



Basics of Computers

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About the Tutorial

A **computer** is an electronic device that receives input, stores or processes the input as per user instructions and provides output in desired format. Computers have become an integral part of our lives because they can accomplish easy tasks repeatedly without getting bored and complex ones repeatedly without committing errors.

In this tutorial we will discuss in detail about the different parts of computer that enable it to carry out tasks efficiently and correctly. We will also discuss about **microprocessors**, the brain of computers, which actually do all the assigned tasks.

Audience

This tutorial is designed for anyone who wants to understand the basic concepts of what a computer is and how it functions.

Prerequisites

There are no prerequisites for this course except a desire to learn about how a computer works. Having worked on a computer would be an added advantage in completing the tutorial.

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1. Introduction to Computers

Being a modern-day kid you must have used, seen, or read about computers. This is because they are an integral part of our everyday existence. Be it school, banks, shops, railway stations, hospital or your own home, computers are present everywhere, making our work easier and faster for us. As they are such integral parts of our lives, we must know what they are and how they function. Let us start with defining the term computer formally.

The literal meaning of computer is a device that can calculate. However, modern computers can do a lot more than calculate. **Computer** is an electronic device that receives input, stores or processes the input as per user instructions and provides output in desired format.

Input – Process – Output Model

Computer input is called **data** and the output obtained after processing it, based on user's instructions is called **information**. Raw facts and figures which can be processed using arithmetic and logical operations to obtain information are called **data**.

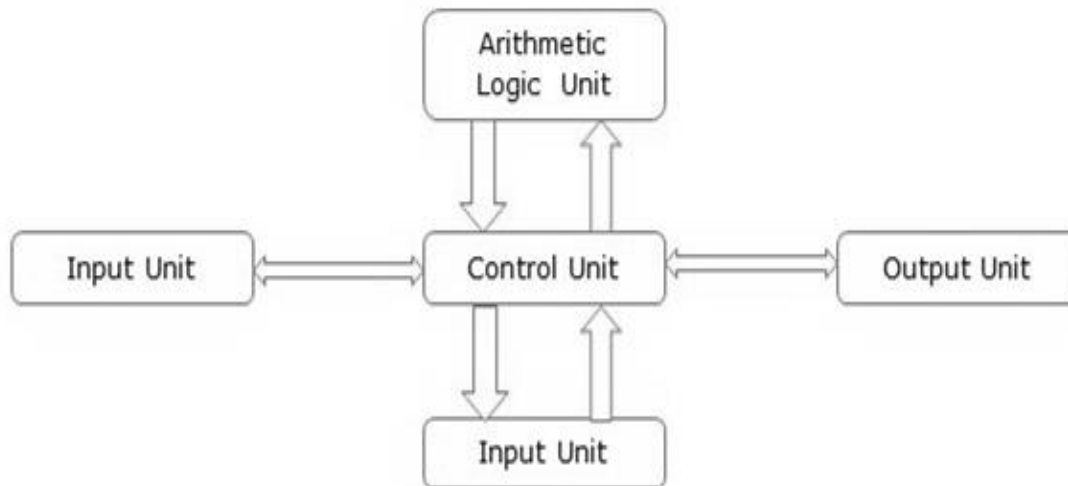


Simplest Workflow of Computer

The processes that can be applied to data are of two types:

- **Arithmetic operations:** Examples include calculations like addition, subtraction, differentials, square root, etc.
- **Logical operations:** Examples include comparison operations like greater than, less than, equal to, opposite, etc.

The corresponding figure for an actual computer looks something like this:



The basic parts of a computer are as follows:

- **Input Unit:** Devices like keyboard and mouse that are used to input data and instructions to the computer are called input unit.
- **Output Unit:** Devices like printer and visual display unit that are used to provide information to the user in desired format are called output unit.
- **Control Unit:** As the name suggests, this unit controls all the functions of the computer. All devices or parts of computer interact through the control unit.
- **Arithmetic Logic Unit:** This is the brain of the computer where all arithmetic operations and logical operations take place.
- **Memory:** All input data, instructions and data interim to the processes are stored in the memory. Memory is of two types – **primary memory** and **secondary memory**. Primary memory resides within the CPU whereas secondary memory is external to it.

Control unit, arithmetic logic unit and memory are together called the **central processing unit** or **CPU**. Computer devices like keyboard, mouse, printer, etc. that we can see and touch are the **hardware** components of a computer. The set of instructions or programs that make the computer function using these hardware parts are called **software**. We cannot see or touch software. Both hardware and software are necessary for working of a computer.

Characteristics of Computer

To understand why computers are such an important part of our lives, let us look at some of its characteristics:

- **Speed:** Typically, a computer can carry out 3-4 million instructions per second.
- **Accuracy:** Computers exhibit a very high degree of accuracy. Errors that may occur are usually due to inaccurate data, wrong instructions or bug in chips – all human errors.
- **Reliability:** Computers can carry out same type of work repeatedly without throwing up errors due to tiredness or boredom, which are very common among humans.
- **Versatility:** Computers can carry out a wide range of work from data entry and ticket booking to complex mathematical calculations and continuous astronomical observations. If you can input the necessary data with correct instructions, computer will do the processing.
- **Storage Capacity:** Computers can store a very large amount of data at a fraction of cost of traditional storage of files. Also, data is safe from normal wear and tear associated with paper.

Advantages of Using Computer

Now that we know the characteristics of computers, we can see the advantages that computers offer:

- Computers can do the same task repetitively with same accuracy.
- Computers do not get tired or bored.
- Computers can take up routine tasks while releasing human resource for more intelligent functions.

Disadvantages of Using Computer

Despite so many advantages, computers have some disadvantages of their own:

- Computers have no intelligence; they follow the instructions blindly without considering the outcome.
- Regular electric supply is necessary to make computers work, which could prove difficult everywhere especially in developing nations.

Booting

Starting a computer or a computer-embedded device is called **booting**. Booting takes place in two steps:

- Switching on power supply
- Loading operating system into computer's main memory
- Keeping all applications in a state of readiness in case needed by the user

The first program or set of instructions that run when the computer is switched on is called **BIOS** or **Basic Input Output System**. BIOS is a **firmware**, i.e. a piece of software permanently programmed into the hardware.

If a system is already running but needs to be restarted, it is called **rebooting**. Rebooting may be required if a software or hardware has been installed or system is unusually slow.

There are two types of booting:

- **Cold Booting**: When the system is started by switching on the power supply it is called cold booting. The next step in cold booting is loading of BIOS.
- **Warm Booting**: When the system is already running and needs to be restarted or rebooted, it is called warm booting. Warm booting is faster than cold booting because BIOS is not reloaded.

2. Classification of Computers

Historically computers were classified according to processor types because development in processor and processing speeds were the developmental benchmarks. Earliest computers used vacuum tubes for processing, were huge and broke down frequently. However, as vacuum tubes were replaced by transistors and then chips, their size decreased and processing speeds increased manifold.

All modern computers and computing devices use microprocessors whose speeds and storage capacities are skyrocketing day by day. The developmental benchmark for computers is now their size. Computers are now classified on the basis of their use or size:

- Desktop
- Laptop
- Tablet
- Server
- Mainframe
- Supercomputer

Let us look at all these types of computers in detail.

Desktop

Desktop computers are **personal computers (PCs)** designed for use by an individual at a fixed location. IBM was the first computer to introduce and popularize use of desktops. A desktop unit typically has a CPU (Central Processing Unit), monitor, keyboard and mouse. Introduction of desktops popularized use of computers among common people as it was compact and affordable.



Riding on the wave of desktop's popularity many software and hardware devices were developed specially for the home or office user. The foremost design consideration here was user friendliness.

Laptop

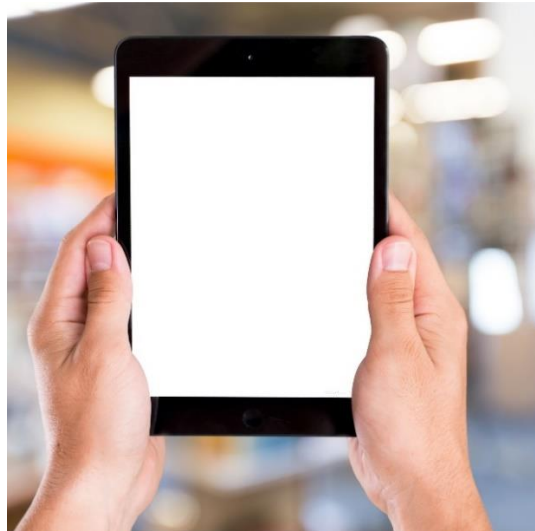
Despite its huge popularity, desktops gave way to a more compact and portable personal computer called **laptop** in 2000s. Laptops are also called **notebook computers** or simply **notebooks**. Laptops run using batteries and connect to networks using Wi-Fi (Wireless Fidelity) chips. They also have chips for energy efficiency so that they can conserve power whenever possible and have a longer life.



Modern laptops have enough processing power and storage capacity to be used for all office work, website designing, software development and even audio/video editing.

Tablet

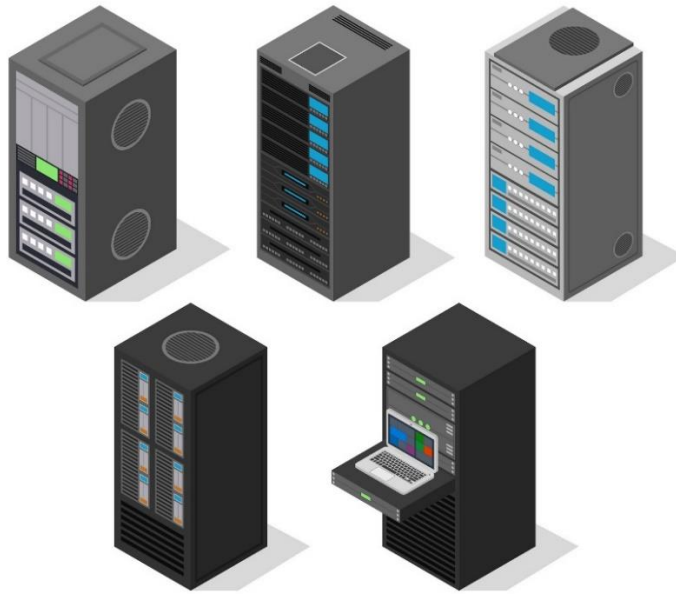
After laptops computers were further miniaturized to develop machines that have processing power of a desktop but are small enough to be held in one's palm. Tablets have touch sensitive screen of typically 5 to 10 inches where one finger is used to touch icons and invoke applications.



Keyboard is also displayed virtually whenever required and used with touch strokes. Applications that run on tablets are called **apps**. They use operating systems by Microsoft (Windows 8 and later versions) or Google (Android). Apple computers have developed their own tablet called **iPad** which uses a proprietary OS called **iOS**.

Server

Servers are computers with high processing speeds that provide one or more services to other systems on the **network**. They may or may not have screens attached to them. A group of computers or digital devices connected together to share resources is called a **network**.



Servers have high processing powers and can handle multiple requests simultaneously. Most commonly found servers on networks include:

- File or storage server
- Game server
- Application server
- Database server
- Mail server
- Print server

Mainframe

Mainframes are computers used by organizations like banks, airlines and railways to handle millions and trillions of online transactions per second. Important features of mainframes are:

- Big in size
- Hundreds times faster than servers, typically hundred megabytes per second
- Very expensive
- Use proprietary OS provided by the manufacturers
- In-built hardware, software and firmware security features

Supercomputer

Supercomputers are the fastest computers on Earth. They are used for carrying out complex, fast and time intensive calculations for scientific and engineering applications. Supercomputer speed or performance is measured in teraflops, i.e. 10^{12} floating point operations per second.



Chinese supercomputer **Sunway TaihuLight** is the world's fastest supercomputer with a rating of 93 petaflops per second, i.e. 93 quadrillion floating point operations per second.

Most common uses of supercomputers include:

- Molecular mapping and research
- Weather forecasting
- Environmental research
- Oil and gas exploration

3. Software Concepts

As you know, the hardware devices need user instructions to function. A set of instructions that achieve a single outcome are called program or procedure. Many programs functioning together to do a task make a **software**.

For example, a word-processing software enables the user to create, edit and save documents. A web browser enables the user to view and share web pages and multimedia files. There are two categories of software:

- System software
- Application software
- Utility software

Let us discuss them in detail.

End of ebook preview

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