Chapter 2   software concepts (class 11)

Hardware and Software

A computer consists of both hardware and software and both are equally important for the working of the computer system.

Hardware:- The electronic components of a computer system that we can see and touch are called hardware.

Software:- Software is a general term used for computer programs that control the operations of the computer. A program is a sequence of instructions that perform a particular task. A set of programs form a software. It is the software which gives hardware its capability.

hardware is of no use without software and software cannot be used without hardware.

Types of Software

Software can be broadly are categorized as:

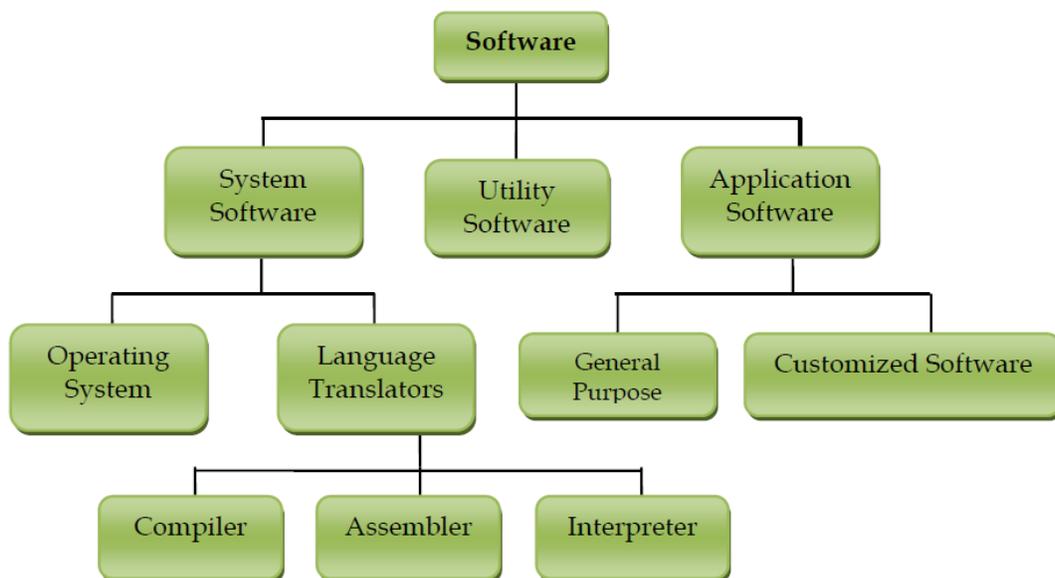➢   System Software
➢ Application Software
➢ Utility Software

Fig: Types of Software

System Software

System Software is the software that is directly related to coordinating computer operations and performs tasks associated with controlling and utilizing computer hardware. These programs assist in running application programs and are designed to control the operation of a computer system. System software directs the computer what to do, when to do and how to do. System software can be further categorized into

> ➤ Operating System
> ➤ Language processor
> ➤ Utility software
> ➤ Device drivers

Operating System

An Operating system is the most important system software. It is a set of programs that control and supervise the hardware of a computer and also provide services to Application software, programmers and users.

It manages all hardware and software, input, output and processing activities within the computer system. Without operating system a computer cannot do anything useful.

When a computer is switched on, the operating system is the first program that is loaded onto its memory. This process of loading up of operating system in memory is called booting up.

A user cannot communicate directly with the computer hardware, so the operating system acts as an interface between the user and the computer hardware.

Some of the popular operating systems used in personal computers are DOS, Windows, Unix, Linux, Solaris, etc.

Booting up

Loading operating system into main memory is called booting up.

The booting up is step by step process as follows:-

1. As soon as machine is powered ON , POST(power on self test) is performed. If any component is found faulty, an error message is displayed.
2. A chip called ROM-BIOS(Read only memory- basic input output services) is read and executed. Then a check is performed for OS files presence on the disk. If nowhere Os files are located following error message is displayed on the screen

non-system disk or disk error

3. If OS files are found in a drive, its very first sector (called MBR-master Boot Record or Boot Sector) is read which first look for active partition and then loads secondary boot record from active partition.
4. This secondary boot record now loads and runs the bootloader program. Every OS has a specific bootloader program that loads its specific OS files into main memory.

Bootloader programs are specific to different operating systems and loads the required files for that particular OS from disk to main memory.

Types of booting

1.Cold booting:- cold booting is the booting process that takes place when we first turn on computer.

2. warm booting:- warm booting is the process that takes place when we reset the computer by pressing reset button

Need for an Operating System
Operating system provides a platform, on top of which, other programs, called application programs can run. As discussed before, it acts as an interface between the computer and the user. It is designed in such a manner that it operates, controls and executes various applications on the computer. It also allows the computer to manage its own resources such as memory, monitor, keyboard, printer etc.

The operating system controls the various system hardware and software resources and allocates them to the users or programs as per their requirement.

Types of Operating System

OS are classified into the following types depending on their capability of processing

(i) Single User OS: It is used on a standalone single computer for performing a single task. Operating systems for Personal Computers (PC) are single-user OS. Single user OS are simple operating system designed to manage one task at a time. MS-DOS is an example of single user OS.

(ii) **Multiuser OS** is used in mini computers or mainframes that allow same data and applications to be accessed by multiple users at the same time. The users can also communicate with each other. Linux and UNIX are examples of multiuser OS.

(iii)**Multiprocessing OS** have two or more processors for a single running process.Processing takes place in parallel and is also called *parallel processing*. Each processor works on different parts of the same task, or, on two or more different tasks. Since execution takes place in parallel, they are used for high speed execution, and to increase the power of computer. Linux, UNIX and Windows 7 are examples of multiprocessing OS.

(iv) Time sharing Operating System: It allows execution of more than one tasks or processes concurrently. For this, the processor time is divided amongst different tasks. This division of time is also called **time sharing**. The processor switches rapidly between various processes.

(v)**Real Time Operating System:** It is a multitasking operating system designed for real time applications like robotics. In this type of operating system, the tasks have to be done within a fixed deadline. System performance is good if task is finished within this deadline. If it is not done, the situation is called Deadline Overrun.
.

(vi)**Distributed Operating System:** On a network data is stored and processed on multiple locations. The Distributed Operating System is used on networks as it allows shared data/files to be accessed from any machine on the network in a transparent manner. We can insert and remove the data and can even access all the input and output devices. The users feel as if all data is available on their workstation itself.

(vii) **Interactive Operating System:** This is the operating system that provides a Graphic User Interface (GUI) through which the user can easily navigate and

interact. The computer responds almost immediately after an instruction has been entered, and the user can enter new instructions after seeing the results of the previous instructions.

Language Processors

The special translator system software that is used to translate the program written in high-level language (or Assembly language) into machine code is called language processor or translator program.
The language processors can be any of the following three types- Assembler, Compiler and Interpreter.

Assembler
The Assembler is used to translate the program written in Assembly language into machine code.
The output generated by assembler is the object code or machine code understandable by the computer.

Compiler
The language processor that translates the complete source program as a whole in one go into machine code is called compiler. Some of the examples are C and C++ compilers.
The program translated into machine code is called the object program. The source code is translated to object code successfully if it is free of errors. If there are any errors in the source code, the compiler specifies the errors at the end of compilation with line numbers. The errors must be removed before the compiler can successfully recompile the source code again.

Interpreter
The language processor that translates a single statement of source program into machine code and executes it immediately before moving on to the next line is called an Interpreter. If there is an error in the statement the interpreter terminates its translating process at that statement and displays an error message.
Only after removal of the error, the interpreter moves on to the next line for execution.

Utilities

A utility software is one which provides certain tasks that help in proper maintenance of the computer. The job of utility programs is to keep the computer system running smoothly. Some of the commonly use utility softwares are antivirus, Disk defragmenter, backup, compression etc

1. Antivirus

An antivirus is utility software which detects and removes computer viruses. If the software is not able to remove the virus, it is neutralized. The antivirus keeps a watch on the functioning of the computer system. If a virus is found it may alert the user, flag the infected program or kill the virus. Some of the common types of viruses are:

▪ **Boot Sector Virus:** A boot sector virus displaces the boot record and copies itself to the boot sector i.e. where the program to boot the machine is stored. So first the virus is loaded on to the main memory and then the operating system.

▪ **File Virus:** A file virus generally attacks executable files. They can attach to various locations of the original file, replace code, fill in open spaces in the code, or create companion files to work with an executable file.

▪ **Macro Virus:** This virus infects an important file called normal.dot of MS Word. As soon as the application is opened the virus gets activated.

▪ **Trojan Horse:** It is a code generally hidden in games or spreadsheets. Since they are hidden, the program seems to function as the user wants but actually it is destroying the program. A Trojan horse does not require a host program to embed itself.

▪ **Worm:** Worm is a program capable of replicating itself on a computer network. A worm also does not require a host as it is a self contained program.

2.File Management Tools

This utility helps the user in storing, indexing, searching and sorting files and folders on the system. The most commonly used tool is the Windows Explorer and Google Desktop.

3. Compression Utility

This utility is used to compress large files. Compression is useful because it helps reduce resources usage and the file transmission on the network becomes easier.

4. disk management tools: as the name suggest these tools are used for efficiently managing data disks so as to have increased performance.

a)Disk Cleaner
This utility scans for file that have not been accessed/used since long. Such files might be occupying huge amount of memory space. In that case the Disk Cleaner utility prompts the user to delete such files so as to create more space on the disk. If the files are important, the user might take a backup before deleting them.

b)Disk Defragmenter
The memory is used in small chunks randomly. Sometimes when a memory chunk of appropriate size is not available, the operating system breaks or fragments the files resulting in slower access to files. A disk defragmenter scans the hard disk for fragmented files and brings all the fragments together.

c)Backup Utility
This utility is used to create the copy of the complete or partial data stored in a disk or CD on any other disk. In case the hard disk crashes or some other system failure occurs, the files can be restored using backup software.

Device drivers:- device drivers are the program written for operating system as to work with different hardware devices.

Application Software
An application software is bought by the user to perform specific applications or tasks An application software can be of two types –
General Purpose Application Software and Customized Application software

General Purpose Application Software
Some of the application software is made for the common users for day to day applications and uses. These are also referred as Office Tools. The users may use them in the manner they want. Some of the popular types of general purpose application software are discussed below:

✡ **Word Processor:** Word processor is a general purpose application software used to create documents. It allows us to create , edit and format documents. We can use different types of fonts of various sizes; underline or make bold a certain part ofthe text.

✡ **Presentation Tools:** Presentation tools is a general purpose application software that lets us create presentations on any topic. We can not only create a

presentation and add slides into that but also can use different types of background, fonts, animations, audio, video, etc.

✡ **Spreadsheet Packages:** Spreadsheet is a general purpose application software that lets us create and store data in tabular form. Both text and numerical values can be entered in that tables known as a spreadsheet.

✡ **Database Management System:** Database Management System is general purpose application software that lets us create computer programs that control thecreation, maintenance, and the use of database for an organization and its end users. We can not only store data but can also manage data in a database.

Customized Software

Customized Software is one which is tailor made as per the user's requirement. Such type of software is customer specific. It is made keeping in mind the individual needs of the user and so are also referred as Domain Specific Tools. Such software cannot be
installed and used by any other user/customer since the requirements may differ. Some examples of customized software are discussed below:

✡ **Inventory Management System & Purchasing System:** Inventory Management
System is generally used in departmental stores or other organizations to keep the
record of the stock of all the physical resources.

✡ **School Management System:** School Management System (sometimes called a
School Information System or SIS) is a system that manages all of a school's data in
a single, integrated application. Having all of the information in a single system
allows schools to more easily connect data together

✡ **Payroll System:** Payroll Management System software is used by all modern
organizations to keep track of employees of the organization who receives wages
or salary.

Financial Accounting: Financial accounting System is used to prepare accounting
information, maintain different accounts ledger, and account books. It also helps
an organization to make budget.

✡ **Hotel Management:** Hotel management software refers to management techniques used in the hotel sector. These can include hotel administration, accounts, billing, marketing, housekeeping, front office or front desk, food and

beverage management, catering and maintenance. Even advance bookings can be
made through this software

Reservation System: Reservation System is software used to book (reserve) air
flights, railway seats, movie tickets, tables in a restaurant, etc
✡ **Weather Forecasting system:** This software makes it possible to forecast the
weather for days and even months in advance

Open Source Concepts
Software are mainly categorised into the following categories based on their licenses:
1. Proprietary
2. Shareware
3. Freeware
4. Open source
5. Free Software
✡ **Proprietary**
We pay a supplier for a copy of the software which these days may be supplied on physical media (disks) or downloaded from the Internet. We get the permission to use the software on one or sometimes more than one machines. Examples of this type of software include Microsoft Office and Microsoft Windows.
✡ **Shareware**
Shareware is basically a software for trial purpose that the user is allowed to try for free, for a specified period of time. It is usually downloaded from the Internet.
When the trial period ends, the software must be purchased or uninstalled.
✡ **Freeware**
Freeware software is free of cost and is usually bundled up with some operating system or any other software. Examples of freeware include Microsoft Internet Explorer which comes bundled up with any Microsoft operating system. The author of the freeware software is the owner of the software, though people may use it for free. The source code is not available, so no modifications can be done.

Freeware should not be mistaken with Open Source Software or Free Software.

✡ Open source

Open Source Software (OSS) is the software which gives the users freedom to run/use the software for any purpose and in any manner. They can be used, modified and even redistributed. In simple terms it can be freely used but it may not be free of charge. The source code is freely available to the customer. Python, Tux Paint etc are examples of Open Source Software.

✡ Free Software

This type of software is freely accessible and can be freely used, modified, copied
or distributed by anyone. And no licence fee or any other form of payment need to be made for a free software. The source code is also accessible in case of free softwares.

Commonly Used Operating Systems

Some of the commonly used operating systems are discussed below:

1. Windows: Microsoft launched Windows 1.0 operating system in 1985 and since then Windows has ruled the world's software market. It is a GUI (Graphic User Interface) and various versions of Windows have been launched like Windows 95, Windows 98, Win NT, Windows XP, Windows 7 and the latest being Windows 8.

2. Linux: Linux is a free and open software which means it is freely available for use and since its source code is also available so anybody can use it, modify it and redistribute it. It can be downloaded from www.linux.org. It is a very popular operating system used and supported by many companies. The defining component of this operating system is the Linux kernel.

3. BOSS (Bharat Operating System Solutions): This is an Indian distribution of GNU/Linux. It consists of Linux operating system kernel, office application suite, Bharateeya OO, Internet browser (Firefox), multimedia applications and file sharing.

4. UNIX: It is a multitasking, multiuser operating system originally developed in 1969 at Bell Labs. It was one of the first operating systems developed in a high level language, namely C. Due to its portability, flexibility and power, UNIX is widely being used in a networked environment. Today, "UNIX" and "Single UNIX Specification" interface are owned and trademarked by The Open Group. There are many different varieties of UNIX, although they share common similarities, the most popular being GNU/Linux and Mac OS X.

5. Solaris: It is a free Unix based operating system introduced by Sun Microsystems

in 1992. It is now also known as Oracle Solaris. Solaris is registered as compliant with Single UNIX Specification. It is quite scalable and is used on virtual machines.

Mobile Operating Systems (Mobile OS)

It is the operating system that operates on digital mobile devices like smart phones and tablets. It extends the features of a normal operating system for personal computers so as to include touch screen, Bluetooth, WiFi, GPS mobile navigation, camera, music player and many more. The most commonly used mobile operating systems are –

Android and Symbian

Android: It is a Linux derived Mobile OS released on 5th November 2007 and by 2011 it had more than 50% of the global Smartphone market share. It is Google's open and free software that includes an operating system, middleware and some key applications for use on mobile devices. Android applications are quiet user friendly and even one can easily customize the Smartphone with Android OS. Various versions of Android OS have been released like 1.0, 1.5, 1.6, 2. x, 3.0 etc. Most Android phones use the 2.x release while Android 3.0 is available only for tablets.

Symbian: This Mobile OS by Nokia (currently being maintained by Accenture) designed for nokia smartphones

Operating System functions

An operating system has variety of functions to perform. Some of the functions of an operating system are:-

1.Processor Management: This deals with management of the Central Processing Unit (CPU). The operating system takes care of the allotment of CPU time to different processes. This is called CPU **scheduling**. Two types of scheduling techniques are employed by an operating system :

    i)   non preemptive
    ii)   preemptive

i)non preemptive scheduling:- in this scheduling, a scheduled job always completes before another scheduling is made. The scheduling techniques which uses non preemptive scheduling are:-

a) first come first serve(FCFS)
b) shortest job next(SJN)
c) deadline scheduling.

ii)Preemptive scheduling:- preemptive scheduling may force a job in execution to release the processor. The scheduling techniques which use preemptive scheduling are:-
   a) round robin(RR)
   b) response ratio

2. storage management
In the working of modern computer system, memory plays a central role , both CPU and I/O system interact with memory. The CPU reads from and writes to specific memory addresses.
Memory can be managed in two ways:
   a) Contiguous memory allocation:- in this approach each problem which is to be executed, is allocated a contiguous storage memory.
   b) Non contiguous memory allocation:- in this approach a program is broken into small components and then these components are stored at different location.

3. Information management:- a computer system works with information. It stores information, processes information, provides information etc. thus managing this information is also an important and necessary task performed by an OS.
Information management component of OS are as follows:
   (i)   Physical IOCS(Input-Output-control-System) is responsible for device management and for ensuring device independence.
   (ii) Logical IOCS is responsible for efficient organization and access of data on IO devices.
   (iii) File system is responsible for protection and controlled sharing of files

Some commonly used operating system

Some of the commonly used operating systems are discussed below:

1. Windows: Microsoft launched Windows 1.0 operating system in 1985 and since then Windows has ruled the world's software market. It is a GUI (Graphic User Interface) and various versions of Windows have been launched like Windows 95, Windows 98, Win NT, Windows XP, Windows 7 and the latest being Windows 8.

2. Linux: Linux is a free and open software which means it is freely available for use and since its source code is also available so anybody can use it, modify it and redistribute it. It can be downloaded from www.linux.org. It is a very popular operating system used and supported by many companies. The defining component of this operating system is the Linux kernel.

3. BOSS (Bharat Operating System Solutions): This is an Indian distribution of GNU/Linux. It consists of Linux operating system kernel, office application suite, Bharateeya OO, Internet browser (Firefox), multimedia applications and file sharing.

4. UNIX: It is a multitasking, multiuser operating system originally developed in 1969 at Bell Labs. It was one of the first operating systems developed in a high level language, namely C. Due to its portability, flexibility and power, UNIX is widely being used in a networked environment. Today, "UNIX" and "Single UNIX Specification" interface are owned and trademarked by The Open Group. There are many different varieties of UNIX, although they share common similarities, the most popular being GNU/Linux and Mac OS X.

5. Solaris: It is a free Unix based operating system introduced by Sun Microsystems
in 1992. It is now also known as Oracle Solaris. Solaris is registered as compliant with Single UNIX Specification. It is quite scalable and is used on virtual machines.

Mobile Operating Systems (Mobile OS)

It is the operating system that operates on digital mobile devices like smart phones and tablets. It extends the features of a normal operating system for personal computers so as to include touch screen, Bluetooth, WiFi, GPS mobile navigation, camera, music player and many more. The most commonly used mobile operating systems are –

Android and Symbian

Android: It is a Linux derived Mobile OS released on 5th November 2007 and by 2011 it had more than 70% of the global Smartphone market share. It is Google's open and free software that includes an operating system, middleware and some key applications for use on mobile devices.

Symbian: This Mobile OS by Nokia (currently being maintained by Accenture) designed for nokia smartphones