Introduction to Computer System

1. Introduction

A **computer** is an electronic device that can be programmed to accept input (data), stores or process it to generate output result (information).

A computer along with additional hardware and software together is called a **computer system**. A computer system primarily comprises a central processing unit (CPU), memory, input/output devices and storage devices. All these components function together as a single unit to deliver the desired output.

A computer system comes in various forms and sizes. It can vary from a high-end server to personal desktop, laptop, tablet computer, or a smartphone. Figure 1.1 shows the block diagram of a computer system. The directed lines represent the flow of data and signal between the components.

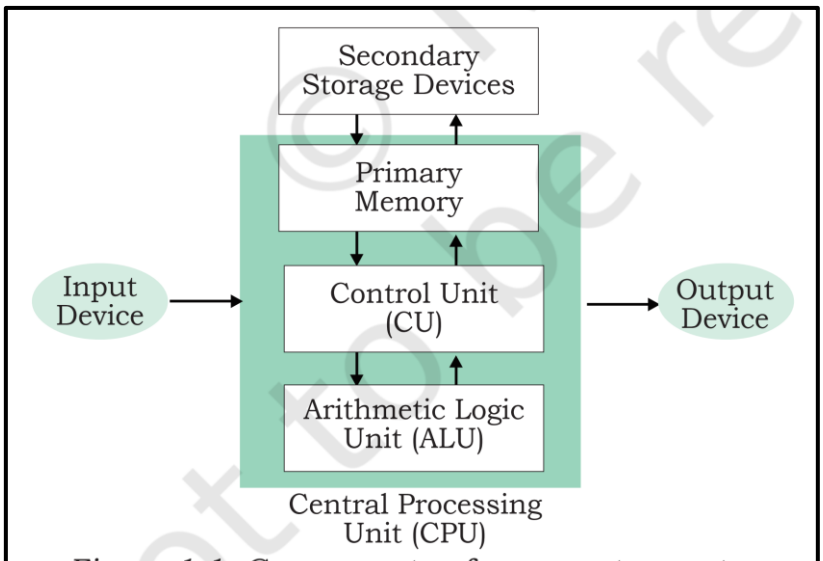

Figure 1.1: Components of a computer system

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2. Components of Computer System

1. **Computer hardware** - are physical parts of a computer. e.g. Input devices, output devices, central processing unit, and storage devices.
2. **Computer software** - also known as programs or applications. They are classified into two classes namely - system software and application software
3. **Live-ware** - is the computer user. Also, known as human-ware. The user commands the computer system to execute on instructions.

3. Functionalities of a computer

The four basic functions of a computer system are as follows:

1. Input
2. Storage
3. Process
4. Output

Let's look at each individually:

Input:

The devices through which control signals are sent to a computer are termed as input devices. These devices convert the input data into a digital form that is acceptable by the computer system. Some examples of input devices include keyboard, mouse, scanner and touch screen, etc., as shown in Figure 1.2 (a).

Output:

The device that receives data from a computer system for display, physical production, etc., is called output device. It converts digital information into human understandable form. For example, monitor, projector, headphone, speaker, printer, etc. Some output devices are shown in Figure 1.2 (b).

Processing:

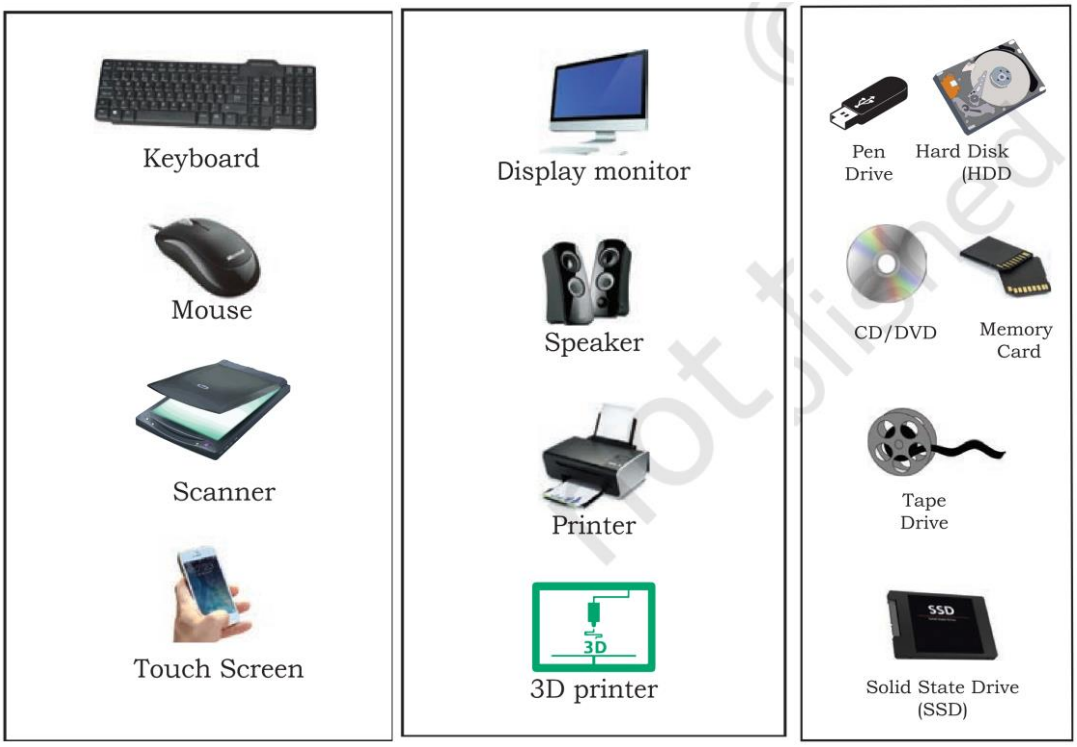
This is where the computer actually does the 'work' - manipulating and controlling data over the entire system.

Storage:

Most computers are able to store data both temporarily (in order to process), but also long-term (i.e., permanently). Storage takes place on hard drives or external storage devices, as shown in Figure 1.2 (c).

Any digital computer carries out the following five functions:

1. Takes data as input.
2. Stores the data/instructions in its memory and uses them as required.
3. Processes the data and converts it into useful information.
4. Generates the output.
5. Controls all the above four steps.



(a) (b) (c)

Figure 1.2 (a) input devices, (b) output devices and (c) storage devices

4. Computer Generations:

- **First-generation:**

  Thermionic vacuum tubes. Mid-1940s. IBM pioneered the arrangement of vacuum tubes in pluggable modules. The IBM 650 was a first generation computer.

- **Second-generation:**

  Transistors. 1956. The era of miniaturization begins. Transistors are much smaller than vacuum tubes, draw less power, and generate less heat. Discrete transistors are soldered to circuit boards, with interconnections accomplished by stencil-screened conductive patterns on the reverse side. The IBM 7090 was a second-generation computer.

- **Third-generation:**

  Integrated circuits (silicon chips containing multiple transistors). 1964. A pioneering example is the ACPX module used in the IBM 360/91, which, by stacking layers of silicon over a ceramic substrate, accommodated over 20 transistors per chip; the chips could be packed together onto a circuit board to achieve unheard-of logic densities. The IBM 360/91 was a hybrid second- and third-generation computer.

- **Fourth-generation:**

  The period of fourth-generation was from 1971-1980. Computers of fourth-generation used Very Large Scale Integrated (VLSI) circuits. VLSI circuits having about 5000 transistors and other circuit elements with their associated circuits on a single chip made it possible to have microcomputers of fourth generation. Fourth-generation computers became more powerful, compact, reliable, and affordable. As a result, it gave rise to Personal-

Computer (PC) revolution. In this generation, time sharing, real-time networks, distributed operating system were used. All the high-level languages like C, C++, DBASE, etc., were used in this generation.

❖ **Fifth-Generation Computer Systems (FGCS):**

It was an initiative by Japan's Ministry of International Trade and Industry (MITI), begun in 1982, to create computers using massively parallel computing and logic programming. It aimed to create an "epoch-making computer" with super-computer-like performance and to provide a platform for future developments in artificial intelligence.

The term "Fifth generation" was intended to convey the system as being a leap beyond existing machines. Whereas previous computer generations had focused on increasing the number of logic elements in a single CPU, the fifth generation, it was widely believed at the time, would instead turn to massive numbers of CPUs for added performance.

The project was to create the computer over a ten-year period, after which it was considered ended and investment in a new "sixth-generation" project would begin. Opinions about its outcome are divided: either it was a failure, or it was ahead of its time.

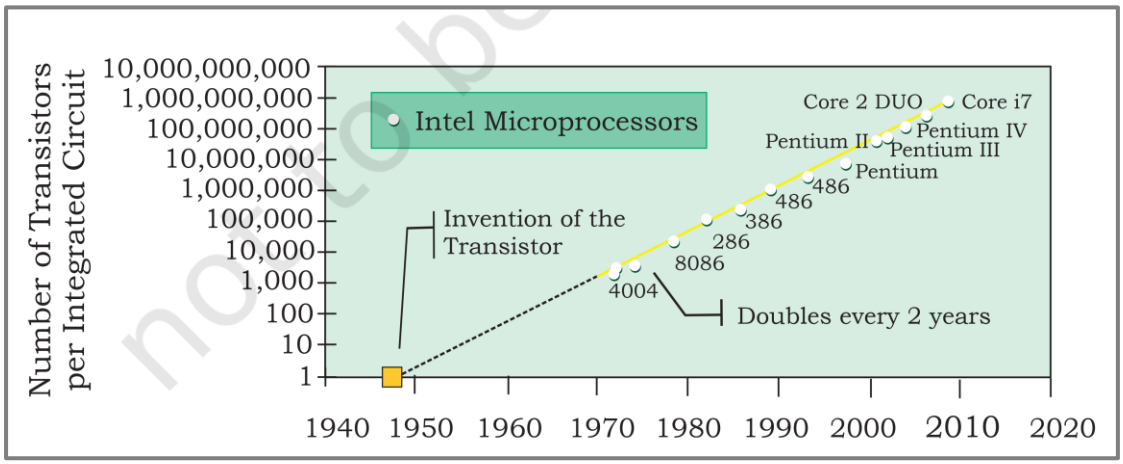
In general, Generation in computer terminology is a change in technology a computer is/was being used. Initially, the generation term was used to distinguish between varying hardware technologies. Nowadays, generation includes both hardware and software, which together make up an entire computer system.

There are five computer generations known till date. Each generation has been discussed in detail along with it’s time period and characteristics. In the following table, approximate dates against each generation has been mentioned, which are normally accepted.

Table 1 explains computer generations, the technology used and the time period of each generation.

Table 1: provides a summary of the main five generations of computers

Generation	Technology	Time period
First generation	Vacuum tube based	1946-1959
Second generation	Transistor based	1959-1965
Third generation	Integrated Circuit (IC) based	1965-1971
Fourth generation	Very Large Scale Integrated (VLSI) Circuit based	1971-1980
Fifth generation	Ultra Large Scale Integrated (ULSI) Circuit based	1980-onwards



5. Generations of Programming Languages

There was also a parallel set of generations for software:

❖ **First Generation Languages:**

These are low-level programming languages such as machine language.

❖ **Second Generation Languages:**

These are low-level programming languages such as assembly languages used in kernels and hardware drives.

- **Third Generation Languages:**

  These are high-level programming languages such as C, C++, Java, Visual Basic, and JavaScript.

- **Fourth Generation Languages:**

  These are high-level programming languages that consist of statements that are similar to statements in the human language, (such as object-oriented languages). These are used mainly in database programming and scripting. Examples of these languages include Perl, Python, Ruby, SQL, MatLab (Matrix Laboratory).

- **Fifth Generation Languages:**

  These are high-level programming languages that have visual tools to develop a program, (they have a logical interface). Examples of fifth generation language include Mercury, OPS5, and Prolog.

The first two generations are called low-level languages, while the next three generations are called high-level languages.