Figure 9 shows the concept of working of firewalls. In Figure-9 those systems which are directly connected with the internet are not secure and chances of virus infections in them are very high. But systems which are protected with firewalls are very secure and data stored in them is safe from the attack of viruses.

In case of virus attack on a system, it is always advisable to follow the dictum "Prevention is better than cure". Viruses are not omnipotent. They can be cured by using anti-viral programs. Functions of anti-virus programs are:

- Prevention
- Detection
- Vaccination
- Identification, and
- Damage control

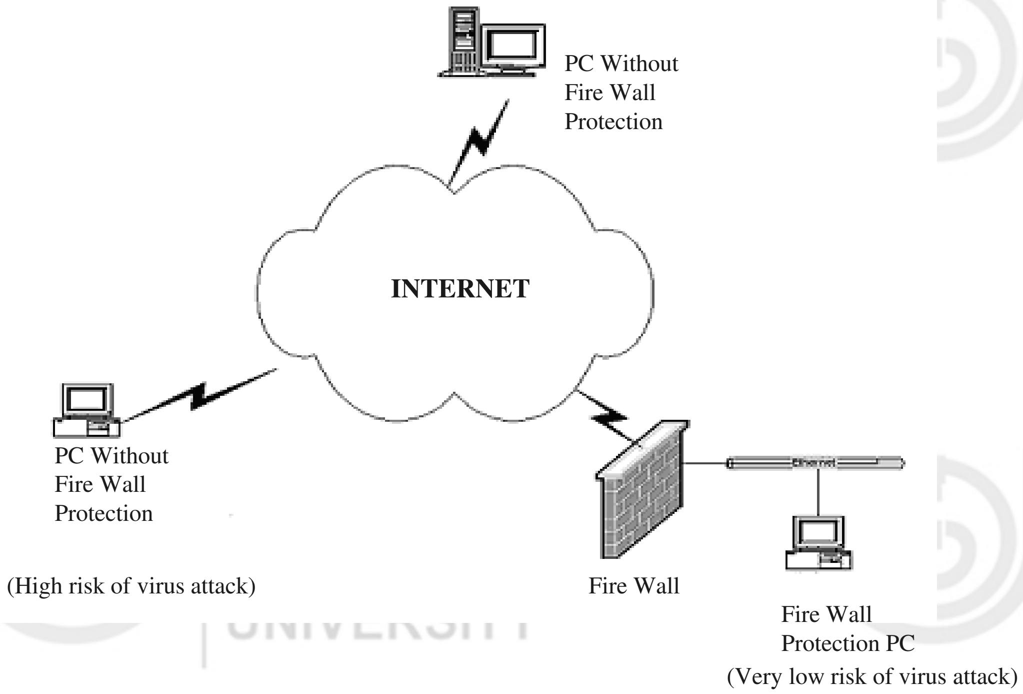

Figure 9: Firewall in Network

Example of some antivirus and prevention software programs are: Norton Anti-Virus, Mcafee Antivirus, Quick heal Anti-virus, Avast Antivirus and firewalls. Remember that firewall is security software which acts as logical wall around your computer and blocks unauthorized access attempts to your computer.

☞ Check Your Progress 3

1) What do you understand by batch processing system?

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2) What is multiprogramming system?

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3) What is distributed operating system?

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4.7 SUMMARY

In this unit, you have studied about software, kinds of software, types of operating system. The term software means set of instruction or given into the computer system for processing. Software can be further divided into two categories, system software and application software.

System software manages all the resources of the computer and also the task of record keeping in files and directories. The application software's are used to do specific types of job with the help of operating system and hardware. For example, writing letter, making presentation slides, drawing etc.

Further we have also discussed, batch processing system, multiprogramming system. Batch processing system is a system in which similar types of jobs are bundled at one place and then are processed by the CPU in one go. Multiprogramming system means processing of multiple programs at the same time by proper scheduling of jobs and computer memory.

4.8 SOLUTIONS/ANSWERS

Check Your Progress 1

1) Software: The term software means set of instruction inputted into the computer by input devices. These programs are used for various purposes in the computer system. A series of instructions that performs a particular task is called **"program"**. The process of software development is called **programming.**

2) System software: System software manages all the resources of the computer and also the task of record keeping in files and directories. System software controls the operation of input/output devices, memory and processor etc. Windows operating system such as Windows 95, Windows 98, Windows 2000, Windows XP Windows Vista etc, are some examples of system software.

3) Application software: Application software's are used to do specific types of job with the help of operating system and hardware. For example, writing letter, making presentation slides, drawing etc.

4) Examples of System software are: Windows XP, Windos 98 and Windows Vista Examples of Application software are: MS office, DBMS, MS Excel, Photoshop etc..

5) Graphical User Interface is the full form of GUI. It is that feature of software in which all the commands and instructions are displayed by using some picture or in the form of command buttons.

6) To do specific jobs such as printer driver etc are called utility or system software's. These are very helpful in operating external devices.

7) MS-Word is word processing application software and is used to write letters, creating tables, writing documents (books etc.)

Check Your Progress 2

1) Control flow determines the sequence and flow of controls in the computer system for performing some activity (program)

2) Functions of OS are: System Monitor activities, memory allocation and record keeping of files and folders and it manages all the resources of computer available for the user.

3) A Operating System which performs its activities in a fixed constraint of timing is called real-time operating system. A real-time operating system (RTOS) is an operating system that guarantees a certain capability within a specified time constraint. A real-time computer system is used in a large computerized environment, where the events are to be performed by their association with one another. The events must be accepted and processed in very short time and have some dead line.

Check Your Progress 3

1) A **batch system** is one in which jobs are bundled together with the instructions necessary to allow them to be processed without intervention. Often jobs of a similar nature can be bundled together to further increase economy. Executing series of non-interactive jobs all at one time is called batch processing.

2) Multiprogramming means sharing resources between more than one program's, device. It requires several programs to reside in memory at the same time. Since several processes are to be kept in memory at the same time, they require some form of memory management.

3) A distributed operating system is one that appears to its users like an ordinary centralized operating system but runs on multiple independent CPU's. These systems are considered to be more reliable than uni-processor based systems. They are functional even if some of their hardware is not functioning. Have multiple CPUs, and each CPU has its own associated memory.

4.9 FURTHER READINGS AND REFERENCES

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