



# C Introduction to Computers and Languages

## Introduction to Computer Hardware and Software

### What is computer?

Computer is an **electronic computing device**. It receives raw data as **input** from its users, **process** and generates desired result as an **output**. If necessary input and output can be **stored** in computer's **secondary memory** for future use.

The major four functions of any computer system are **input, process, output and store**.

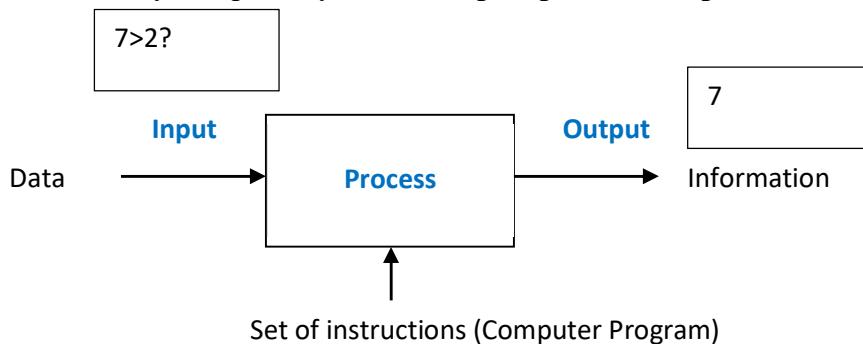


Figure 1. Input-process-output concept

### Features or Characteristics of a computer system

Some of the key characteristics of a modern digital computer as follow.

- 1) **Speed:** Computer is a fast electronic device. It can solve large and complex problems in fraction of seconds.

The speed of a computer is measured in milliseconds( $10^{-3}$  or 1/1000 or 0.001), microseconds( $10^{-6}$  or 1/1000000 or 0.000001), nanoseconds( $10^{-9}$  or 1/1000000000 or 0.000000001) and picoseconds( $10^{-12}$ ).

The speed of a computer depends upon its hardware configuration that is in terms of **MIPS** (Millions of instructions (clock pulses) per second) i.e. **MHz**,

**BIPS** (Billions of instructions (clock pulse) per second) i.e. **GHz** and even more speed.

- 2) **High Storage Capacity:** A computer can store huge amount of data in many different formats in computer's secondary memory.

Unit of computers memory is **byte**. 1 byte means 8 binary digits (**bits**).



bits=binary digits like 0s and 1s

0s and 1s are called binary numbers (bits)

Machine (Computer) understands only 0s and 1s

Zero (0) means False, No, OFF	One (1) means True, Yes, ON
Absence of voltage Ex: Assume 0 Volatge	Presence of voltage Ex: Assume +5 V
Unmarked area on disk like CD or DVD	Marked area on disk like CD or DVD
Demagnetized particle of magnetic disk	Magnetized particle of magnetic disk

For a computer system

A means 65. The decimal value 65 is **ASCII** Value of A.

ASCII stands for **American Standard Code for Information Interchange**

A=65, B=66, C=67, ...., Z=90

a=97, b=98, c=99, ...., z=122

Enter Key=13      Esc Key=27

High Level Language='A'      Machine Level Language=1000001

'A' =  $(65)_{10} = (1000001)_2$

Ex: To get binary equivalent of 65, we need to divide the number 65 by 2 and note down remainders from bottom to top.

<u>65</u>		Remainders
2	32	1
2	16	0
2	8	0
2	4	0
2	2	0
2	1	0
2	0	1

Note: Note down remainders from bottom to top.

i.e. 1000001

This is binary equivalent of 'A' = **65=1000001**



# ASCII TABLE

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	'
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	\$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[ENG OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	\	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	-
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	DEL	127	7F	DEL

# Bits, Bytes and Words

A single binary digit is called a *bit*. The value of a bit is 0 or 1.

A group of 8 bits is called a *byte*.

1	0	1	1	0	1	0	1
---	---	---	---	---	---	---	---

There are 256 different bytes, because  $256 = 2^8$

Larger collections of bits are called *words*: typically 16, 32 or 64.

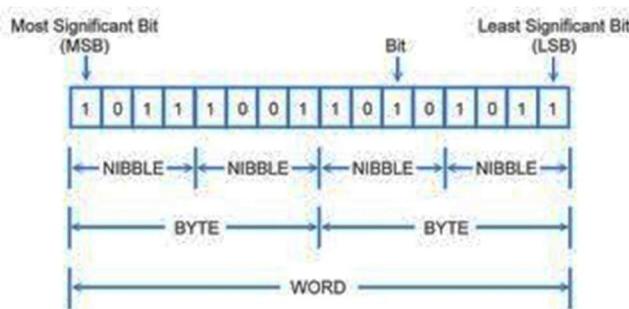
16 bit word:

byte	byte
------	------

32 bit word.

byte byte byte byte

64 bit word:



Byte:

To store **one character** in computers memory, machine uses **1 byte**.

1 byte = 8 bits (binary digits)

'A'=65= 0100 0001

To store one character in memory machine uses 1 byte

4 bits	1 nibble
8 bits	1 byte (by eight=nibble)
1024 Bytes	1 Kilo Byte (KB)
1024 KB	1 Mega Byte (MB)
1024 MB	1 Giga Byte (GB)
1024 GB	1 Tera Byte (TB)
1024 TB	1 Peta Byte (PB)

- 3) **Accuracy:** A computer carries all the calculations with great accuracy. The accuracy given by the computer depends upon the written program (set of instructions) and its hardware configuration.



**Q. What is software? Discuss the types of software with examples.**

### Computer Program

The **set of instructions** given to a computer system **to do specific task** is called computer program.

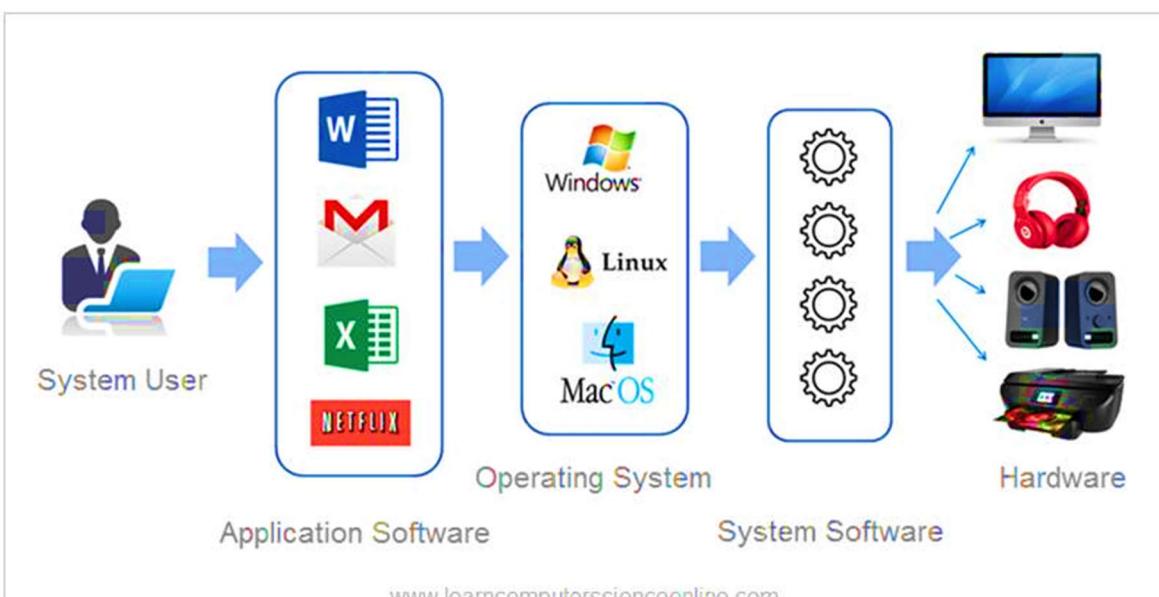
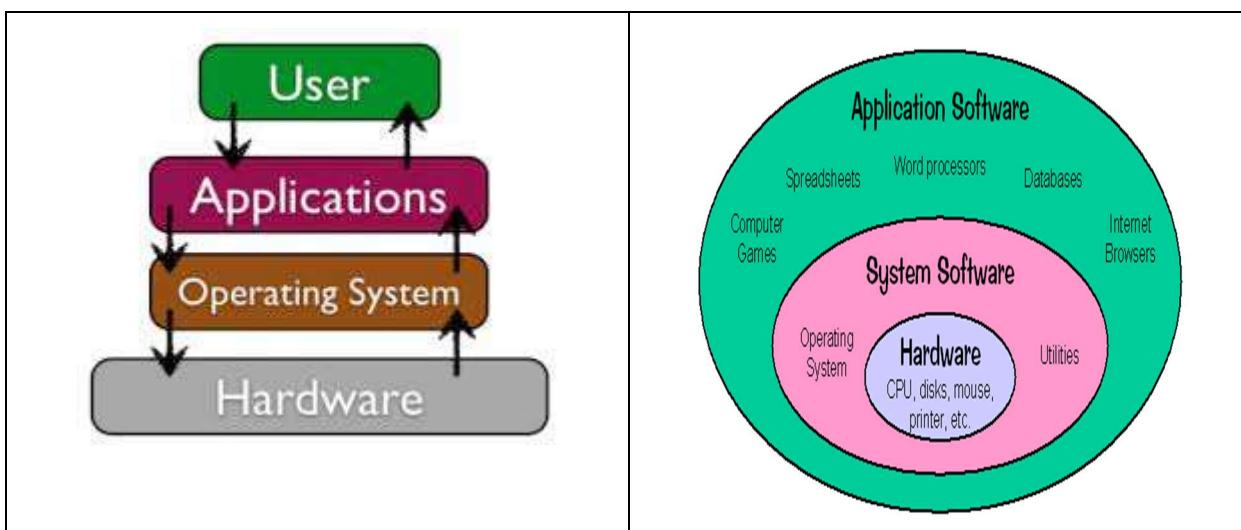
```
#include<stdio.h>
void main()
{
int a=7, b=3;
clrscr();
printf("\n Addition=%d", a+b);
printf("\n Subtraction=%d",a-b);
getch();
}
Output:
Addition=10
Subtraction=4
```



## Software

The **set of computer programs** will make a software.

The software might be the system **software** or **application** software.





## Types of Software

### 1. System Software

A computer program that is written to run computer's hardware and application programs. These are developed to manage entire computer resources. Programming of system software is complex.

Programs that controls all the operations of a computer system and devices connected to it are called system software. It runs on hardware components and provides required services to all application software installed on it. You can not install application software without system software.

#### Examples:

Operating systems like DOS(Disk Operating System), Windows O.S., UNIX O.S. Ubuntu O.S. Fedora O.S. Andriod O.S. Black Berry O.S., etc.

Device drivers like printer drivers, Sound Card Drivers, Display Drivers, etc.

BIOS (Basic Input Output System), Compiler (that converts the program written from high level to machine level language),etc.

### 2. Application Software

The software designed for specific use or task is called application software. It runs on Operating System. User can use the installed application software for specific task. There are similar to Apps installed in our mobile.

#### Examples:

Ms Word, MS Excel, MS PowerPoint, MS Access, SOLID EDGE, AutoCAD, ANSYS, CATIA, Corel Draw, Page Maker, Baraha, Nudi. ShriLipi, etc.



### C program to find addition of two integers:

```
#include<stdio.h>
void main()
{
    int n1, n2, ans;
    clrscr();
    printf("Enter two integers");
    scanf("%d%d",&n1,&n2);
    ans=n1+n2;
    printf("Addition is %d", ans);
    getch();
}
```

It allocates 3 memories named n1,n2,ans (3 variables)  
It clears the screen  
It prints the message  
It reads two integer values from user through keyboard  
Addition of n1 and n2 will be stored in ans by ALU  
It prints message and contents of memory named ans  
It waits to get one character input meanwhile we see result

#### Output:

Enter two integers

7 3 [Enter Key]

Addition is 10

- 4) **Reliability:** A computer produces consistent correct results with no errors. Most of the computer generated errors due to incorrect instructions given by the programmer. Therefore, computers are trustworthy machines.
- 5) **Versatility:** Computers are versatile machine. They can perform variety of tasks in many fields. These are used in all most all the fields like engineering, medical, scientific, commercial, entertainment and teaching aid, etc.
- 6) **Diligence:** Computers can perform repetitive calculations any number of times without any error with the same accuracy. That is, computers do not suffer from human traits such as tiredness, fatigue, lack of concentrations, etc.
- 7) **Programmability:** Programmers can write the programs by using high level programming languages like C to develop application and system software's.

### Limitations or disadvantages of a computer system

1. GIGO (Garbage in Garbage Out): An incorrect input data would result in incorrect result.
2. Lack of common sense.
3. High investment for **software** as compare to **hardware**.



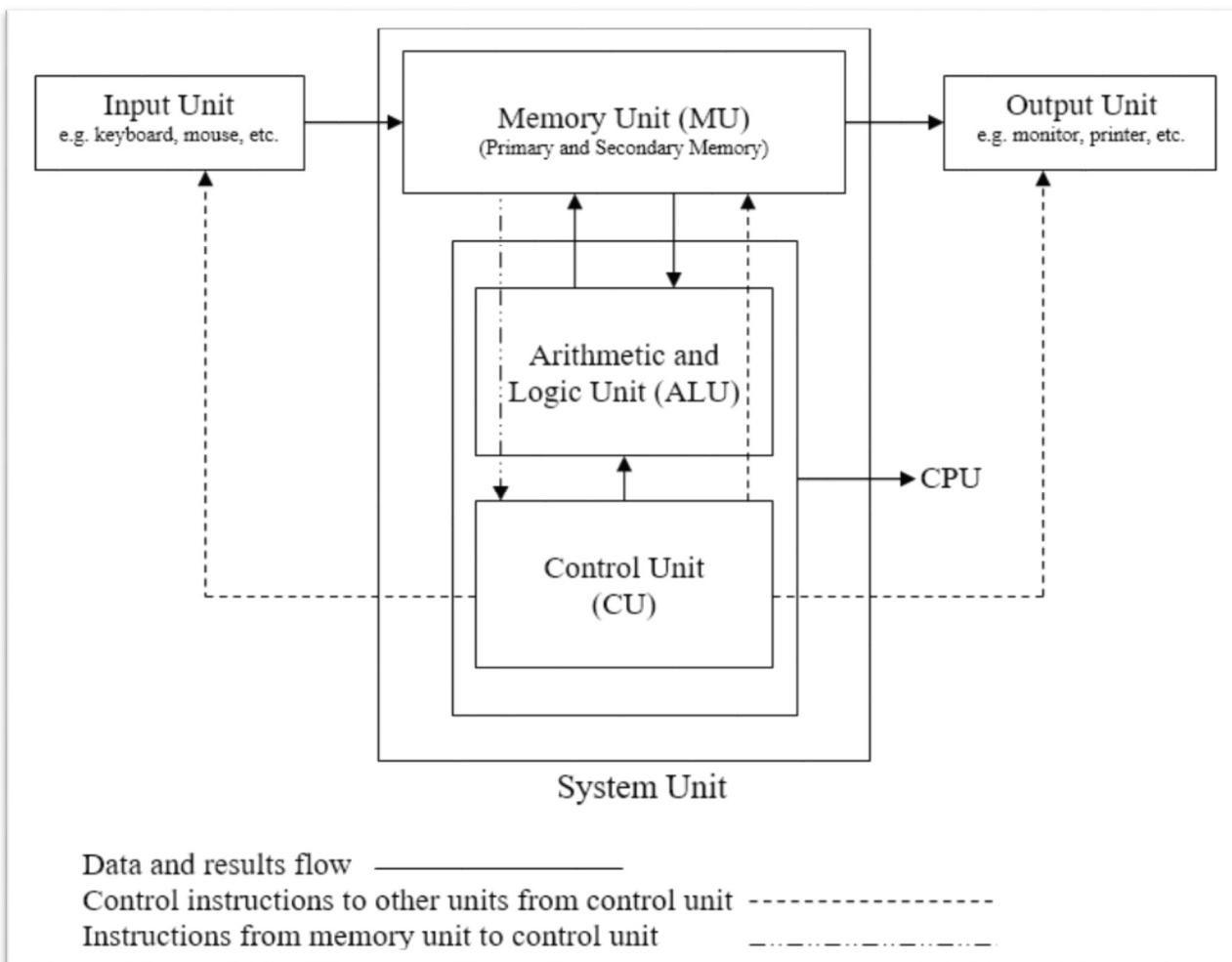
**Q. Discuss the structure of a computer with its neat block diagram. (10 m)**

**Answer:**

## Structure of a Computer

Computer is an **electronic computing device**. It receives raw data as **input** from its users, **process** and generates desired result as an **output**. If necessary input and output can be **stored** in computer's **secondary memory** for future use.

The major four functions of a computer system are **input**, **process**, **output** and **store**. These functions are performed by different functional units of a computer system as shown below.





## 1) Input unit

The input unit helps to give inputs to a computer system to get desired result after processing.

The most commonly used input device is **keyboard**.

A keyboard is used to enter alphanumeric characters and symbols.

The mouse is used to pick or select a command from the monitor screen.

A **scanner** is used to scan an image or to read a **barcode** and so on.

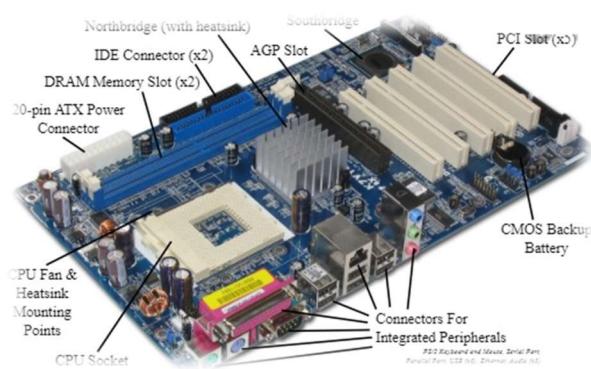


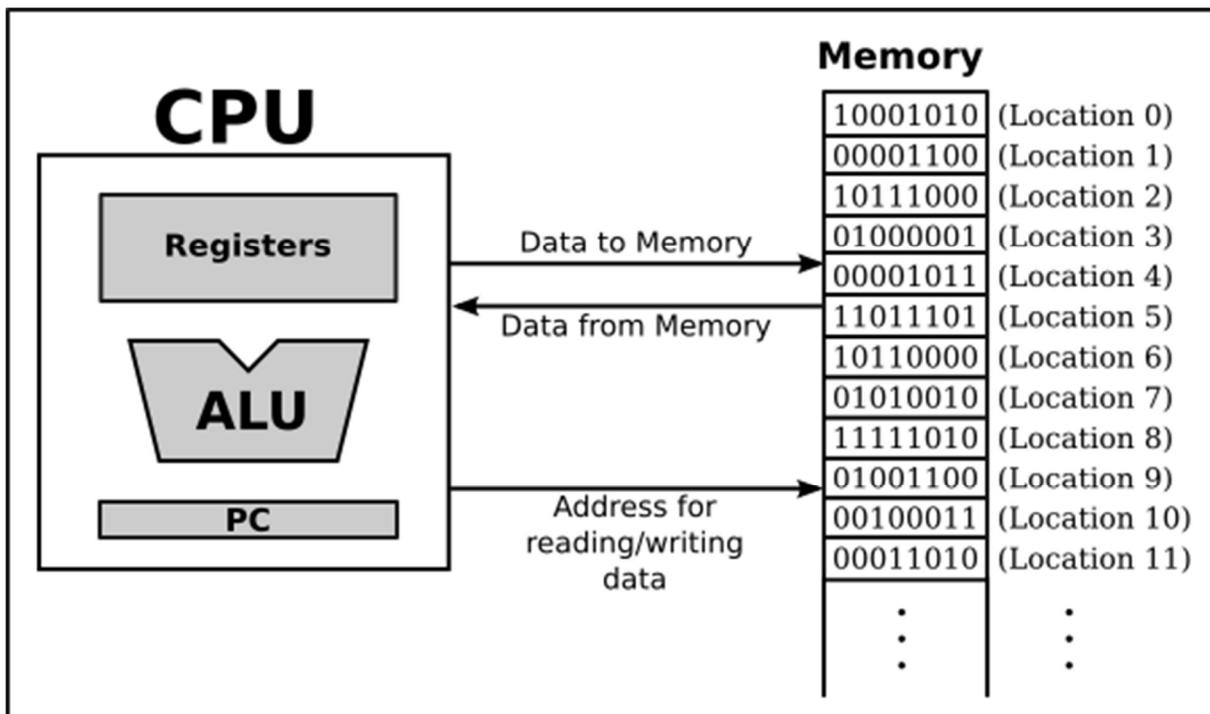
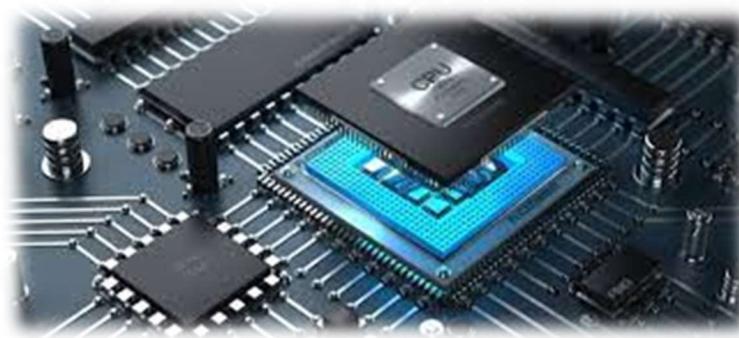
## 2) Central Processing Unit (CPU)

The CPU is the single chip present on mother board. Its job is to execute **computer programs**. It is the **brain** or **heart** of a computer system. It is also called as **processor**. Examples are Intel's i3-processor, i5 processor & i7-processor. It interprets (understands) instructions from written program and processes data accordingly. It includes more than billion ( $10^9$ ) transistors.

It includes the following two major components

- Arithmetic & Logical Unit (ALU)
- Control Unit (CU)





### Arithmetic and Logic Unit (ALU)

The ALU performs both arithmetical and logical operations with the data.

Arithmetical Calculations like addition (+), subtraction (-), multiplication (\*) , division (/) and modulus (%).

Examples: if  $a=7$ ,  $b=3$  then

Arithmetical Expressions	Result
$a+b$	10
$a-b$	4
$a*b$	21
$a/b$	2
$a\%b$	1

Note:

The **division operator** (/) returns **quotient** after division operation. e.g.  $10/2=5$

The **mod operator** (%) returns **remainder** after division operation. e.g.  $10\%2=0$



Logical Calculations may include relational and logical operators.

The relational operators like greater than ( $>$ ), less than ( $<$ ), greater than equals to ( $\geq$ ), less than equals to ( $\leq$ ), equality ( $=$ ) and not equals to ( $\neq$ ).

Examples: if  $a=7$ ,  $b=3$  then

Relational Expressions	Result
$a < b$	$7 < 3$ False (0)
$a \leq b$	$7 \leq 3$ False (0)
$a > b$	$7 > 3$ True (1)
$a \geq b$	$7 \geq 3$ True (1)
$a == b$	$7 == 3$ False (0)
$a != b$	$7 != 3$ True (1)

We can combine relational expression by using logical operators like logical AND ( $&&$ ), logical OR ( $||$ ), and logical not  $!$ , etc.

All these operations will be performed by ALU.

### Control Unit (CU)

The control unit controls the overall activities of the computer system. It will fetch (takes) program instructions from primary memory RAM to assign the work to other components to function correctly. It manages and coordinates the entire computer system including its input and output unit i.e. by sending control signals to all components. It acts as a supervisor of a computer system.

### Functions of control unit

1. It will fetch instructions from main memory
2. It communicates with ALU, main memory, input and output unit.
3. It will assign the work to ALU to operate on data as per the program instructions.
4. It controls the flow of data among memory, processor and other components of a computer system
5. The overall supervision of a computer system is done by CU.



### 3) Memory Unit

Computer memory is the storage space in computers. It helps to store **data** and **instructions** for real time use or future use. The computer's memory is divided into small parts called memory cells. Each memory has unique ADDRESS. The address of memory helps to store and retrieve data from memory cells. The memory address starts from ZERO and ends with memory size minus one. Addresses will be in the form of integers.

The unit of computer's memory is byte (8 bits). A bit is a binary digit, which represents one's (1) and zero's (0)

4 bits	= 1 nibble
8 bits	= 1 byte
1024 bytes	= 1 Kilobyte (KB)
1024 Kilobytes	= 1 Megabyte (MB)
1024 Megabytes	= 1 Gigabyte (GB)
1024 Gigabytes	= 1 Terabyte (TB)
1024 Terabytes	= 1 Petabyte (PB)



The computer's memory is categorized into following two types.

- Primary memory (main or internal memory)
- Secondary memory (external memory)

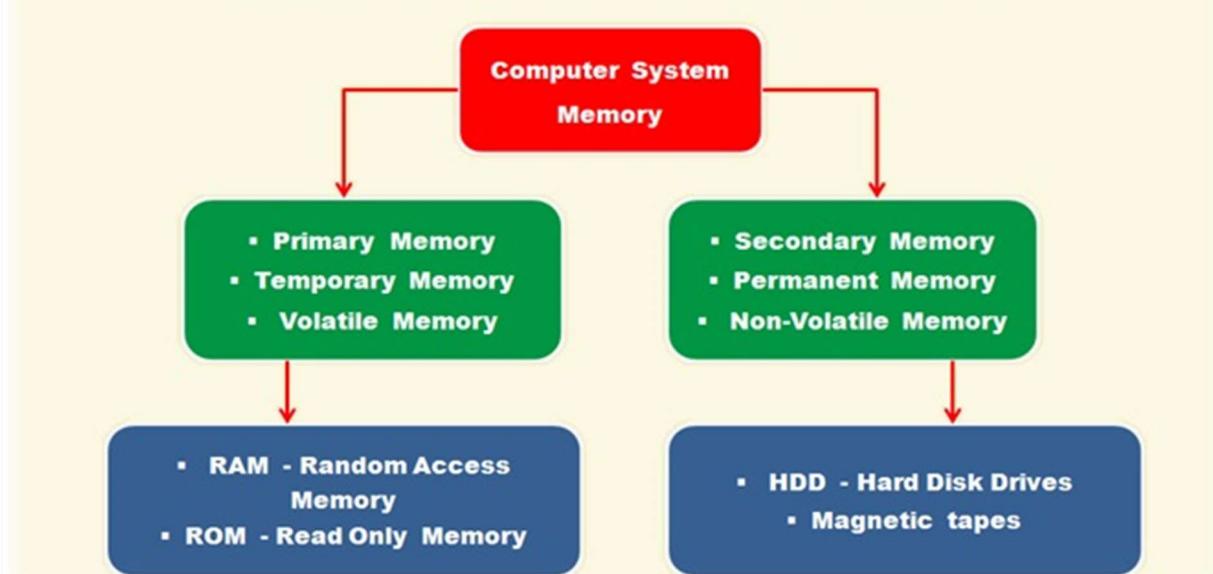


Sl.No	Primary Memory	Secondary Memory
1	This memory is also called internal or main memory	This memory is also called external memory
2	Reading data will be much faster	Reading data will be much slower
3	Temporary storage	Permanent Storage
4	Expensive	Less Expensive
5	Storage devices are semiconductors	Storage devices are magnetic disk or optical disk
6	Examples: ROM (Read Only Memory) RAM (Random Access Memory)	Examples: HDD (Hard Disk Drive) CD (Compact Disk), Floppy Disk, etc.

### Difference between ROM and RAM

Sl.No	ROM	RAM
1	Read Only Memory	Random Access Memory
2	The stored data can be read only.	The data can be read and rewritten
3	Permanent memory or non-volatile memory	Temporary memory or volatile memory
4	Used by machine	Used by programmer and machine both
5	Data is available after the power cut off	No data is available after the power cut off

## Computer System Memory Types

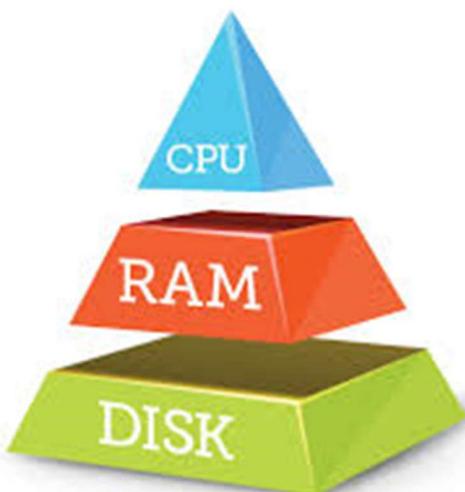
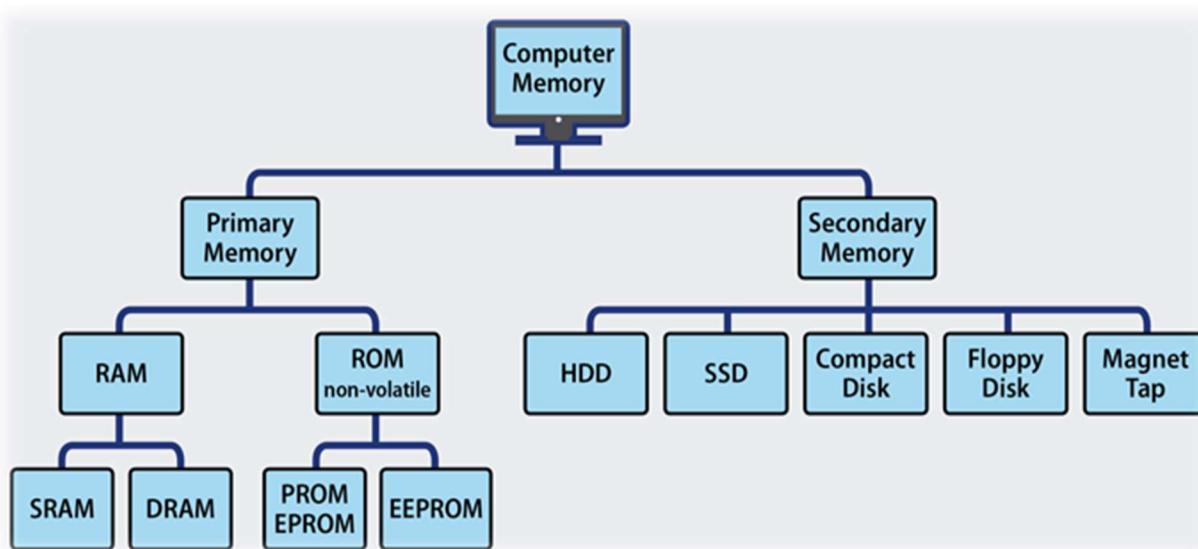


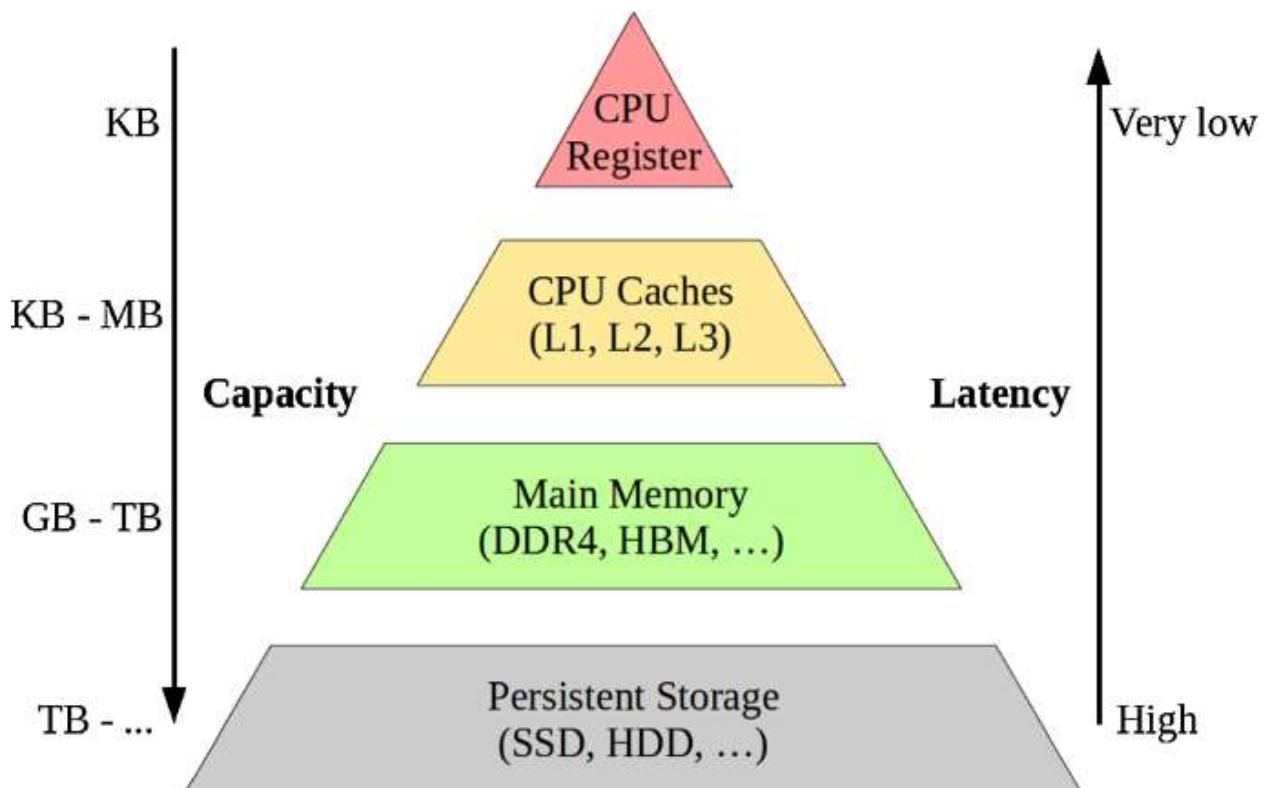


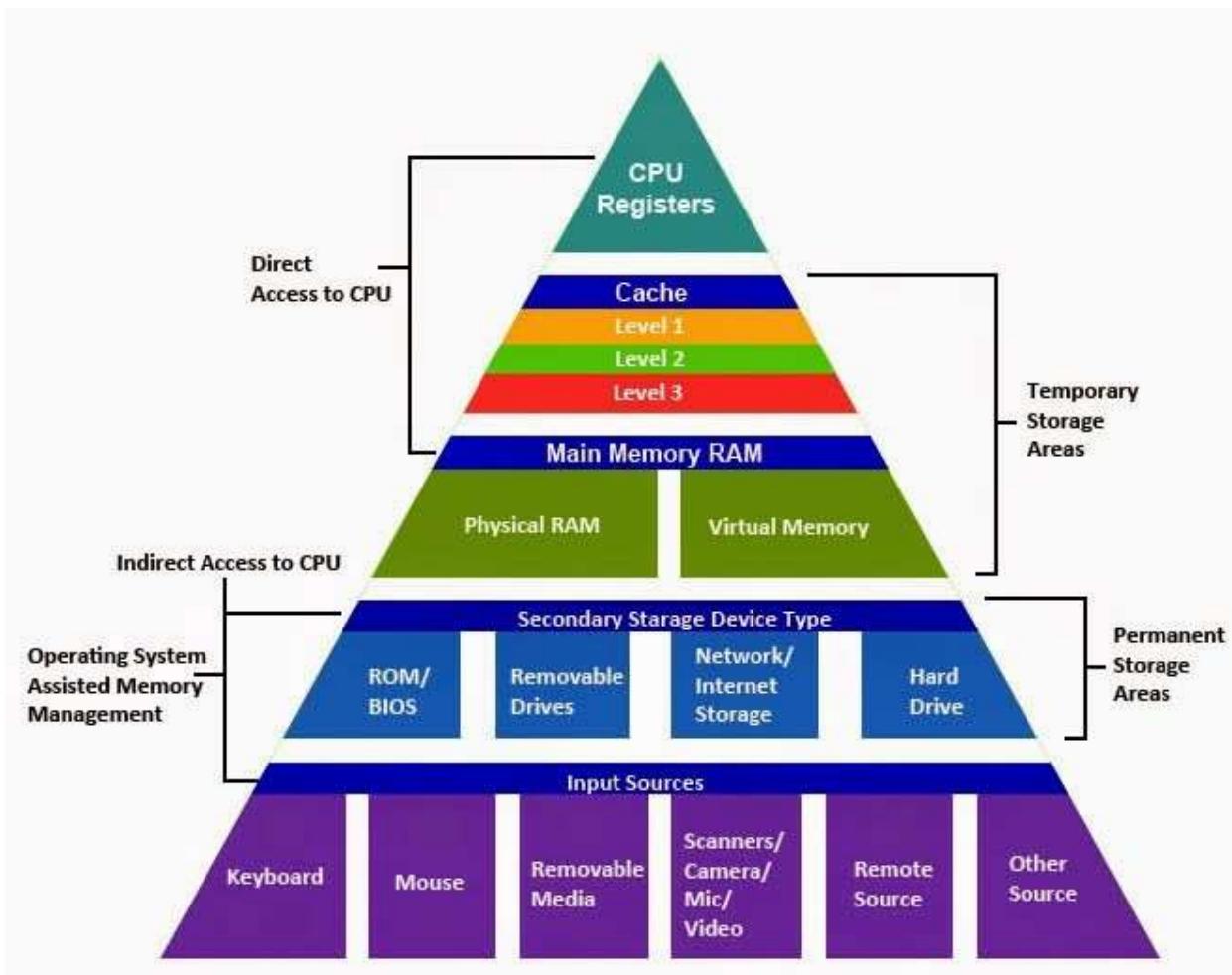
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Lecture Video by : Mr. Chidanand S. Kusur, Asst. Prof. Dept. of CSE, [www.cskusur.blogspot.in](http://www.cskusur.blogspot.in), 9739762682







#### 4) Output Unit

The output unit is responsible for displaying or printing the processed information. The most commonly used output devices are **monitor** and **printer**.

A monitor is used to display the result in the form of text and graphics. A result displayed in a monitor is temporary and it disappears when the next result is displayed.

The printers like **dot matrix**, **ink jet** and **laser printers** are used to print the files. These printouts can be used for any business correspondence or documentation.

A **plotter** is used to plot or print graphical result from a computer. It is big in size. Usually **A0 size** paper will be used to get real time printouts.

The **Hard Disk (secondary memory)** can be used to store the processed information as a soft copy with valid file name.





**Q. Discuss in brief about computer generations. (5 m or 8 m)**

**Answer:**

## Computer Generations



Generation of computers means **change** in **hardware** and **software technology** used for processing the given input to get the desired output. There are five computer generations known till date.

1. **First** Generation 1946 to 1959   **Vacuum Tube** based
2. **Second** Generation 1959 to 1965   **Transistor** based
3. **Third** Generation 1965 to 1971   **Integrated circuit** based
4. **Fourth** Generation 1971 to 1980   **VLSI** (Very Large Scale Integrated)
5. **Fifth** Generation 1980 onwards   **ULSI** (Ultra Large Scale Integrated)





## 1) First Generation Computers

The period of first generation was 1946 to 1959.

**Vacuum Tube** was used as processing unit.

Vacuum tube was similar to electric bulb. It was producing **lot of heat** so there was a need A.C. for the first generation of computers.

**Batch processing** operating system was used.

**Punch cards** were used to give input to a machine.

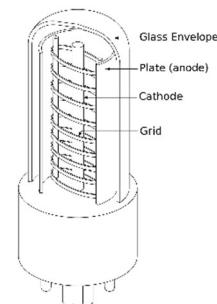
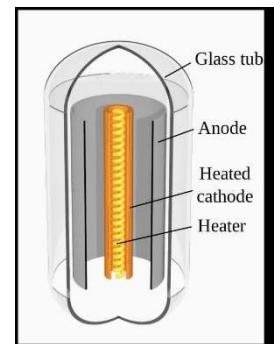
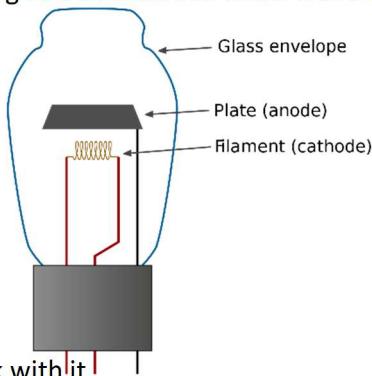
**Magnetic tape** was used to store output.

### Features:

- **Huge** size
- Very **Expensive**
- **Machine language** (0's and 1's) was to work with it.
- Generating **lot of heat**. So, need of Air Conditioner
- Consuming **lot of electricity**

### Examples:

**ENIAC** (Electronic Numerical Integrator and Calculator), **EDVAC** (Electronic Discrete Variable Automatic Computer) and **UNIVAC** (Universal Automatic Computer-I)





## Know it:

ENIAC

First electronic computer and developed by American Scientists John Presper and John W Mauchly in 1946 by using semiconductors.

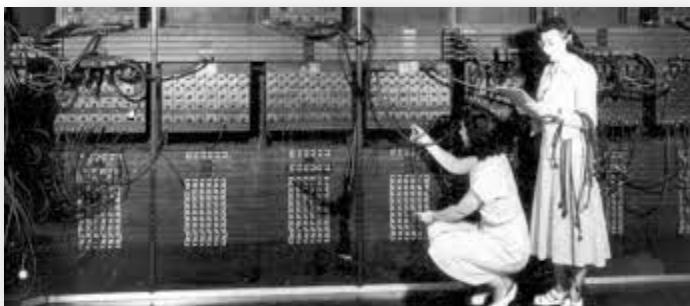
It had a short memory and various components had to be manually operated in different ways to perform different computations.

Its size was 80 feet long with nearly 30 ton of weight.

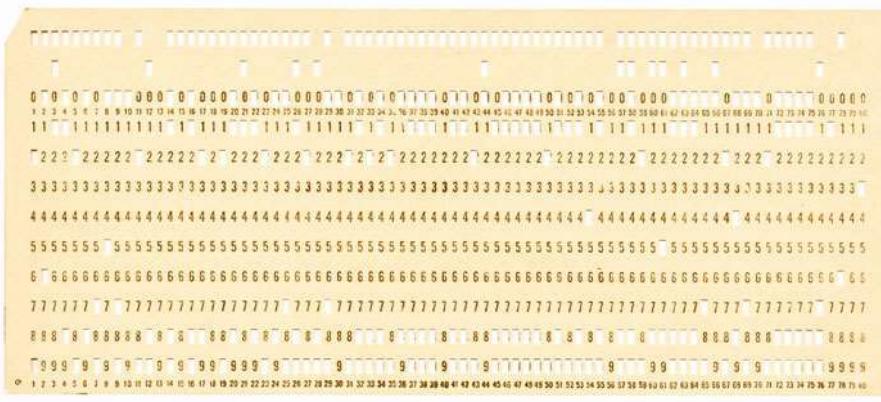
It was used by American Govt. to calculate the trajectories (path) of bombs and shells.

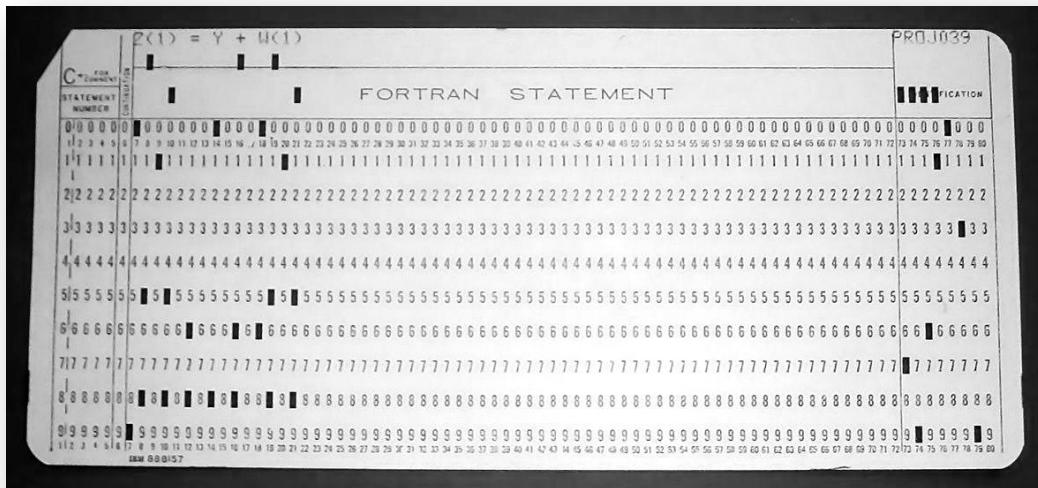
This machine could be reset to perform other types of calculations by changing switch settings and plugs and socket connections.

The biggest problem with this computer was that all the instructions were hardwired within the computer



Example of a punch card





**EDVAC** was introduced by John Von Neumann in 1950 with a new concept of storage information in a large internal memory i.e to overcome the disadvantage of ENIAC. It was capable read data and instructions from external resources through the punched cards. Thus, problem of ENIAC was solved by it.

**UNIVAC** (Universal Automatic Computer-I) was developed in 1951. It was developed for both scientific and commercial applications. It also had a compiler to translate programs to machine code.





## 2) Second Generation Computers

The period of first generation was 1959 to 1965.

In this generation, **transistors** were used that were cheaper, consumed less power, more compact in size, more reliable and faster than the first-generation machines made of vacuum tubes.

One transistor is equals to nearly **40 vacuum tubes**.

In this generation, magnetic cores were used as the primary memory and magnetic tape and magnetic disks as secondary storage devices.

In this generation, **assembly language** was used to write programs instructions.

[Transistors (1959-1965)]

### Features:

- Use of **transistors**
- **Reliable** in comparison to first generation computers
- **Smaller size** as compared to first generation computers
- Generates **less heat** as compared to first generation computers
- Consumed **less electricity** as compared to first generation computers
- **Faster** than first generation computers
- Still **very costly**
- **AC required**
- Supported **machine** and **assembly languages**



### Examples:

- **IBM** 1620
- **IBM** 7094
- **CDC** 1604
- **CDC** 3600
- **UNIVAC** 1108



### 3) Third Generation Computers

The period of third generation was from 1965-1971.

The computers of third generation used

**Integrated Circuits (ICs)** in place of transistors. A single IC has many transistors, resistors, and capacitors along with the associated circuitry.



The IC was invented by **Jack Kilby**. This development made computers **smaller in size, reliable, and efficient**.

1 IC= 10 to 100 transistors



**Jack Kilby** was an American electrical engineer who took part in the realization of the first integrated circuit while working at Texas Instruments in 1958. He was awarded the Nobel Prize in Physics on December 10, 2000

In this generation remote processing, time-sharing, multi-programming operating system were used. High-level languages (FORTRAN-II TO IV, COBOL, PASCAL PL/1, BASIC, ALGOL-68 etc.) were used during this generation.

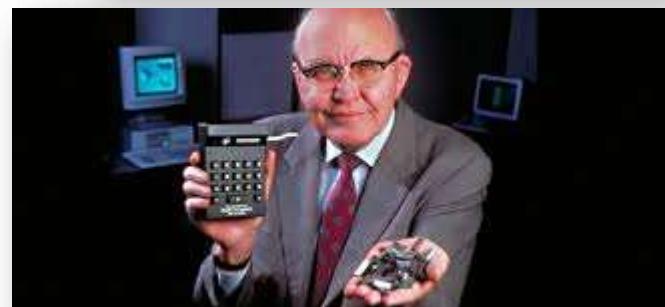
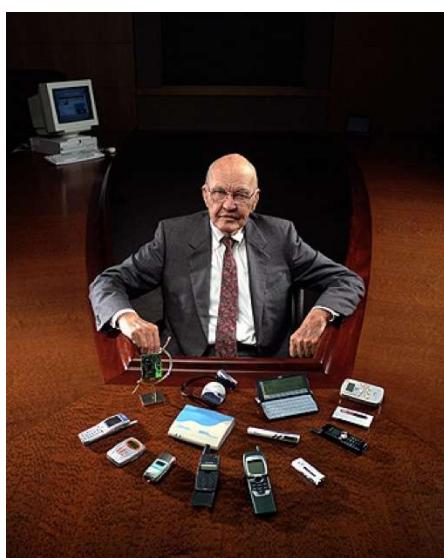
#### Features:

- IC used
- More reliable in comparison to previous two generations
- Smaller size
- Generated less heat
- Faster
- Lesser maintenance
- Costly
- AC required
- Consumed lesser electricity
- Supported high-level language



#### Examples:

- **IBM-360 series**
- **Honeywell-6000** series
- **PDP** (Personal Data Processor)
- **IBM-370/168**
- **TDC-316**





## 4) Fourth Generation Computers

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.

1 LSI= 100 to 1000 transistors. 1 VLSI= millions of transistors

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++, COBOL, FORTRAN etc.**, were used in this generation.

### Features:

- VLSI technology used
- Very cheap
- Portable and reliable
- Use of PCs
- Very small size
- Pipeline processing
- No AC required
- Concept of internet was introduced
- Great developments in the fields of networks



### Examples:

- DEC 10
- STAR 1000
- PDP 11
- CRAY-1(Super Computer)
- CRAY-X-MP(Super Computer)





## Do You Know This Man ?



**Dr. Vijay Panduranga Bhatkar is the Architect of Super-computing in India. He rolled out India's first indigenous supercomputer: PARAM 8000. It was the 2nd fastest Supercomputer in the world. In 2015 he was honoured with Padma Bhushan for his invaluable contribution. Feel Proud To Share This Picture**



## Quality Of "PARAM-10000"



- PARAM-10,000" supercomputer, capable of performing one trillion mathematical calculations per second.
- "PARAM-10,000", based on an open-frame architectures.
- "PARAM-10,000" is a hundred times more powerful than that the first PARAM machine built.



## 5) Fifth Generation Computers

The period of fifth generation is **1980-till date**.

In the fifth generation, VLSI technology became **ULSI (Ultra Large Scale Integration)** technology, resulting in the production of microprocessor chips having **ten million electronic components**. This generation is based on parallel processing hardware and **AI (Artificial Intelligence)** software. AI is an emerging branch in computer science, which interprets the means and method of making computers think like human beings.

All the **high-level languages like C and C++, Java, .Net** etc., are used in this generation.

### Features:

- ULSI technology
- Development of true **artificial intelligence**
- Development of **Natural language** processing
- Advancement in **Parallel Processing**
- Advancement in **Superconductor technology**
- More **user-friendly** interfaces with multimedia features
- Availability of very powerful and compact computers at **cheaper rates**



### Examples:

- Desktop
- Laptop
- Notebook
- Ultrabook
- Chromebook





## Computer Generations

Generations	Period	Processing Hardware Component	Language Supported	Features	Examples
<b>First</b>	<b>1946 to 1959</b>	Vacuum Tube	Machine Language	Huge size Very Expensive Machine language (0's and 1's) was to work with it. Generating lot of heat. So, need of Air Conditioner Consuming lot of electricity	ENIAC EDVAC UNIVAC
<b>Second</b>	<b>1959 to 1965</b>	Transistor	Assembly Language	<ul style="list-style-type: none"><li>Smaller size as compared to first generation computers</li><li>Generates less heat as compared to first generation.</li><li>Faster than first generation computers</li><li>Still very costly</li><li>AC required</li></ul>	IBM 1620 IBM 7094 CDC 1604 CDC 3600 UNIVAC 1108
<b>Third</b>	<b>1965 to 1971</b>	IC (Integrated circuit)	High Level	Smaller size Generated less heat Faster Costly AC required	IBM-360 series Honeywell-6000 series PDP (Personal Data Processor) IBM-370/168 TDC-316
<b>Fourth</b>	<b>1971 to 1980</b>	VLSI	High Level Languages like COBOL, FORTRAN, C, C++, etc. etc.	Very cheap Portable and reliable Use of PCs Very small size Pipeline processing No AC required Concept of internet was introduced Great developments in the fields of networks	DEC 10 STAR 1000 PDP 11 CRAY-1 (Super Computer) CRAY-X-MP (Super Computer)
<b>Fifth</b>	<b>1980 onwards</b>	ULSI	High Level Languages	Very cheap Portable and reliable Use of PCs Very small size Pipeline processing No AC required Concept of internet was introduced Great developments in the fields of networks	Desktop Laptop Notebook Ultrabook Chromebook

Thank You



**Q. Discuss the ‘types of computer’ in brief. (6 m)**

**Answer:**

## Types of Computers

Computers are mainly classified into following two types.

- Based on **Working Principle**
- Based on **Number of End Users** (Single User or Multi User)

### 1. Classification based on working principle

- a) **Analog** Computers
- b) **Digital** Computers
- c) **Hybrid** Computers



### 2. Classification based on number of users using.

- Computers used by single (individual) user  
(**Micro Computers**)
  - a) **Desktops**
  - b) **Workstations**
  - c) **Laptops**
  - d) **Handheld Computers**
  - e) **Smart Phones**
- Computers used by multi users  
(**Computers for Organizations**)
  - a) **Super Computers**
  - b) **Mainframe Computers**
  - c) **Mini Computers**



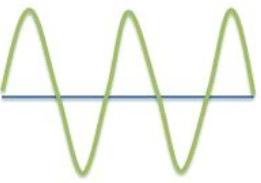
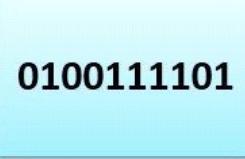
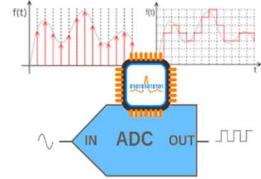


## Types of Computers

Based on Working Principle	Based on End Users	
	Computers for Single User (Micro Computers)	Computers for Multi Users (Computers for Organization's)
1) Analog computers	1) Desktop Computers 2) Workstations	1) Super Computers
2) Digital Computers	3) Notebook Computers 4) Tablet PCs	2) Mainframe Computers
3) Hybrid Computers	5) Handheld PCs and 6) Smart Phones, etc.	3) Mini Computers



## Classification of Computers based on Working Principle

Analog Computers	Digital Computers	Hybrid Computers
<p>These machines will use <b>analog signals</b> as input for processing. Analog signal is a <b>continuous wave</b> that keeps on changing over a time period.</p> 	<p>These machines will make the use <b>binary digits</b> like 0's and 1's for processing the input. A digital signal is a <b>discrete wave</b> that carries information in binary form.</p> 	<p>The <b>combination</b> of both <b>analog</b> and <b>digital</b> computers are called <b>hybrid computers</b>.</p> 
<p>It will process the data which is in <b>continuous form</b> like <b>temperature, pressure, voltage, voice, etc.</b></p> <p>The analog computer is the first generation of computers i.e beginning of the computing world.</p>	<p>Digital computers process the data in <b>numeric</b> as well as <b>non-numeric</b> form. It can perform <b>arithmetic operations</b> such as <b>addition, occurrence, subtraction, multiplication, or division</b> and all types of <b>logical</b>(mathematical) <b>operations</b>.</p>	<p>The analog component often acts as a <b>solver of many differential equations &amp; other mathematically complicated equations</b>.</p> <p>The digital component usually acts as a controller and prepares logical and numerical operations.</p>
<b>Measuring</b> of data takes place	<b>Counting</b> of data takes place	<b>Combination</b> of both
Less Storage	High Storage	High Storage
<b>Examples:</b> <b>1.</b> Speedometer of a car measures the speed. <b>2.</b> Thermometers helps to measure body temperature. <b>3.</b> Weighing machine helps to measure weight.	<b>Examples:</b> Today, most of the computers available in the market are digital computers	<b>Examples:</b> <b>1.</b> It is used in the ICU (intensive Unit Care) of the Hospital. <b>2.</b> To create a model for the real-time automatic system control that contains both the features of analogs and digital devices. <b>3.</b> Used in the sectors like ships, defense sector, airline sector, and in radar systems as well.



Audio input devices like a **microphone** is used to input a **person's voice** into the computer.

A **sound card** translates **analog audio signals** from **microphone** into **digital codes** that the **computer** can store and process.

**Sound card** also translates back the **digital sound** into **analog signals** that can be sent to the **speakers**.





## Computers for individuals (Single User)

Types	Description
1) Desktop computers	<p>It is <b>standalone computer system</b> placed on desk. It has input, process and output units. These are used in <b>home</b> and <b>offices</b>. These machines are <b>cheaper</b> and <b>easy for maintenance</b>. Examples: <b>DELL, HP, Lenova</b>, etc. with hardware configuration like i3,i5 &amp; i7 processor with 4 GB/8GB RAM.</p>
2) Workstations	<p>A workstation is a special computer <b>designed for technical or scientific applications</b>.</p> <p>These machines are usually used as a <b>SERVER</b> in computer's network.</p> <p>It can be used as standalone machine to run the software that requires <b>high end microprocessor</b> with others processors like GPU, etc.</p> <p>These are used by professionals to run CAD/CAM software's, 3D graphics and animation software.</p> <p>Examples:</p> <p>Manufactured by Sun Microsystems like Hewlett Packard &amp; IBM with the hardware configuration like <b>Intel i9-processor, 128 GB RAM, nVidia Graphics Card,etc.</b></p>
3) Laptop Computers	<p>A laptop computer, or notebook computer is a <b>small, portable personal computer</b> (PC) with a screen and alphanumeric keyboard. These are used in temporary space within airlines, trains and in meetings etc. These are <b>expensive</b> and <b>delegate</b>.</p> <p>Examples: Dell laptop, SONY laptop and HP laptop etc.</p>
4) Tablet Computers	<p>A tablet computer is a <b>mobile device</b>. It has <b>touchscreen</b> display processing circuitry, and a rechargeable battery in a single, <b>thin and flat</b> package. These <b>looks like smart phones</b>.</p>
5) Handheld PCs	<p>A handheld PC is a <b>miniature computer</b>. It is significantly <b>smaller</b> than any standard <b>laptop computer</b>. It is sometimes called as a <b>palmtop computer</b>. These are also <b>mobile computing device</b> and small enough to hold in our hand. These are used to store <b>contact number &amp; address</b> and <b>memos</b>. These can be called as <b>PDA (Personal Digital Assistant)</b>.</p>
6) Smartphones	<p>A smartphone is a <b>portable device</b> that combines <b>mobile telephone</b> and <b>computing functions</b> into one unit. These typically contain a number of metal–oxide–semiconductor (MOS) integrated circuit (IC) chips, sensors, camera and support wireless communications protocols such as Bluetooth, Wi-Fi, or satellite navigation.</p>





## ii. Computers for Multi Users (organizations):

1. Super Computers
2. Mainframe Computers
3. Mini Computers

### Super Computers

A supercomputer is **most powerful machines with the speed** terms of **peta floating-point operations per second (FLOPS)** instead of million instructions per second (MIPS).

These can perform over  $10^{17}$  FLOPS (a hundred quadrillion FLOPS, **100 petaFLOPS** or **100 PFLOPS**).

Speed	: petaFLOPS
Operating System	: Linux based O.S.
Processors	: Thousands of Processors
Nodes	: <b>Thousands of computing nodes</b> (e.g. 1376 computing nodes)
Each Node contains	: <b>12 core processor</b> with 2.5 GHz, <b>125 GB DRAM</b> , <b>100 GPU Nodes</b> , etc.
Cost	: More Expensive, Assume: It can be 5 lakh dollars to <b>200 million dollars</b> . (We Need Govt. fund for it)

### Uses of Supercomputers:

#### Biology Areas:

Mostly, supercomputer used to diagnose for various diseases, and provide the assistance for producing good result in strokes, brain injuries and other blood flow issues in your body.

#### Military and Defense Missions:

Supercomputing help to provide virtual testing for nuclear explosion and weapon launching.

#### Climate Patterns:

Supercomputer application is able to study and understand climate patterns.

#### Airlines Industry:

Design of flight simulators to training for new pilots.

#### Weather Forecasting:

The prediction of cyclone effect and other pollution level on the particular areas, and then take final step to prevent them

#### Scientific Research areas:

In the weather and science research areas depend on the supercomputer because for analyzing data from the exploring solar system, satellites that rounding earth, and other area such as nuclear research.

#### Advance database :(Data Mining)

Some large scale companies need the supercomputer for extracting useful information from data storage house or in the cloud system. Such as insurance companies.

#### Financial Market Place:

Supercomputer plays vital role in the real financial success in the emerging online currency world such as bit coin and stock market.

yotta [Y]	$10^{24} = 1\,000\,000\,000\,000\,000\,000\,000\,000$
zetta [Z]	$10^{21} = 1\,000\,000\,000\,000\,000\,000\,000$
exa [E]	$10^{18} = 1\,000\,000\,000\,000\,000\,000$
peta [P]	$10^{15} = 1\,000\,000\,000\,000\,000$
tera [T]	$10^{12} = 1\,000\,000\,000\,000$
giga [G]	$10^9 = 1\,000\,000\,000$
mega [M]	$10^6 = 1\,000\,000$
kilo [K]	$10^3 = 1\,000$
hecto [h]	$10^2 = 100$
deca [da]	$10^1 = 10$

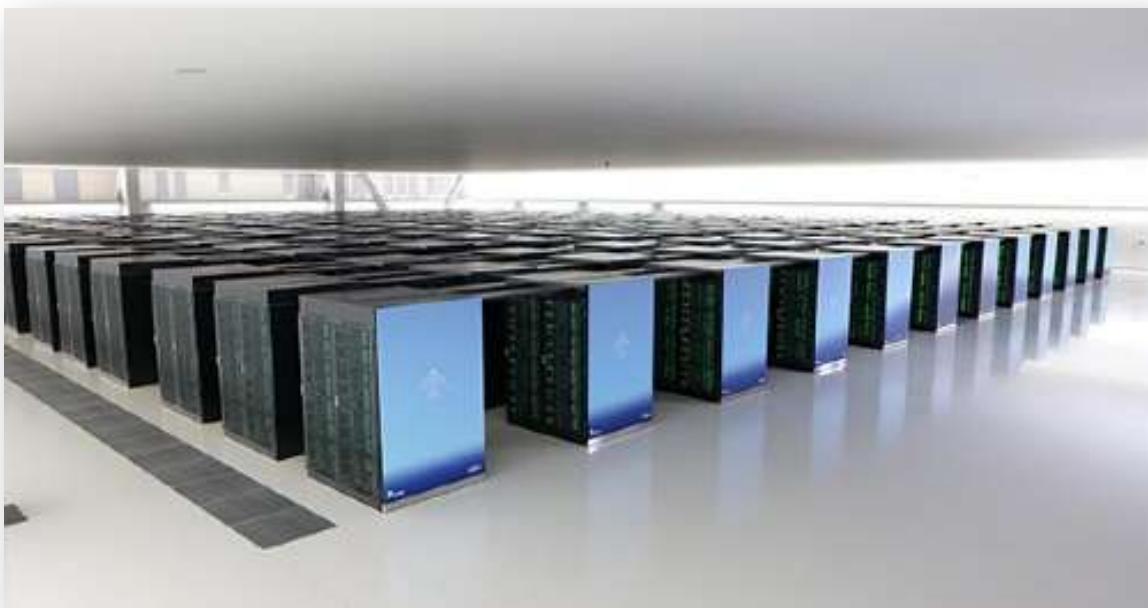


### Examples:

Top 5 Super Computers in the world

- 1) **Fugaku** , Japan, Speed is 415.5 petaflops.
- 2) **IBM's Summit**, 22-core Power 9 CPUs and six NVIDIA Tesla V100 GPUs, US. Speed is 148.8 petaflops.
- 3) **The Sierra system.** , two Power9 CPUs and four NVIDIA Tesla V100 GPUs in each of its 4,320 nodes. It can achieve 94.6 petaflops.
- 4) **Sunway TaihuLight.** , 93 petaflops.
- 5) **Tianhe-2A.** , Guangzhou. , 61.4 petaflops.

India's Super Computers: **PARAM Siddhi-AI and Mihir, Pratyush & Param Shivay. SahasraT (Cray XC40)**



World's Number 1 Super Computer: [Japan's Fugaku Supercomputer](#) Speed is 415.5 petaflops.

Two supercomputers from India — **PARAM Siddhi-AI and Mihir** — have made it to the **TOP500 list** of **the world's** most **powerful supercomputers**. The two systems have been ranked **63rd and**



**146th**, respectively, and remain the only two supercomputers from India in the latest list of TOP500 released on November 18.

**PARAM Siddhi-AI** has an Rpeak capacity of **5.267 Petaflops**. This **Artificial Intelligence-based system's** wide applications cover advanced materials, education, space, agriculture, defence and national security, computational chemistry and astrophysics, drug design and preventive healthcare systems, as well as flood forecasting in major cities like Delhi, Mumbai, Chennai, Patna and Guwahati.

## **PARAM Siddhi-AI India's fastest HPC-AI Supercomputer**



**'Mihir'** is a **2.8 Petaflop** supercomputer which has been operational at the National Centre for Medium Range Weather Forecast (NCMRWF), Noida. It is one of the powerful systems owned by the Ministry of Earth Sciences and has helped improve India's forecasting skills.

**Pratyush** and **Mihir** are the supercomputers established at **Indian Institute of Tropical Meteorology (IITM), Pune** and National Centre for Medium Range Weather Forecast (**NCMRWF**), **Noida** respectively. As of January 2018,

Pratyush and Mihir are the fastest supercomputer in India with a maximum **speed** of **6.8 PetaFlops** at a total cost of INR **438.9 Crore**.

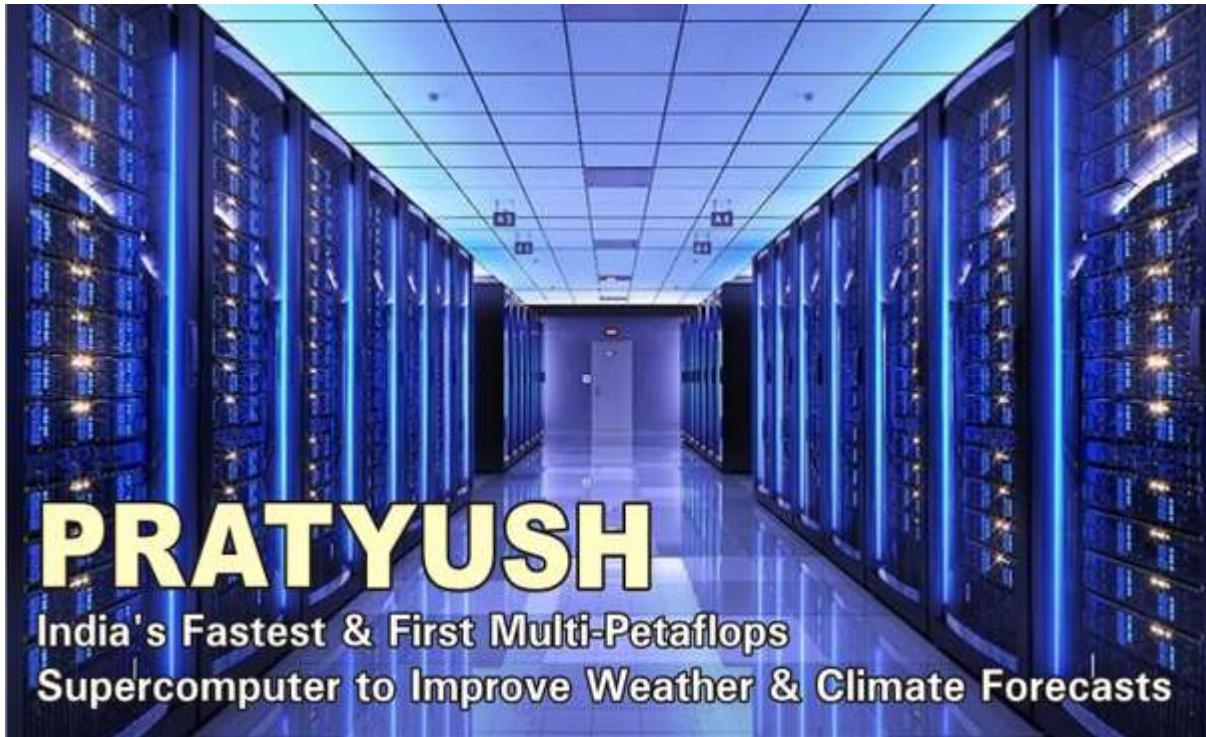
The word **Pratyush** ( प्रत्युष) defines the **rising sun**.



B.L.D.E.A's Vachana Pitamaha Dr. P. G. Halakatti College of Engineering and Technology, Vijayapur.

Affiliated to Visvesvaraya Technological University (VTU), Belagavi, Karnataka, India.

Lecture Video by : Mr. Chidanand S. Kusur, Asst. Prof. Dept. of CSE, [www.cskusur.blogspot.in](http://www.cskusur.blogspot.in), 9739762682



### Make in India Supercomputer: **Param Shivay (1991)**

The supercomputer named Param Shivay is of **833 teraflop** capacity, and it is built under the National Super Computing Mission at the Indian Institute of Technology (IIT), Banaras Hindu University (BHU).



Make in India Supercomputer: Param Shivay



The supercomputer will find its application in many different fields, such as climate assessment, weather forecasting, space engineering, seismic analysis, finance, disaster simulation and management, search astrophysics, macro-data analytics, information collection. Additionally, it will prove to be of great help in issues related to the common man, such as irrigation schemes, traffic management, health, an affordable drug and many more!

### **SahasraT (Cray XC40)**

**SahasraT** supercomputer is located at Supercomputer Education and Research Centre (SERC) facility at Indian Institute of Science in Bangalore. SERC is India's state-of-the-art research facility for high-performance computing in the field of science and engineering. This system bagged 96th position in the [Top500](#) list of top 500 supercomputers in the world.

#### **Uses:**

**SahasraT** provides service to our nation in the fields of aerospace engineering, meteorology predictions and astrological simulations. Also **SahasraT** is used for molecular and material research and mapping entire climate condition of the particular region via simulation. Overlapping of supernovae was simulated by the **SahasraT** system.

#### **Specifications:**

**SahasraT (CRAY XC40)** is the product of Cray Inc. An American supercomputer manufacturer.

This Supercomputer consist of Intel Haswell Xeon E5-2680v3 processors, NVIDIA K40 GPU accelerators and Intel Xeon Phi 5120D coprocessors.

There are around 1500 processors and coprocessors and 44 GPUs to handle complex tasks in the system.

Cray's Linux environment is used as the OS for the system.

**SahasraT** has been rated to 901.54 TFLOPS, which the highest rating amongst all supercomputers in India.



## Mainframe Computers

A **mainframe computer** is used primarily by **large organizations** to **run critical applications** to process **bulk data processing** such as the **census** and **industry** and **consumer statistics**, **enterprise resource planning**, and **large-scale transaction processing**.

A mainframe computer is larger and has more processing power than some other classes of computers, such as minicomputers, servers, workstations, and personal computers.

Mainframe computers are often **used as servers**. These are less powerful than super computers.

Speed is measured in **MEGAFOPS** (Millions of Floating Point Arithmetic Operations Per Second)

### Uses:

**Airline booking, railway ticket reservation ([www.irctc.co.in](http://www.irctc.co.in)) and network banking.**

### Examples

IBM 3000, VAX 8000 and CDC 6600





## Mini Computers

A minicomputer is a **class of smaller general purpose computers**. These are **less powerful than mainframe and mid-size computers**.

The class formed a distinct group with its own software architectures and operating systems.

**Used in small private business environments.**

Middle range as compare to both

**Examples** for mini computers are PDP 11, VAX 7500 etc.



*Don't quit yet, the worst moments are usually followed by the most beautiful silver linings. You just have to stay strong, remember to keep your head up and remain hopeful.*



*Therightmessages.com*