Software Concepts & Productivity Tools

Learning Objectives

After studying this lesson the students will be able to:

- understand the importance of binary language
- appreciate the need and importance of an Operating System
- identify different types of software - utility, general purpose application software, specific purpose application software and developer tools
- perform basic operations in word processor, spreadsheet tool, presentation tool and database tool
- differentiate between interpreter, compiler and assembler
- understand the various components of an Integrated Development Environment

Introduction

We are all familiar with the fact that the computer is a programmable electronic device that performs mathematical calculations and logical operations and can especially process, store and retrieve large amounts of data very quickly. The computer has hardware components and software that help us work with the computer. Hardware is one that is tangible. The storage devices (Hard disk, CD's etc.), mouse, keyboard, CPU and display devices (Monitor) are Hardware. Computer instructions that can be stored electronically is Software. In this chapter we will discuss more about software and its different types.

Computer being an electronic device, understands only electric pulses i.e. whether the electricity is flowing through a circuit or not. We denote these two states of pulses (electricity flowing & not flowing) by 1 and 0, and thus computer understands a language that consists of only two 'characters' namely 1 and 0. This special language is

popularly known as Binary language or Machine language, which is directly understood by the computer. 0 and 1, the digits of binary language or Binary Digits are also known as Bits (**B**inary **D**igits). Binary language consists of ones and zeros, typically in groups of 8 or 16 bits, used for storing characters and numbers.

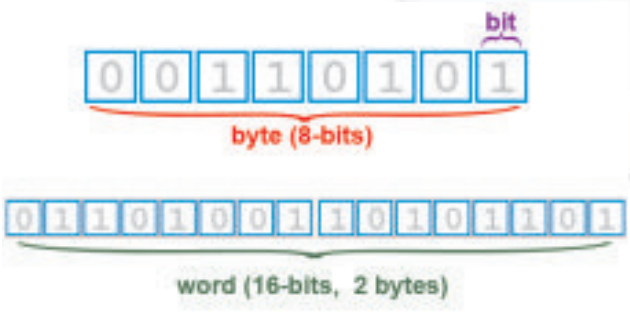


Figure 2.1 Bits and Bytes

Any instruction given to the computer is ought to be in binary language for the computer to understand and act accordingly. But for us as a human being, learning of binary language is extremely difficult and thus we use some interpreter to translate human language into machine language and vice versa. We will discuss about these translators in detail later in this chapter.

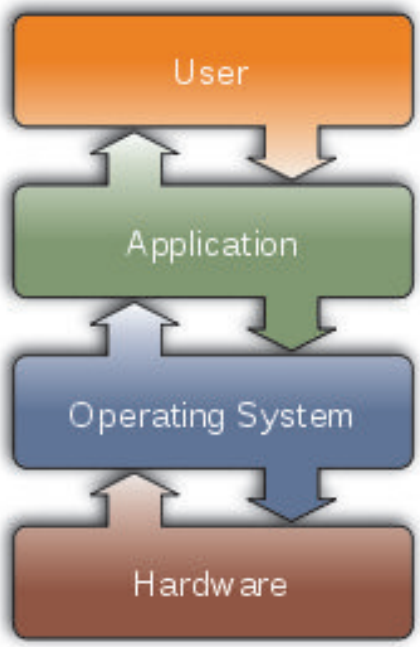


Figure 2.2 Interacting with Hardware

When we buy a television set and a DVD player, it is the hardware we are buying. But this hardware is of no use until and unless we have some movie VCD or DVD to play on it. The content in the VCD or DVD refers to the software which makes a hardware device useful. Similarly a computer system is incomplete, if you just have the CPU, Monitor, Keyboard and other devices without any software.

Software is not only the basic requirement of a computer system, it makes a computer more powerful and useful. We can make railway reservation, send and receive emails, and listen to music only when the hardware and software works together.

An ordered set of instructions given to the computer is known as a program and a set of such programs that governs the operation of a computer system and/or its related devices is known as Software.

Types of Software

Software can be divided into different types depending upon their uses and application. Software can be broadly divided into two categories such as System Software & Application Software. Software required to run and maintain basic components of computer system come under the category of system software whereas software required to solve some specific task of daily use is generally called application software. An operating system is an example of system software while documentation tool, a presentation tool, a spreadsheet tool are all examples of application software. Even your favorite computer game is an example of application software.

System Software

Being an electronic device, a computer as such can not perform anything of its own. The functions of all the physical components of a computer system are guided by some instructions or program collectively known as System Software. System Software controls all internal activities inside a computer system and between all attached components of a computer system. It controls all possible activities inside the computer system which can be summarized as follows:

- Reads data and instructions through the input devices;
- Translates all data and instruction into computer understandable form and vice versa;
- Controls all devices attached to the computer system;
- Processes and generates the result on the output devices;

Figure 2.3 A Computer

Some common examples of System Software as follows :

- BIOS
- Operating System
- Device Drivers
- Language Processors

BIOS

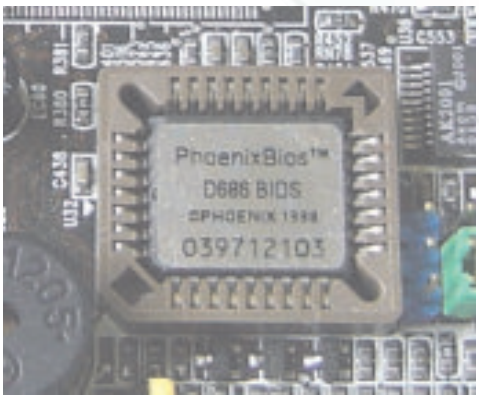


Figure 2.4 BIOS chip

The basic input/output system (BIOS) is also commonly known as the System BIOS. The BIOS is boot firmware, a small program that controls various electronic devices attached to the main computer system. It is designed to be the first set of instructions run by a Computer when powered on. The initial function of the BIOS is to initialize system devices such as the RAM, hard disk, CD/DVD drive, video display card, and other hardware. The BIOS sets the machine hardware into a known state to help the operating system to configure the hardware components. This process is known as booting, or booting up. BIOS programs are stored on a chip as shown in Figure 2.4.

Know more

Boot firmware is the ROM-based software that controls a computer from the time that it is turned on until the primary operating system has taken control of the machine. The main function of boot firmware is to initialize the hardware and then to "boot" (load and execute) the primary operating system. Secondary functions include testing the hardware, managing hardware configuration information, and providing tools for debugging in case of faulty hardware or software.

Operating System

An operating System is the most important program that runs on a computer. It is stored (installed) on the hard disk or any other external storage device. It is the first program to be executed on a computer after the BIOS. Every computer must have an operating system to operate all its components and run other programs. Operating system is a set of system programs that controls and coordinates the operations of a computer system. Operating systems perform all basic tasks, such as identifying basic input/output devices, accepting input from the input devices, sending results to the output devices, keeping track of files and directories on the disk, and controlling other peripheral devices such as disk drives and printers as shown in Figure 2.5.

Need for an Operating System

Operating system provides a software platform, on top of which, other programs, called application programs are run. The application programs must be written to run on the environment of a particular operating system. Our choice of operating system, therefore, depends to a great extent on the CPU and the other attached devices and the applications we want to run. For PCs, some of the most popular operating systems are Microsoft Windows, Linux, Mac OS, Solaris, BOSS, etc.

Figure 2.5 Components controlled by an Operating System

Major Functions of an Operating System

The functions of an operating system can be broadly outlined as follows:

- Communicate with hardware and the attached devices [Device Manager]
- Manage different types of memories [Memory Manager]
- Provide a user interface [Interface Manager]
- Provide a structure for accessing an application [Program Manager]

- Enable users to manipulate programs and data [Task Manager]
- Manage the files, folders and directory systems on a computer [File Manager]
- Provide basic networking structure for LAN and Internet [Network Manager]
- A smart OS also provides a minimal security to the computer system through authorization (user name) and authentications (password) [Security manager]

Types of Operating system

Following types of operating system are generally available and used depending upon the primary purpose and application and the type of hardware attached to the computer:

- **Single User:** Allows one user to operate the computer and run different programs on the computer. MS DOS is a common example of single user operating system.
- **Multi-user:** Allows two or more users to run programs at the same time on a single computer system. Unix, Linux, Windows are common examples of multi user operating system.
- **Real time:** Responds to input instantly. Real-time operating systems are commonly found and used in robotics, complex multimedia and animation, communications and has various military and government uses. LYNX and Windows CE are examples of real time operating systems.

Know more

Apart from the above general categories, an Operating System can also be categorized as:

- *Multiprocessing: Supports allocating programs on more than one CPU (processor).*
- *Multitasking: Allows more than one program (task) to run concurrently.*
- *Multithreading: Allows different parts of a single program to run simultaneously.*

Device Driver

Figure 2.6 Driver Disc

A device driver is a system software that acts like an interface between the Device and the user or the Operating System. All computer accessories like Printer, Scanner, Web Camera, etc come with their own driver software. These driver software help the operating system and other application software to communicate with those devices for optimal use.

Language Processor

Figure 2.7 Few Language Processors

As discussed above, a computer system understands only machine language or binary language, also known as Low Level Language (LLL). This language is extremely difficult to learn for a general programmer and thus there is a need for some special language that is easy to learn and understand for the programmer in order to interact with the computer system. These special languages or set of commands are collectively known as programming languages or High Level languages (HLL). Some examples of High Level Programming Languages are Basic, C, C++, JAVA, etc. These high level programming languages can easily be translated into machine language and vice versa using language translators like assembler or Interpreter or Compiler. These translators are also known as language processors.

- **Assembler -** Some advance programmers prefer to learn a language which is very close to the low level language, called the Assembly language. This language consists of mnemonic codes, is difficult to learn and is machine dependent. Assembler is a language processor, which translates a program written in assembly language into machine language.
- **Compiler** - A compiler is a language processor which converts (or translates) the entire program written in high level language into machine language in one go. If it fails to convert the program because of error(s) present in the program, all errors

are reported together along with the line numbers for debugging. After all the errors are removed, the program can be recompiled to obtain the object program. After the compilation process is completed, the object program can directly be executed, without the intervention of the compiler thus saving memory.

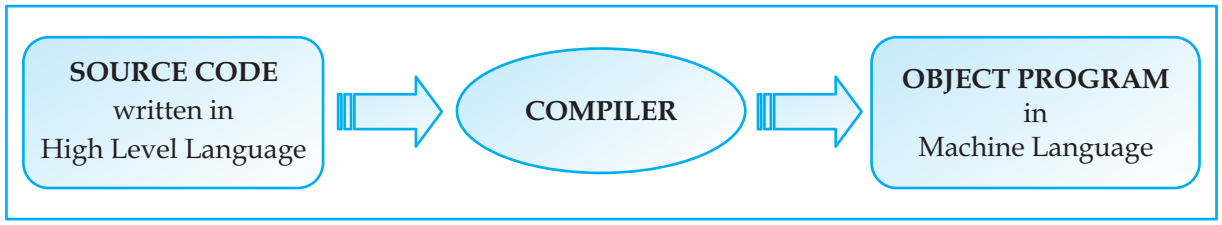


Figure 2.8 Conversion of a Source Code to Object Code

- **Interpreter -** This language processor converts a high level language program into machine language line by line as well as executes it. If there is any error in the program, translation and execution stops and the error is reported for debugging. The conversion and execution resumes only after that error is rectified. This is a slow process and consumes high memory as the interpreter is also required to execute the correct code along with reporting the errors, but is very useful for debugging and thus suitable for novice programmer. Debugging is the process of removing all errors from a computer program.

Know more

Apex Language Processor, developed by Centre for Development of Advanced Computing(CDAC), is a multilingual word processor running under DOS and UNIX that allows typing of all Indian scripts through the common INSCRIPT keyboard overlay.

Application Software

Application software is a set of programs to carry out a specific task like word processor, spreadsheet, presentation tools, library management software, railway reservation, antivirus software, etc. Generally an application software can perform only one specific job and can not be used for something else. For instance, a library management software can not be used for railway reservation system or a word processing software is generally not used as a spreadsheet.

Application Software can be divided into different categories depending upon their uses as follows:

- Utility Software
- General Purpose Application Software
- Specific Purpose Application Software
- Developer Tools

Utility Software

After all the basic and necessary software like Operating System and Device Drivers have been installed, we also require some additional software to keep our computer system efficient and trouble free. Generally these software come bundled with the Operating System Software but we can also use utility software provided by other vendors. Few examples of utility software are as follows:

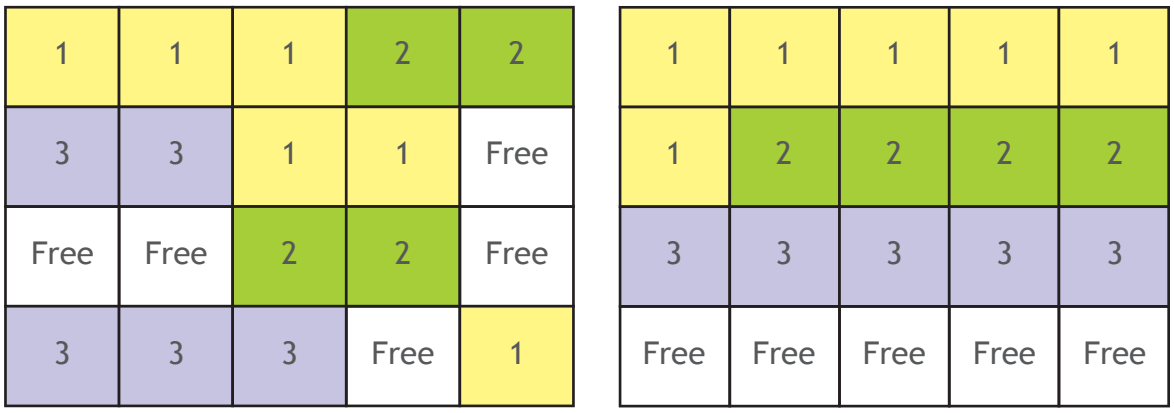
- **Compression utility software:** Using this software, you can reduce (compress) the storage size of any computer program/file while not in use. This utility comes in handy when you want to transfer a big program or computer file from one computer to another either through internet or using storage devices like Pen Drive, CD or DVD.

Figure 2.9 Utility Software

- **Backup utility software:** Though computer is in general a dependable device but it is always advisable to take regular back up of important data and programs stored in the computer. In case of any damage to the system, the back-up files can be restored and the important data can be recovered from the back-up files. This utility software facilitates you to take regular back-up of important files and folders stored in a drive into another storage device like a Pen drive or CD or a DVD or another computer. This backup data can be restored in case of any unforeseen situation.

- **Disk De-fragmentation Utility software:** When computer system finds a file too large to store in a single location, it splits the file and stores it in pieces (called fragments), which are logically linked. This simply means that different parts of the file are scattered across the hard drive in noncontiguous

locations. This type of fragmented file requires some extra time to access and slows down the system. Disk de-fragmentation utility software speeds up the system by rearranging such fragmented files stored on a disk in contiguous locations in order to optimize the system performance. For example if you have three defragmented files named 1(stored in 6 fragments),2(stored in 4 fragments) and 3(stored in 5 fragments) as shown in Figure 2.10, then running the defragmentation utility will reorganize the file contents in consecutive locations as shown in Figure 2.10.



Example of a Fragmented Drive **Example of a Defragmented Drive**

Figure 2.10 A Simple Visualization of Disk Defragmentation

! You should regularly defragment your hard drive so as to increase the speed of accessing files thereby improving the system performance.

- **Antivirus detection and protection software:** A computer virus is a computer program intended to hamper the performance of a computer system. These virus are copied into the system through some other infected programs (copied into the system) or downloaded from the internet. This utility software provides the user with a virus free work environment by restricting the entry of any unwanted program into the system.
- **Text Editor:** This utility software helps one to create, store or edit a basic text file. A text file generally stores English type text and can also store numeric and special characters with little formatting. Popular examples of text editors are Notepad, Notepad2, Notepad++, Gedit and KWrite.

Know more

A text editor (like notepad) is where you simply make some quick changes to the text. Remember that you can not do much formatting with text editors. Whichever font or formatting style you use in the document stays throughout the document; you cannot change fonts or formats within the document.

A word processor (like MS Word), on the other hand has a variety of options to format text within the document like inserting special symbols, changing colors, line spacing, tables and a whole lot of other things that you can not do with a normal text editor.

General Purpose Application Software

Some of the application software are designed for general day to day applications and uses. Some of these popular general purpose application softwares are discussed below:

- **Word Processor:** Word Processor is general purpose application software that facilitates the creation of text documents with extensive formatting. The user can not only create a document and add lines into it but can also use different types of fonts of various sizes along with features like underlining or making

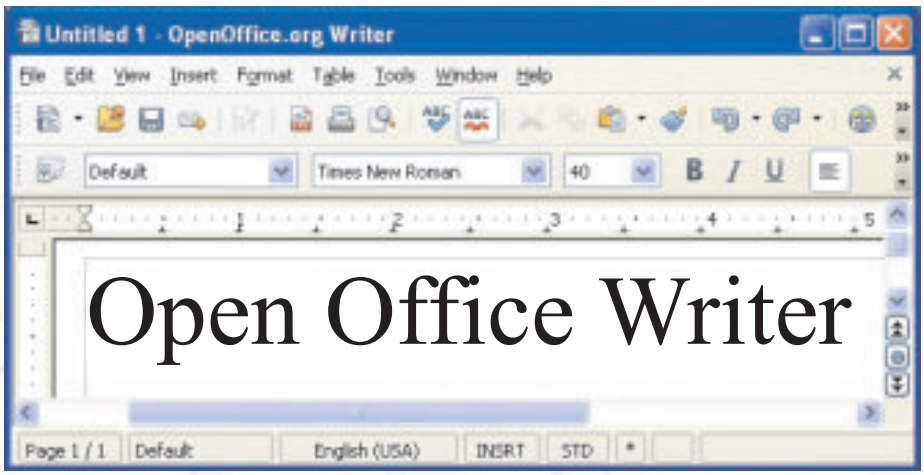


Figure 2.11 Open Office Word Processor (Writer)

a certain part of the text bold. One can also add clipart and other graphics into the document. Therefore we can use word processing software for various tasks from writing a simple document to designing special art effect. Preparing a common letter for different addressee (using mail merge feature),

writing stories, applications and designing posters (using clip art and graphics) are some of the common applications of a word processor. Popular examples of Word processing software are Microsoft Word and Writer (open office).

❖ **Presentation Tools:** Presentation Tool is general purpose application software that facilitates the creation of presentations on any particular topic like Uses of Internet, Global Warming, Social networking or any topic of social interest and importance. It allows one to not only create a presentation and add slides into that but also allows use of various formatting features like adding different types of background, different fonts, animations, audio, video, clipart and other graphics. Popular examples of Presentation tools are Microsoft Power Point and Impress (open office).

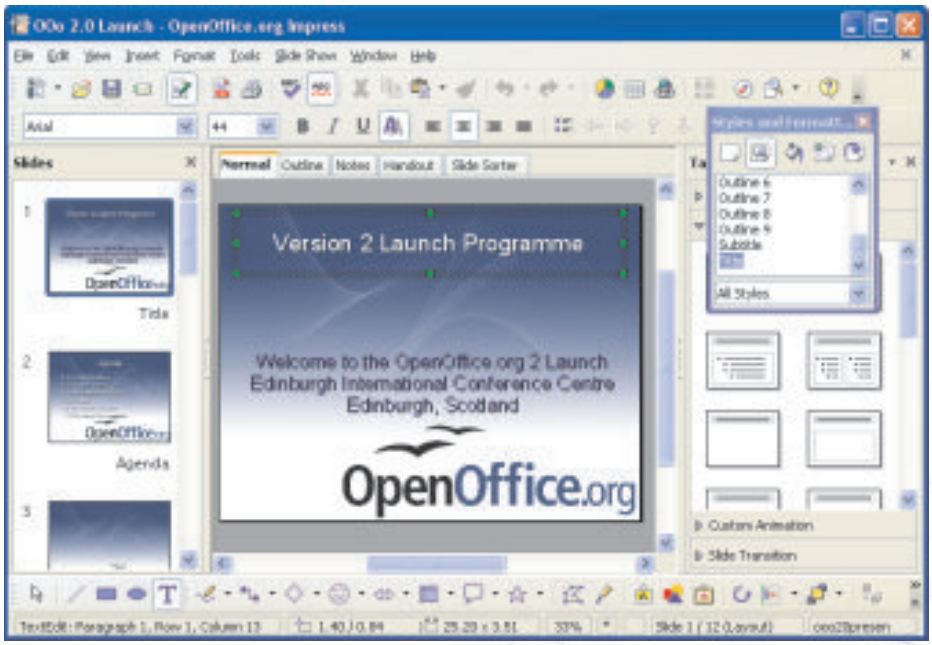


Figure 2.12 Open office Presentation Tool (Impress)

! Presentation tools can be used for various purposes. Since some presentation software also support linking between different slides, this software is used for information packages at the information kiosks.

❖ **Spreadsheet Tools:** Spreadsheet Tool is general purpose application software that facilitates creation of tabular forms where some text and numerical values can be stored. A spreadsheet tool not only allows one to create a

document and add data into it but also allows creation of different types of charts and graphs based upon the numerical data stored in a worksheet. Furthermore, all common mathematical and statistical formulae can be used on the stored numeric data and various text functions can be used on the text stored in the worksheet. Popular examples of Spreadsheet tools are Microsoft Excel and Calc (open office). A spreadsheet tool can be used by a class teacher to maintain the marks scored by different students. This will enable her to statistically analyze the performance of the students both individually and collectively. Similarly spreadsheet is used by almost all professionals to maintain and statistically analyze data.

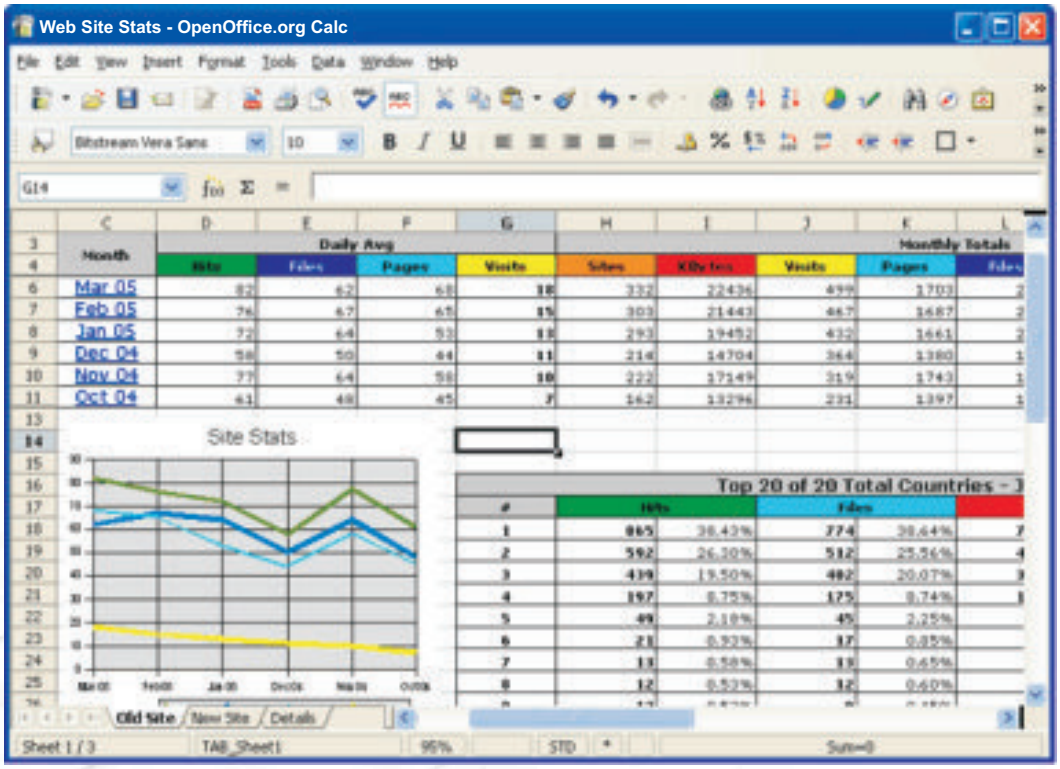


Figure 2.13 Open Office Spreadsheet Tool (Calc)

- **Database Management System:** Database Management System is general purpose application software that facilitates creation of computer programs that control the creation, maintenance, and the use of database for an organization and its end users. It allows the user to not only store data but also control the addition, deletion, management, and retrieval of data in a database. It also allows importing and exporting the data to many formats

including Excel, Outlook, ASCII, dBase, FoxPro, Oracle, SQL Server, ODBC, etc. Popular examples of Database Management System are Base (Open Office) and Microsoft Access .

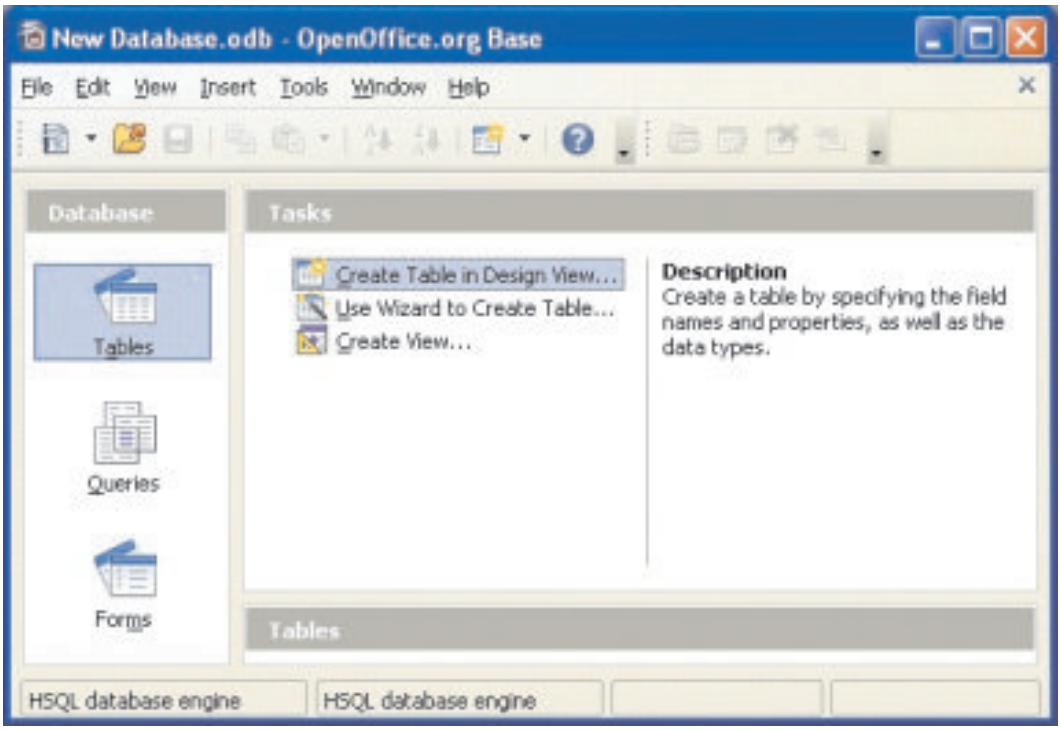


Figure 2.14 Open Office Database Management System (Base)

Specific Purpose Application Software

Some application software are made for performing specific tasks generally used by the institutions, corporate, business houses, etc. and such software come under the category of specific purpose application software. The usage of few specific purpose application software is explained below:

- **Inventory Management System & Purchasing System:** Inventory Management System is generally used in departmental stores or in an institution to keep the record of the stock of all the physical resources. For example, a school keeps record of the number of computers, printers, printing sheet, printer cartridge available in the school's computer department. Maintaining this kind of data also helps the administration to place purchase order when the current stocks of consumables like printing sheet or printer cartridge is less than the critical limit.

- **Payroll Management System:** Payroll Management System software is used by all modern organizations to encompass every employee of the organization who receives a regular wage or other compensation. All different payment methods are calculated by the payroll software and the appropriate paychecks are issued.
- **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 management, food and beverage management, catering and maintenance.
- **Reservation System:** Commonly seen at railway reservation offices, this software helps the concerned department to automatically check the availability of the seats or berths of any train for any particular date with incomparable speed. Now a days using the internet and this software one can book or reserve tickets of any train for any dates with in no time.
- **Report Card Generator:** This software is commonly used in schools by the examination department to prepare and generate the report card of students. It performs all possible mathematical calculations and checks whether a student can be promoted to the next class or not. It can also be used to calculate the class wise ranking of a student.

Developer tools

When a programmer starts the process of writing a program to develop software for any type of application, he/she requires a series of software developing tools like code editor, debugger and compiler. A platform where all these software developing tools are bundled into a package is known as Integrated Development Environment (IDE).

Integrated Development Environment

An Integrated Development Environment (IDE) is an application program that consists of all required software developing tools required for developing software as part of a single interface. It typically consists of the following tools:

- Source Code Editor
- Graphical User Interface (GUI) builder

- Compiler / Interpreter
- Debugger
- Build Automation tool

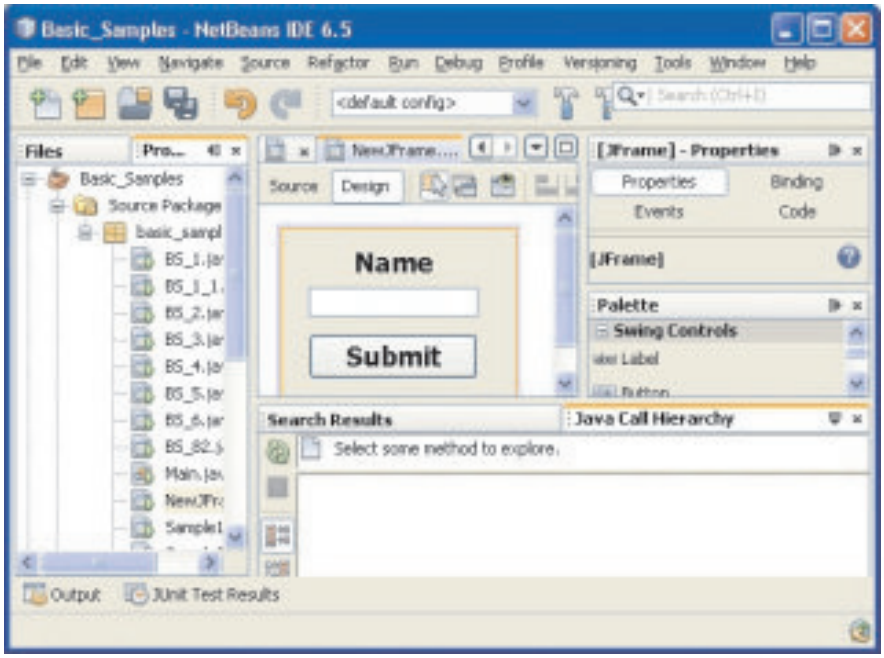


Figure 2.15 Netbeans IDE

To quickly recapitulate all that we have learnt in this lesson observe Figure 2.16 that depicts the relationship between hardware and the different types of software.

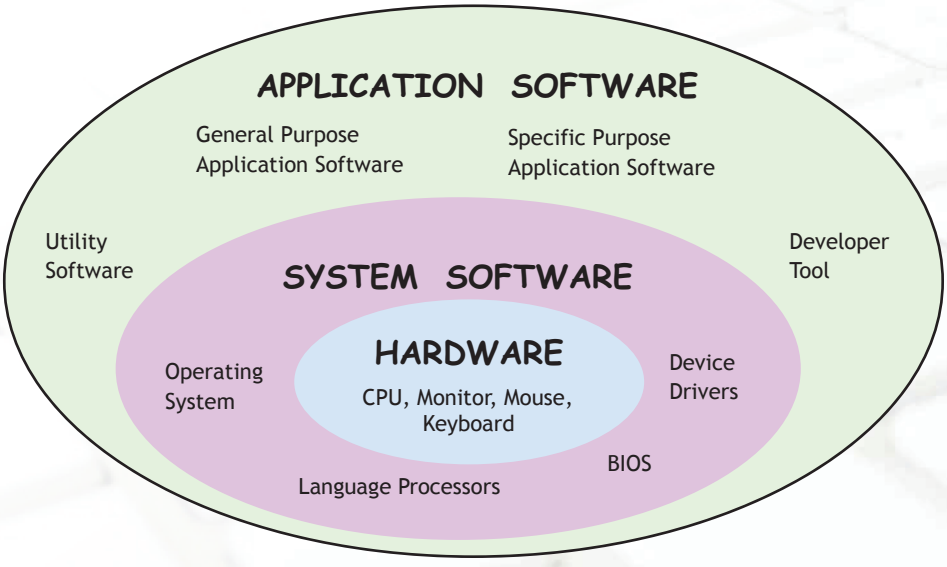


Figure 2.16 Relationship Between Hardware and Different Types of Software

Summary

- Software is a set of programs that governs the operation of a computer system and its related devices.
- Software can be broadly divided into two categories - System Software & Application Software.
- System Software controls all internal activities of a computer system and between all attached components of a computer system.
- BIOS-The basic input/output system is the built-in software that contains the code required to control the keyboard, monitor, disk drives, communications ports, and other functions independently of the computer operating system.
- Operating system is set of system programs that control and coordinate the operations of a computer system. It is the interface that acts like a bridge between a user and the hardware components of a computer.
- Major functions of an operating system are Device Manager, Memory Manager, Interface Manager, Program Manager, Task Manager, File Manager, Network Manager, Security Manager.
- Different Types of Operating system include Single User, Multi-user, Multiprocessing, Multitasking, Multithreading and Real time.
- A device driver is system software that acts like an interface between the Device and the user or the Operating System.
- Application software is a set of programs to carry out a specific task like word processor, spreadsheet, presentation tools, library management software, railway reservation etc.
- Utility Software are used to keep your computer system efficient and trouble free.
- Word processor is general purpose application software that facilitates creation and formatting of text documents.
- Presentation tools are general purpose application software that facilitate creation of presentations on any particular topic.

- Spreadsheet is general purpose application software that facilitates creation of worksheets that stores text and numerical data in tabular form. Performing basic statistical analysis including graphs is the main utility of this software.
- Debugging is the process of removing all errors from a program.
- An interpreter converts as well as executes a high level language program into machine language line by line.
- A compiler is a language processor which converts (or translates) the entire program written in high level language into machine language in one go.
- An Integrated Development Environment (IDE) is a platform or an application program that consists of all required software developing tools required for developing an application at one place. The various tools are arranged as separate windows integrated into one big environment.

Multiple Choice Questions

1. Interpreter converts a HLL program into machine language by converting and executing:

a) In one go

b) line by line

c) Group of Five lines

d) None of the above

2. Which of the following Operating System is suitable for handling more than one user at one time?

a) Multiprocessing OS

b) Multiuser OS

c) Multiprogram OS

d) Multiprogramming OS

3. Calculator is a

a) Package

b) Utility Software

c) Customized software

d) Developer Tool

4. A bit stands for

a) Boolean Digit

b) Binary Digit

c) Binary Decimal

d) Byte Digit

5. Which of the following is not an application software:

a) Word Processor

b) Anti Virus Program

c) Operating System

d) Railway Reservation System

6. Which of the following is not an utility software:

a) Text Editor

b) Anti Virus Program

c) Compression software

d) Railway Reservation System

7. Which of the following is not a component of Open Office:

a) Word

b) Impress

c) Calc

d) Writer

8. A program written in high level language is known as:

a) Source Program

b) Main Program

c) Object Program

d) Image Program

Exercises

1. What do you mean by a bit and a byte?
2. Define the term Software.
3. Explain the relationship between hardware and software with the help of a suitable example.
4. What are the main types of software? Explain with appropriate examples.
5. Define the term System Software.
6. What do you mean by BIOS?
7. Write down the four major functions of an operating system.
8. Differentiate between the following :
   a) Single user & Multiuser OS
   b) Compiler & Interpreter
9. Write short note :
   a) Utility Software b) Device Driver
10. Give any four examples, where you use word processing software.
11. What do you mean by presentation software?
12. What are the uses of Payroll Management System?
13. Explain different types of language processors.
14. Explain the different types of Operating System.
15. Define the term Application software.
16. Explain the term Integrated Development Environment.

Lab Exercises

1. Write an essay on "Role of ICT in Education" in a word processor with suitable formatting and save it.
2. Create a presentation on "Global Warming" with suitable custom animation and slide tranisitions.

3. Tariq Fashions maintains their employees' salary details in a spreadsheet as shown below. A sample data of 7 employees is shown below. Create the given spreadsheet and write formulas for the operations (i) to (iv).

	A	B	C	D	E	F
1	NAME	BASIC	HRA	DA	PF	NET SALARY
2	Surinder	50000	20000	___	600	___
3	Kanika	56000	20000	___	600	___
4	Aashish	35000	15000	___	400	___
5	Harjit	45000	15000	___	500	___
6	Abhijit	60000	25000	___	700	___
7	Jyoti	75000	30000	___	700	___
8	Amita	25000	10000	___	300	___
9	Maximum					___
10	No. of Emp					___

(i) To calculate the DA as 25 % of BASIC+HRA for each employee and display in column D.

(ii) To calculate the NETSALARY as BASIC+HRA+DA-PF for each employee and display in column F.

(iii) To find the maximum NETSALARY and display in cell F9.

(iv) To count the number of employees and display in cell B10.

4. Create two tables in a database using a database tool to store information about an actor. The first table should contain personal information about the actor and the second table should contain information about his movies.