
UNIT 2 COMPUTER HARDWARE, SOFTWARE AND PACKAGES

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2.1 INTRODUCTION

Modern computers are equipped with powerful hardware facilities driven by extensive software packages. Today computing speed is very high and it is capable of doing huge amount of work within seconds with proper accuracy. Nowadays computing and telecommunication both controls the whole universe with multiple manners. To access the state of art of computing, it is always better to review the historical milestones in the developments of computers. Nowadays the computer system plays such a vital role that no corporate or individual can survive without it by any means. Starting from the country's national security to any common issue, the use of the computer system is enormous.

In general, the computer accepts inputs, then processes it, and gives the output.

2.2 OBJECTIVES

After studying this unit, you will be able to:

- describe the evolution and development of computing;
- list hardware components of a computer;
- explain what is software and the different types of software; and
- discuss major problems faced by the management, namely software crisis.

2.3 EVOLUTION AND DEVELOPMENT OF COMPUTING

As far as hardware technology is concerned, the first generations (1945-1954) used vacuum tubes and relay memories interconnected by insulated wires. The second generation (1955-1964) was marked by the use of discrete transistors, diodes, and magnetic ferrite cores, interconnected by printed circuits. The third generation (1965-1974) was started with integrated circuits (ICs) for both logic and memory in small scale or medium scale integration (SSI or SMI) and multilayered printed circuits. The fourth generation (1974-1991) was started with large scale or very large scale integration (LSI or VLSI) having core memory replaced with semiconductor memory. High density and high-speed processors are used in the fifth generation (1991-Present) and memory chips based on even more improved VLSI technology are used. For example, 64-bit 3.0 GHz microprocessors are now available on a single chip. Random Access Memory (RAM) of more than 1024 MB is commonly available in the market now.

The First Generation: From architectural and software point of view, these were built with a single central processing unit (CPU) which performed serial fixed-point arithmetic using a program counter, branch instructions, and an accumulator. The CPU must be involved in all memory access and input/output (I/O) operations. Machine and assembly language were used in first generation computers.

The Electronic Numerical Integrator And Calculator (ENIAC), built at the school of the University of Pennsylvania in 1950, was the first model of the first generation Computers.

The Second Generation: In this era of computers, index registers, floating-point arithmetic, multiplexed memory, and I/O processors were introduced. High-level Languages (HLLs), such as Fortran, ALGOL, and Cobol were introduced along with compilers, subroutines and batch processing monitors. Irving Reed (1957) developed registers Transfer Language for systematic design of digital Computers. Example for the above system is IBM 7030 (the stretch computer) featuring instruction look ahead and error-correcting memories built in 1962.

The Third Generation: These were being started with microprogrammed control. Pipelining and cache memory were introduced to close up the speed gap between the CPU and main memory. The idea of multiprogramming was implemented to interleave CPU and I/O activities across multiple user programs. Example of the third generation system is IBM/360-370 series.

The Fourth Generation: Parallel computers in various architectures were started in this era, using shared or distributed memory or optional vector hardware. Multiprocessing OS, Special languages and compilers were developed for parallelism. Software tools and environments were created for parallel processing or distributed computing. During this period, the technology of parallel processing matured and entered the production mainstream. Example of fourth generation system is VAX 9000.

The Fifth Generation: The development in the fifth generation is still in progress. Here more importance is placed on massively parallel processing (MPP). Scalable

and latency to learnt architecture is being adopted in MPP system using VLSI silicon, GaAs technologies, high-density packaging and optical technologies.

2.4 HARDWARE COMPONENTS OF COMPUTERS

The electronics or mechanical parts of the computer are generally called hardware components. From a layman point of view, the common visibility hardware of computers are Central Processing Unit (CPU), Display Unit (Monitor), Input Unit (Keyboard), Pointing Device (mouse), Multimedia Unit (Sound, video and Game) and Output Unit (Printer). Apart from these, there are so many enhancing devices like pen drive (high capacity removable storage device, scanner (for scanning Photo etc), combo drive (for DVD play) which are easily available in market.

As our study is basically concerned with cyberspace (Internet related) only, so it is better to understand more about network and the Internet application hardware. These are the essential components, which are needed if somebody desires to work on the Internet:

- a) Autonomous computer,
- b) Modem or Lan Card,
- c) Connection from ISP,
- d) Normal phone line (If dial up connection), and
- e) Browsing software.

Nowadays broadband connection (speed is more than 256 KBPS) is available almost everywhere throughout India. So customers are generally attracted towards high speed Internet instead of dial-up access.

Though the Internet may run on Pentium-I machine having min 32 MB RAM, the following system configuration is highly desirable:

- A) Pentium 2.0 GHz (or more), cache 512, Intel Genuine Based Motherboard Chip set and Min FSB 512,
- B) At Least 128 MB RAM (or more) having 80 GB HDD (Hard disk Drive),
- C) Ideally 17" Color Monitor,
- D) Quality VGA card (min 32 MB) with better sound Quality, and
- E) Branded Modem or Ethernet Card.

Modem is the most important hardware when the need of the Internet arises. Let us analyse how modem works.

Modem stands for modulator/demodulator. It is the most popular type of Data Circuit-terminating Equipment (DCE).

Additionally, some other enhancing device like the web cam and microphone may also be used for better multimedia facilities.

Please answer the following Self Assessment Question.

Self Assessment Question 1

Spend 2 Min.

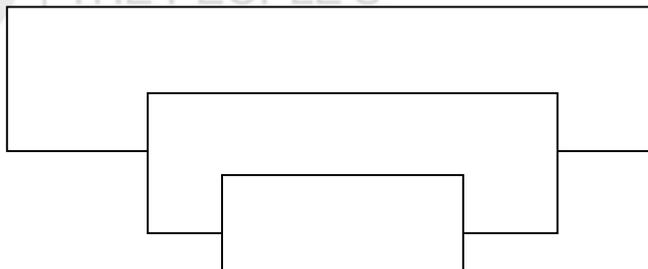
Fill in the blanks:

- i) The _____ part of the computer is called hardware components.
- ii) _____ is the most popular type of Data Circuit-Terminating Equipment (DCE).

2.5 WHAT IS SOFTWARE?

Software is a program, which controls hardware and user interface. It combines the user and hardware through common set of instructions of particular software. So, for starting a computer, an Operating System (OS) is needed first. An OS makes a computer prompt to understand what the human input coming in and what output needed there. As computer understands only binary code (means only 0 and 1), OS converts human code to binary code.

Software consists of computer programs, which are sequences of instructions for the computer. The process of writing (coding) programs is called programming and individuals who perform this task are called programmers. The computer is unable to do anything until it is instructed by software. Although computer hardware is, made for, general purpose, software enables the user to instruct a computer system to perform specific functions that provides commercial value to individual as well as corporate. There are two major types of software: system software and application software. The relationship between hardware, system software and application software is pictured here in figure.



The relationship between Hardware, System Software and Application Software.

2.5.1 Difference between System Software and Application Software

System Software is a set of instructions that serves primarily as an intermediary between computer hardware and application programs and also is directly manipulated by skilled users. System software provides important self-regulatory functions for computer systems, such as loading itself when the computer is first turned on, managing hardware resources such as secondary storage for all applications and providing commonly used sets of instructions for all applications to use. System programming is either the creation or maintenance of system software.

Application software is a set of computer instructions that provide more specific functionality to the user. That functionality may be broad, such as general Excel

Sheet or narrow such as a Stock Programming. An application program applies to a computer to a certain need. Application programming is either the creation or modification and improvement of application software. There are large numbers of application software available in the market today.

Finally, the basic difference between both of them is the application programs primarily manipulate data or test to produce or provide information where as system programs manipulate computer hardware resources.

Please answer the following Self Assessment Question.

Self Assessment Question 2

Spend 3 Min.

True or False:

- i) Software consists of computer programs, which are sequences of instructions for the computer. ()
- ii) The computer can do everything without any instructions by the software. ()
- iii) Application programs manipulate data or test to produce or provide information where as system programs manipulate computer hardware resources. ()

2.6 SYSTEM SOFTWARE: FUNCTIONAL CATEGORIES

Basically two major functional categories come under the system software:

System Control Programs

System Support programs

2.6.1 System Control Programs

System control programs control the use of the hardware, software and data resources of a computer system. The main system control program is the Operating System. The operating system provides the overall operations of the computer including monitoring the computer's status and scheduling operations, which includes the input and output process. In addition, the operating system allocates CPU time and main memory to programs running on the computer and it also provides an interface between the user and the hardware. Especially the operating system provides services that include process management, virtual memory, file management, security, fault tolerance and the user interface.

Process management involves managing the program or programs (jobs) running on the processor at a given time. In a desktop operating system, it loads a program into the main memory and executes it. The program utilizes the computer resources until it relinquishes control. Some operating systems offer more sophisticated forms of process management, such as multitasking, multithreading and multiprocessing.

The management of two or more tasks or programs, running on the computer system at the same time is called multitasking, or multiprogramming. The first program is

executed until any interruption occurs, such as request for input or with the priority defined by the batch process. While the input request is handled, the execution of second program begins. Multithreading is a form of multitasking that focuses on running multiple tasks within a single application at a time. When the parent process generates multiple child process on the same parent process ID is called threading. The idea of threading is to faster the application process with higher resource utilization. For example, a word processor application may edit one document while another document is being checked for spelling. Time-sharing is an extension of multiprogramming. In this mode, a number of users operate online with the same CPU, but each user uses a different input/output terminal. The programs of these users are placed into partitions in primary storage. Execution of these programs rotates among all users, occurring so rapidly that it appears to each user as though he or she were the only one using the computer.

Multiprocessing occurs when a computer system with two or more processors can run more than one program, or thread, at a given time by assigning them to different processors. Multiprocessing uses simultaneous processing with multiple CPUs, whereas multiprogramming involves concurrent processing with one CPU. The idea of multiprocessing is, all the processors will continue different jobs of the application program without interrupting or waiting for the other processor, to complete or release the resources, multiprocessing is highly recommended where application response time is critical like less than one millisecond.

Virtual memory simulates more main memory than what actually exists in the computer system. It allows a program to behave as if it had access to the full storage capacity of a computer, rather than just access to the amount of primary storage installed on the computer. Virtual memory divides an application program or module into fixed-length portions called pages. The system executes some pages of instructions while pulling others from the secondary storage. In effect, primary storage is extended into a secondary storage device, allowing users to write programs as if the primary storage were larger than it actually is. This enlarged capability boosts the speed of the computer and allows it to efficiently run programs with very large number of instructions. Virtual memory is not good for high memory intensive program. High memory intensive program requires higher memory space and memory access time, since the virtual memory is defined or secondary storage, to access the page of program or data again required some I/O operation or extra CPU and other resource cycle.

The operating system is responsible for resource management of the system like, file management, memory management or device management and security management up to some extent. The file management is to create and manages a directory structure that allows file to be created and retrieved by name, and it also responsible to manage the indexes for it is internal usages. It may control access to those files based on permissions and access controls. The operating system provides other forms of security as well. For example, it must typically provide protected memory and maintain access control on files in the file system. The operating system also must keep track of the users and their authority level as well as audit charges to security permissions.

Fault tolerance is the ability of a system to produce correct results and to continue to operate even in the presence of fault or errors. Fault tolerance can involve error-

correcting memory, redundant computer components and related software that protect the system from hardware, operating systems or user errors.

Although operating systems perform some of their functions automatically, for certain tasks, the user interacts directly with the computer through the system software. The ease or difficulty of such interaction is to a large extent determined by the interface design. Older text-based interfaces like Disk Operating System (DOS) needed typing in cryptic commands. In an effort to make computers user-friendlier, the Graphical User Interface (GUI) was developed.

The GUI allows users to have direct control of visible objects (such as icons) and actions that replace complex command syntax. The GUI was developed by researchers at Xerox Palo Alto Research Center (PARC) and then popularized by the Apple Macintosh computer. Microsoft soon introduced its GUI-based Windows operating system for IBM-style PCs. The next generation of GUI technology will improve features such as wireless communication, artificial intelligence, etc. The next step in the evolution of GUIs is social interfaces. A social interface is a user interface that guides the user through computer applications by using cartoonlike characters, graphics, animations and voice commands. The cartoonlike characters can be cast as puppets, narrators, guides, inhabitant's avatars (computer generated human like figures), or hosts.

Types of Operating System: If hardware is the skeleton and software is the body then operating system (O.S.) is the soul of the system. It manages all the hardware and gives operating environments, from which the user can communicate with the system, it allows system developers to create system applications or share the system resources by requesting the allowed operating system services and allow the application developers to develop the run user application from application environment. Operating system can directly and indirectly interact with user programs. Operating environments are not operating systems, but work only with an operating system. For example, the early versions of Windows were operating environments that provided a graphical user interface and worked only with MS-DOS.

Operating system can be categorised by the number of users they support as well as by their level of sophistication. OS, for mobile devices, are designed to support a single person using a mobile, handheld device, or information appliance. Desktop operating systems are designed to support a single user or a small workgroup of users. Departmental server OSs generally support thousands of simultaneous users and millions or billions of simultaneous transactions. Super computer operating system supports the particular processing needs of a supercomputer.

Supercomputer and enterprise server operating system offer the greatest functionality, followed by departmental server operating systems, desktop operating systems and finally mobile device operating systems. An important exception is that the user interface, which is most sophisticated on desktop operating system is least sophisticated on supercomputer and enterprise server operating systems.

Mobile device operating systems are Embedded Linux, Windows CE 32 bit, Pocket PC, Windows Embedded NT 4.0 32 bit, and Palm Operating System.

Desktop and notebook computer operating system: The Windows family is the leading series of desktop operating system. The MS-DOS (Microsoft Disk

Operating System) was one of the original operating systems for the IBM PC and its clones. This 16-bit operating system, with its text-based interface, has now been almost totally replaced by GUI operating system such as Windows 2000 and XP. Windows 1.0 through 3.1 were not operating system, but were operating environments that provided the GUI that operated with and extended the capabilities of MS-DOS.

Windows 95, released in 1995, was the first version of a series of products in the Windows operating system that provided a streamlined GUI by using icons to provide instant access to common tasks. It is a 32 bit processing that features multitasking, multithreading, networking, etc. It also offers plug-and-play capabilities, which is a feature that can automate the installation of the new hardware by enabling the operating system to recognise the new hardware and install the needed software (called device drivers) automatically.

Subsequent products in the Microsoft Windows Operating System are:

Windows 98, Windows Millennium Edition, Windows NT, Windows 2000, Windows XP, Windows 2003 and Windows 2005.

UNIX provides many desktop features including multiprocessing and multitasking. It is more secured than desktop operating system so, big commercial organizations use the UNIX servers. Linux is a powerful version of the UNIX that is totally free of charge. Nowadays, various organizations use Linux as most windows version are being pirated in the market.

2.6.2 System Support Programs

The second major category of systems software, system support program, supports the operations, management, and users of a computer system by providing a variety of support services. Examples of system support programs are system utility programs, performance monitors, and security monitors.

System utilities are the programs that have been written to accomplish common tasks such as sorting records and checking the integrity of diskettes and creating directories and subdirectories. They also restore accidentally erased files, locate files within the directory structure, manage memory usage, and redirect the output.

System performance monitors are programs that monitor the processing of jobs on a computer system. They monitor computer system performance and produce reports containing detailed statistics relating to the use of system resources such as processor time, memory space, and application program. These reports are used to plan and control the efficient use of the computer system resources and to help troubleshoot the system in case of problems.

System security monitors are programs that monitor the use of a computer system to protect it and its resources from unauthorized use, fraud or destruction. Such programs provide the computer security needed to allow only authorized users access to the system. Security monitor also controls the use of the hardware, software and data resources of a computer system.

Please answer the following Self Assessment Question.

Self Assessment Question 3

Spend 3 Min.

What do you mean by software? How many types of software are there?

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2.7 SOFTWARE CRISIS

At present, software comprises a much larger percentage of the cost of modern computer system than it was earlier. There are so many grounds for this trend. First, the price of the hardware has dramatically reduced, while the performance of hardware has exponentially increased. Second, building applications—a process called software development—is slow, complex and error-prone. Software is, therefore, expensive and getting more so as its complexity grows. Thirdly, salaries of software developers are steadily increasing because there is an increased demand for their skills.

The above factors have led to major problems for the management, called Software Crisis. The software crisis arises when the organizations are not able to develop new software applications fast enough to keep up with rapidly changing business conditions and the rapidly evolving technologies. Computer hardware can be designed and manufactured on automated assembly lines and so can be turned out quickly but, software must be engineered by hand. Therefore, software generally lags several generations behind hardware. The result is that the organizations are unable to make full use of hardware due to a lack of software to effectively exploit the hardware.

The increasing complexities of software exacerbate the software crises. This complexity naturally leads to the increased potential for error or bugs. Large applications today may contain millions of lines of computer code, written by hundreds of people over the course of several years. So the potential for errors is huge and testing and debugging software is expensive and time-consuming.

2.8 APPLICATION SOFTWARE OR PACKAGES

Application software consists of an instruction that directs a computer system to perform specific information processing activities and that provides functionality for users. As there are so many different users for the computers, there are correspondingly large numbers of different application softwares available. A controversial set of software applications involves surveillance.

Application software includes a proprietary software and off-the-shelf application software. Proprietary software addresses a specific business need for an organization. This type of software may be developed in-house by the organization's IT experts or it may be commissioned from a software vendor. Such specific software programs developed for a particular company by a vendor is called Contract Software.

Alternatively, off-the-shelf application software can be purchased, leased or rented from a vendor that develops programs and sells them to many organizations. It may be a standard package or it may be customizable.

Personal applications software is designed to help the individual users to increase their productivity. Some of them are highlighted below:

Spreadsheet: This software transforms a computer screen into a ledger sheet, or grid, of coded rows and columns. Users can enter numeric or textual data into each grid (cell). In addition, formula can be entered into a cell to obtain a calculated answer displayed in those cells location. It is very useful for financial transaction such as income statements or cash flow analysis.

Data Management: It supports the storage, retrieval and manipulation of related data. DBMS and RDBMS are most popular in this regard.

Word Processing: It allows the user to manipulate the text rather than just numbers. Modern word processors contain many productive writing and editing features. MS Word is popular in this regard.

Desktop Publishing: It allows microcomputers to perform photographs, pictures and other images combined with text, to produce a readymade document.

Graphics: It allows the user to create, store and display or print charts, graphs and maps and drawings. There are basically three categories of graphics software packages: presentation graphics, analysis graphics and computer aided-design software. Example of this software is PhotoShop and CorelDraw, etc.

Multimedia: It combines at least two media for input or output of data. These media include audio, voice, animation, video, text, graphics, and images.

Communications: To exchange information between networked computers, computers utilize communication software. E-mail and video conferencing rely on communication software.

Speech-Recognition Software: Two categories of this are available today: discrete speech and continuous speech. Many firms and people use speech-recognition software when use of a mouse and a keyboard is impractical.

GroupWare: It is a class of software that facilities communication coordination and collaboration among people. It is useful because it allows the workgroups to communicate and share information even when they are working together at a distance. The most elaborate system, IBM's Lotus Notes/Domino, is a document management system, a distributed client/server database, and a basic for Intranet and electronic commerce system as well as a communication support tool.

So the importance of software in the computer system has brought new issues to the forefront for the organizational managers. These issues include software evaluation and selection, software testing, software upgradations, open systems, and open source software.

Please answer the following Self Assessment Question.

Self Assessment Question 4

Spend 3 Min.

Write about the different types of application software

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Let us now summarize the points covered in this unit.

2.9 SUMMARY

- Computer accepts Inputs, then processes the inputs and finally produces the output.
- The VLSI technology is the latest technology used in the modern computers.
- The electronic and mechanical parts of a computer are generally called Hardware components of the system.
- A computer system consists of a CPU, monitor, keyboard, mouse and multimedia the device.
- For simple Internet connection, an autonomous computer with modem or LAN card, an Internet account or broadband connection and browsing software are must.
 - Broadband connection means an Internet connection with speed more than 256 KBPS without interruption.
 - Modem stands for modulator /demodulator. It is the most popular type of Data Circuit Termination Equipment.
 - Software is a program, which controls the hardware and the user interface.
 - System Software is a set of instructions that serves primarily as an intermediary between computer hardware and application program.
 - Application software is a set of instructions that provides more functionality to the user.
 - Software crisis are the unbalanced situation between changing hardware and software version.

2.10 TERMINAL QUESTIONS

- 1) How computer was developed? Write about its generation-wise progress.
- 2) What do you mean by Software crisis? How can it be managed?

3. What are DBMS and RDBMS? Do you think there is any difference between these two?
4. Define system software. Discuss its functional categories.

2.11 ANSWERS AND HINTS

Self Assessment Questions

- 1) (i) electronics or mechanical (ii) Modem
- 2) (i) True, (ii) False (iii) True
- 3) Software is a program, which controls the hardware and user interface. There are two types of software: System Software and Application Software.
- 4) Application software includes proprietary software and off-the-shelf application software. Proprietary software addresses a specific business need for an organization. This type of a software may be developed in-house by the organization's IT experts or it may be commissioned from a software vendor. Such specific software programs developed for a particular company by a vendor is called Contract Software. Alternatively, off-the-shelf application software can be purchased, leased or rented from a vendor that develops programs and sells them to many organizations. It may be a standard package or it may be customizable.

Terminal Questions

- 1) Refer section 2.3 of the unit.
- 2) Refer section 2.7 of the unit.
- 3) Refer section 2.8 of the unit.
- 4) Refer section 2.6 of the unit.

2.12 REFERENCES AND SUGGESTED READINGS

1. Kai Hwang. Advanced Computer Architecture. Singapore: McGraw-Hill International Edition, 1993.
2. Turban, Rainer and Potter. Introduction to Information Technology. 2nd ed. John Wiley & Sons, INC 2003, 2004.