

An Overview of Computer System

Introduction to Software Engineering and
Computing

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- What is Computing
- Definition and characteristics of computer
- Limitations of computers
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What is computing?

- The activity of using **computers or computer software** in order to do a task
- Any activity that uses computers to **manage, process, and communicate information** that includes development of both hardware and software.
- Software Engineering is one of the major discipline of computing

Definition and Characteristics of Computer

What is Computer?

Computer

- The word computer is derived from the word **compute**. Compute means to **calculate**. The computer was originally defined as a **super fast calculator**.
- An electronic device that perform **diverse operation** with the help of predefined instruction called a **program** to process the information in order to archive desired results.
- It is an electronic device, operating under the **control of instructions stored** in its own memory that can accept data (**input**) from user, **process** the data according to **specified rules**, produce information (**output**), and **store** the information for future use.

- **Functionalities of Computer- Steps**
 - Accepts input/data
 - Process data and convert it into useful information
 - Produces output
 - Stores data/instructions in its memory and use them when required

Characteristics of Computer

- Both computers and humans can do tasks such as:
 - Compute numbers
 - Sort large number of lists
 - Search items from a list etc
- What makes the computer special are the following basic characteristics

a. Speed

- Speed of computers refers to the amount of time it takes to carryout a basic operation
 - In the order of micro, nano and pico seconds

b. **Storage**

- Fast and efficient
- Efficient because it can store large amount of information within a limited space
 - In a very organized manner
- Fast because it can access the stored information in a fraction of a second

c. **Accuracy**

- Unless there is an error in the input data or in the instruction used to process data computers perform tasks with a highest possible accuracy
 - Consistent accuracy
- GIGO (Garbage In Garbage Out)

d. **Automatic**

- Once necessary **data** and **instruction** is feed to the computer, it can perform the task without human intervention

e. **Diligence**

- Computers do not get tired, get bored, loss concentration
- Can work for hours, or days ...
- Makes them suitable for routine type of work

f. **Versatility**

- Capacity to perform completely different type of work.
 - As an **accountant**, **secretary** ...

Limitations of Computer

1. No IQ

- Cannot think, Need to be instructed by users
- Cannot take its own decision

2. Not self directing

- Computers are not self-directing & independent machines.
 - Precise instructions are needed even for the simplest action.
 - However, once put in operation they hardly ever fail

3. **No Feeling/Sympathy**

- Does not distinguish between what is wrong and what is right

4. **No Accountability**

- Do not take responsibility to what they do

5. **No working through trial and error**

- Do not learn by experience

6. **No Interpretation**

- Do not know the interpretations of actions they take
- Do what they are fed to do
 - 1 and one are different for computers

In **general terms** computers can use for the following purposes:-

- To make the **work easy**.
- To do the **work efficiently** (Efficiency).
- To **improve the quality** of the result of work (Quality).
- To assist the **work** (Assistance).
- To finish the **task faster** (Speed).

Types of Computer

- There are different types of computers.
- The classification depends on different characteristics of computers such as:
 - Purpose or Functionality
 - Type of data handled
 - Physical size, price, capacity, performance and processing power of computers.

According to Purpose or Function

1. Specific Purpose

- Designed to perform a **single specific task**.
- They have set of instructions permanently programmed (pre-programmed instructions) into them that are designed to perform **only one major function**.
- Often used as **training** simulator.

Examples: The public telephone box, Traffic control system, Ticket machines (used in grocery, super market etc.), ATM, Washing Machine etc...

2. General Purpose Computers

- Designed to **handle variety** of tasks.
- Programmed to do many different kinds of tasks, rather than one that is **limited by design** to a specific task.
- More **flexible, versatile** and **store large amount of data**
- Can have software installed for many different uses.

Example: Desktop computer, Laptop Computer, Smart phones

According to Type of Data Handled

1. Analog Computers

- Recognize data as a continuous measurement of physical quantity.
- Don't compute directly with numbers, rather they use physical quantity such as electric current, voltage, mechanical motion and distance to represent and process data.
- Most of them are special purpose computers

Examples: Thermometer, voltmeter, speedometer of a car, and gasoline pump.

2. Digital Computers

- Handle information that **can be counted**. Uses digital circuits and are designed to operate on two states, namely **bits** (0 or1).
- **These bits** can be combined to denote information such as **numbers, letters, graphics, images** and program instructions.
- Are suitable for **complex computation** and have higher processing speeds. They are programmable.
- Are the most widely used, and **have higher accuracy** and **speed than analog computers**

Examples: The general purpose computers like Desktop, smart phones etc...

3. Hybrid Computers

- Is a combination of both **analog** and **digital computer**. Can handle both analog and digital data.
- Combines the best **characteristics** of both the **analog** and **digital computer**. It can accept data in both analog and digital form
- Applicable in area such as **manufacturing, transportation, power systems, healthcare** and others.

Example: Petrol pump



ICU device in hospitals



Based on Size & Processing Powers

1. Microcomputers (Personal Computers)

- They are relatively **small** or **compact in size** and are often found on a tabletop or desktop

Come in a variety of sizes and shapes for a variety of purposes. Basically they can be grouped into three namely: **Laptop**, **Palmtop** and **Desktop computers**.

Laptop computers are smaller versions of microcomputers about the size of a briefcase designed for portability.

Unlike desktop PCs that have mostly detachable components, laptops **include all their components** (except their **printer**) in a single unit.

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- Palmtop computer is the smallest microcomputer that is about the same size as a pocket calculator.
- Palmtops are typically used for a limited number of functions, such as maintaining personal calendar, name and address files, or electronic worksheets.
- Desktop computer is the most widely used type of personal computer (microcomputers).
- Unlike laptop and personal computers, desktop computers have detachable parts.
- However, since its size is larger than the other types of personal computers, it is not easily portable.

2. Minicomputers

- Are midrange computers that are larger and more powerful than most **microcomputers** but are smaller and less powerful than **mainframe** computer systems.
- The size prevents it from being easily portable although it can be moved more easily than a **mainframe** computer.
- Most minicomputers can function in ordinary operating environments, as they do not need **special air conditioning** or **electrical wiring**.
- Are being used for a **large number of business** and **scientific applications**.
- They are popularly used in **scientific laboratories**, **research centers**, **universities** and **colleges**, engineering firms, industrial process monitoring and control etc.

3. Mainframe Computers

- Are large, powerful computers that are physically larger than micros and minis and usually have processors with faster instruction processing speeds.
- Able to process from 10 to 200 million instructions per second.
- Generally found in a special computer room where environmental factors such as temperature, humidity, dust and air conditions are closely monitored.
- Because of the computer's cost and the value of the information stored there, the rooms in which mainframes are located have security systems allowing only authorized personnel to enter.

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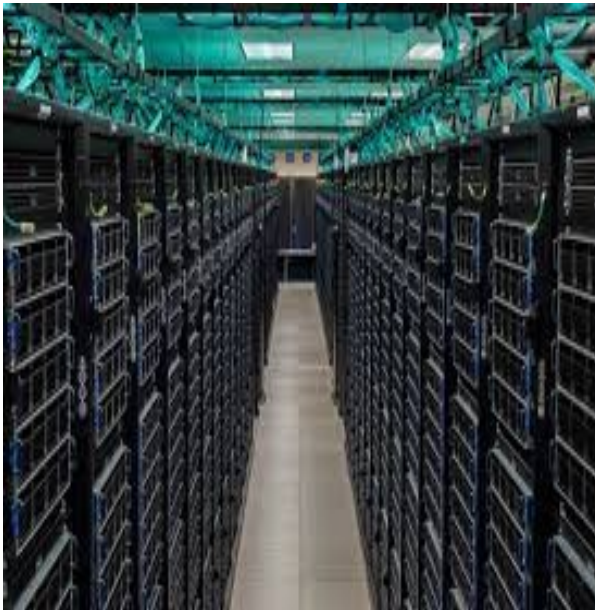
- Have the capacities to host multiple operating systems and can handle hundreds of users (can serve up to 50,000 users simultaneously)
- Designed to handle the information processing need of organization with many employees and customers or with complex computational problems.
- To give some example, mainframes can handle the processing of thousands of customer inquiries, employee paychecks, student registrations, sale transactions, and inventory changes.
- They are also used as the center of computer networking. These computers are used by organizations that have enormous and complex data processing assignments.

4. Super Computers

- The fastest and most expensive type of computers
- Operates 4 to 10 times faster than mainframe computers
- Can take inputs from over 10,000 individual computers and users at the same time.
- Highly trained data processing professionals are required to operate supercomputers.
- Largely used by highly calculation-intensive tasks and research organizations, military defense systems, national weather forecasting agencies, large corporations, aircraft manufacturer etc ...

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- Some supercomputers require **extra floor support** to hold the extreme weight of the complete system that includes storage units.



Applications of Modern Computers

- Now a days every field or discipline either directly or indirectly uses computer in order to process information.
- Here are some of the application areas of computer:
 - Science and Engineering
 - Education
 - Medicine and health care
 - Entertainment
 - Communication and etc.

Assignment 1

- Write and briefly discuss the evolutions of computers.
- What are the different computer generations.
- Briefly discuss the technology and programming language used in each generation.
- Compare and contrast each computer generation.

Next Class

Components of Computing System