

# Overview of Computers

## Lecture 1

Based on the text book  
**Fundamentals of Computer by E.Balagurushamy**

# Content

1. What is Computer?
2. Evolution of Computer
3. Generation of Computer
4. Classification of Computer
5. Parts of Computer System

- A long time ago, human are using their fingers, stones etc to do calculation.
- At the same time, they are trying to create an apparatus that could facilitate the calculation process.
- After a few trial, finally the complex and advance calculation system has been produced and it is known as a computer.

- The History & Evolution Of Computer Basically, the history of computer development is divided into 2 parts :

**before 1940 & after 1940 .**



# **BEFORE 1940**



# Abacus Counting Device

- Created on 3000 B.D. at Babylonia.
- Was the first mechanical counting device in the world.
- Able to execute addition and subtraction operation .



# John Napier's Bone



- Created on 1614 by John Napier.
- Facilitate multiplication and division processes – faster & easier.
- The first logarithm table has been created.

# Napier's Bones

1. It is manual calculating device.
2. The device consisted of rods made of bones, ivory or metal with numbers written on them.
3. It was mainly used for multiplication and division.
4. It was developed in Scotland.
5. John Napier is known as inventor of Napier's Bones.
6. He was born in Edinburgh, Scotland in 1 February, 1550.

<b>x</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<b>1</b>	0 1	0 2	0 3	0 4	0 5	0 6	0 7	0 8	0 9
<b>2</b>	0 2	0 4	0 6	0 8	0 0	1 2	1 4	1 6	1 8
<b>3</b>	0 3	0 6	0 9	1 2	1 5	1 8	1 1	1 4	1 7
<b>4</b>	0 4	0 8	1 2	1 6	2 0	2 4	2 8	2 2	3 6
<b>5</b>	0 5	1 0	1 5	2 0	2 5	3 0	3 5	4 0	4 5
<b>6</b>	0 6	1 2	1 8	2 4	3 0	3 6	4 2	4 8	5 4
<b>7</b>	0 7	1 4	2 1	2 8	3 5	4 2	4 9	5 6	6 3
<b>8</b>	0 8	1 6	2 4	3 2	4 0	4 8	5 6	6 4	7 2
<b>9</b>	0 9	1 8	2 7	3 6	4 5	5 4	6 3	7 2	8 1

	<b>5</b>
1	0 5
2	1 0
3	1 5
4	2 0
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6	3 0
7	3 5
8	4 0
9	4 5

	5	4	7
1	0	5	0
2	1	0	8
3	1	5	1
4	2	0	1
5	2	5	2
6	3	0	2
7	3	5	2
8	4	0	3
9	4	5	3

	5	4	7
1	0	5	0
2	1	0	8
3	1	5	1
4	2	0	1
5	2	5	2
6	3	0	2
7	3	5	2
8	4	0	3
9	4	5	3

$$\begin{array}{r}
 3 \times 678 \\
 \times 678 \\
 \hline
 2034
 \end{array}$$

**5846 X 3 = 17538**

**5846 X 2 = 11692**

$$\begin{array}{r} 17538 \\ + 116920 \\ \hline 134458 \end{array}$$

1	7	3	73
2	1	4	146
3	2	1	219
4	2	1	292
5	3	1	365
6	4	1	438
7	4	2	511
8	5	2	584
9	6	2	657

$$19491 \div 73$$

$$\begin{array}{r}
 73 \overline{)19491} \\
 14600 \quad 200 \\
 \hline
 4891 \\
 4380 \quad 60 \\
 \hline
 511 \\
 511 \quad 7 \\
 \hline
 0
 \end{array}$$

267

1	5	7	8
2	1 0	1 4	1 6
3	1 5	2 1	2 4
4	2 0	2 8	3 2
5	2 5	3 5	4 0
6	3 0	4 2	4 8
7	3 5	4 9	5 6
8	4 0	5 6	6 4
9	4 5	6 3	7 2

578  
1156  
1734  
2312  
2890  
3468  
4046  
4624  
5202

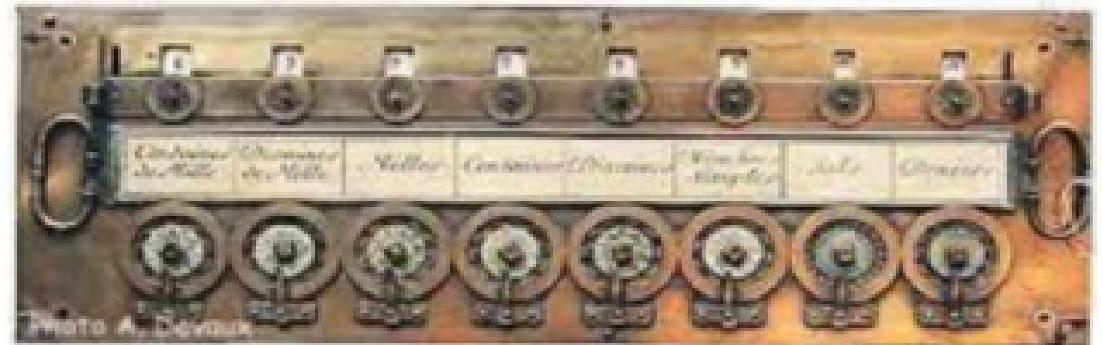
$$2268072 \div 578$$

$$\begin{array}{r}
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 1734000 \quad 3000 \\
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 534 \quad 672 \\
 520 \quad 200 \quad 900 \\
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 138 \quad 72 \\
 115 \quad 60 \quad 20 \\
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 231 \quad 2 \\
 231 \quad 2 \quad 4 \\
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 \end{array}$$

3924

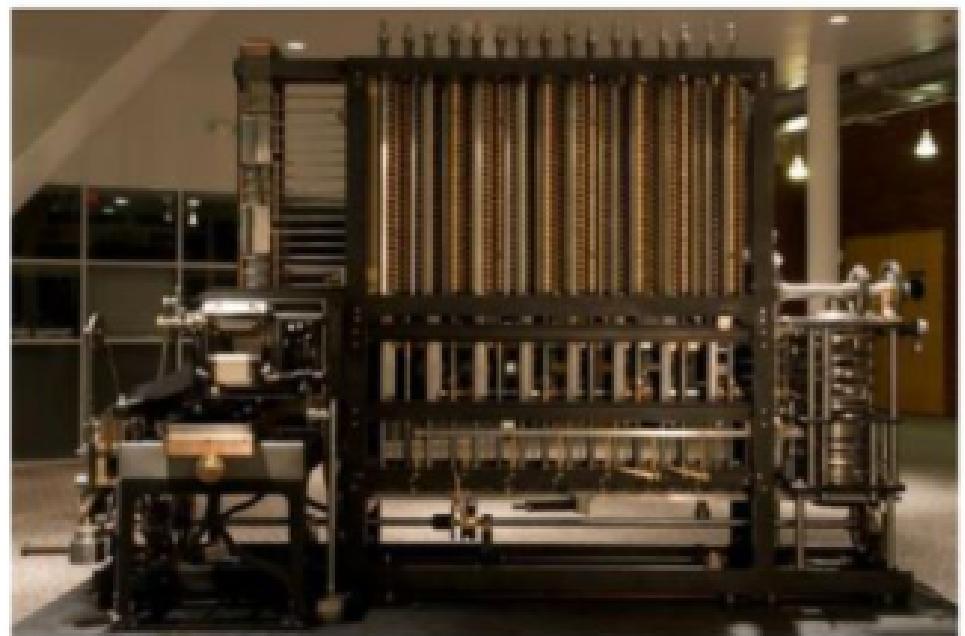
# Pascaline Machine

- Created on 1642 by Blaise Pascal.
- Was the first mechanical machine or calculator in the world.
- Able to execute addition and subtraction processes.



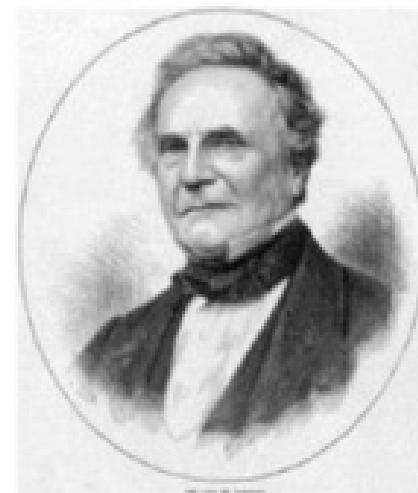
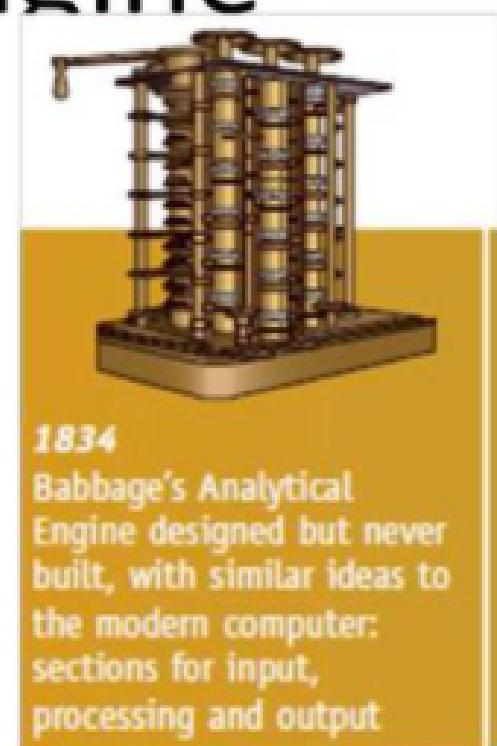
# Babbage Differentiation Machine

- Created by Charles Babbage on 1821.
- Was the first mechanical machine which is used the steam power.
- Able to do a calculation and printing the output automatically.



# Babbage Analytical Engine

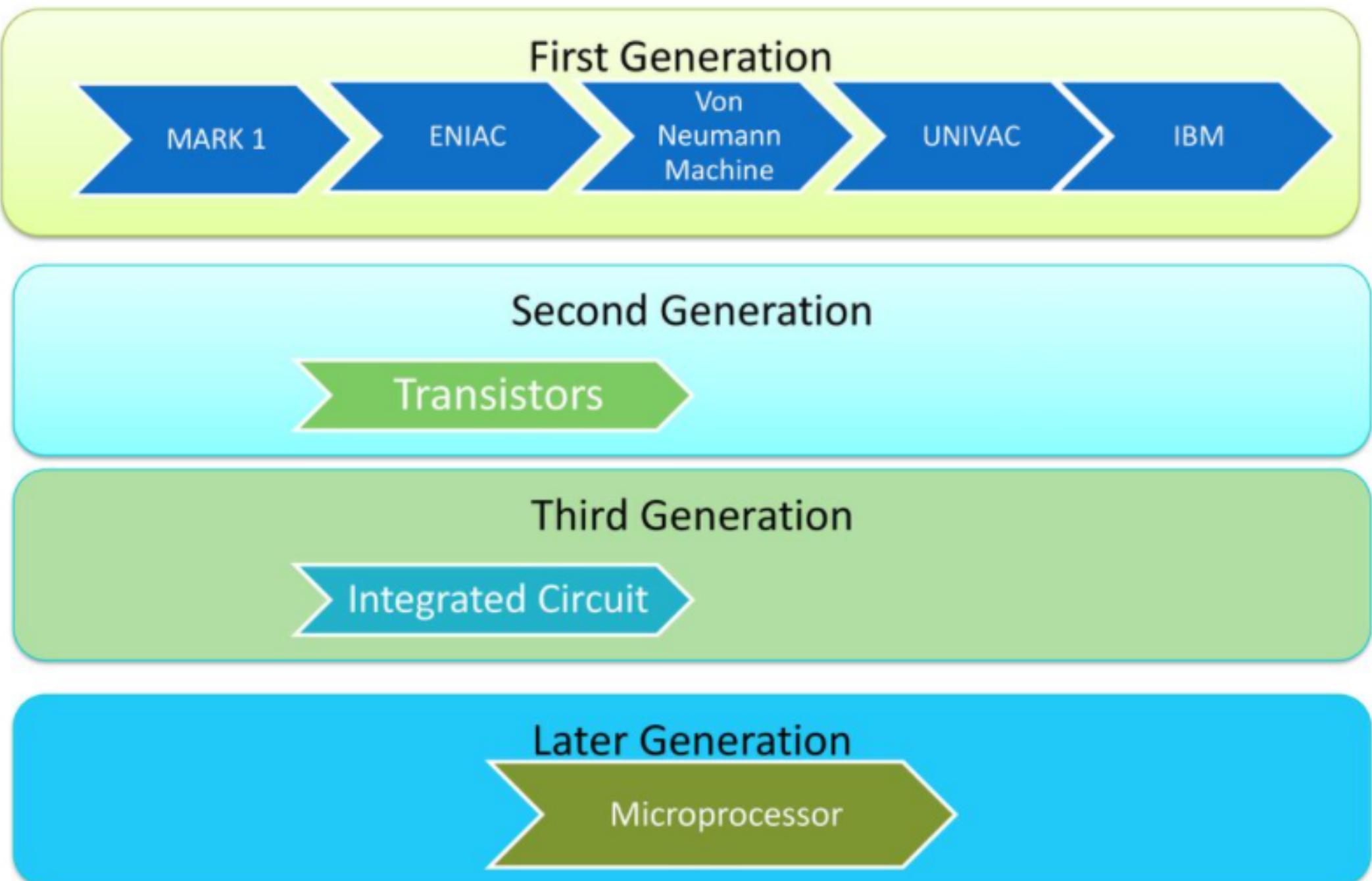
- It has five (5) main parts :
  - Input unit
  - Output unit
  - Processing Unit
  - Control unit
  - Memory unit
- His invention has became a theory model for today's computer technology. Because of that, Charles Babbage has been known as The Ancestor of A Modern Computer

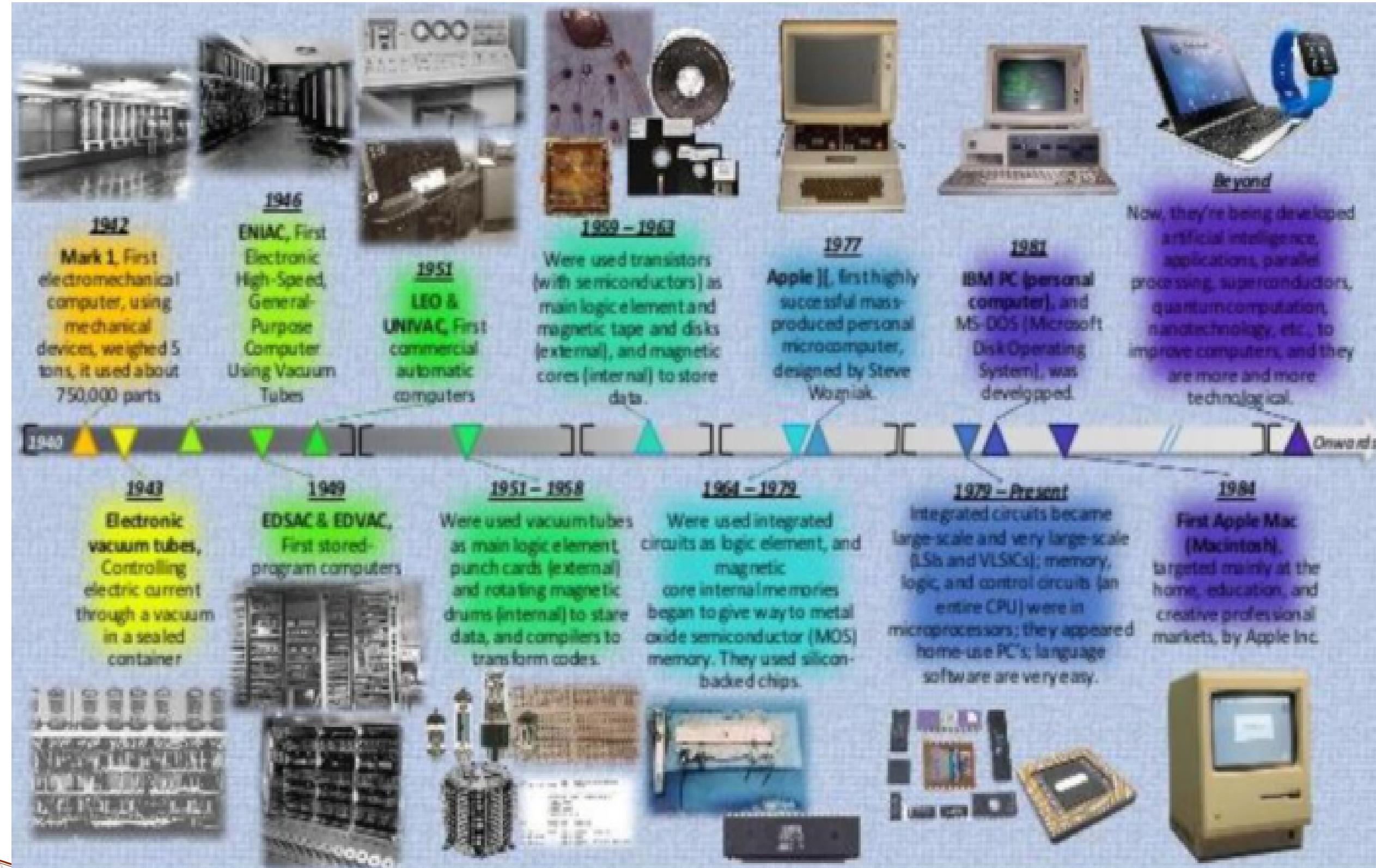


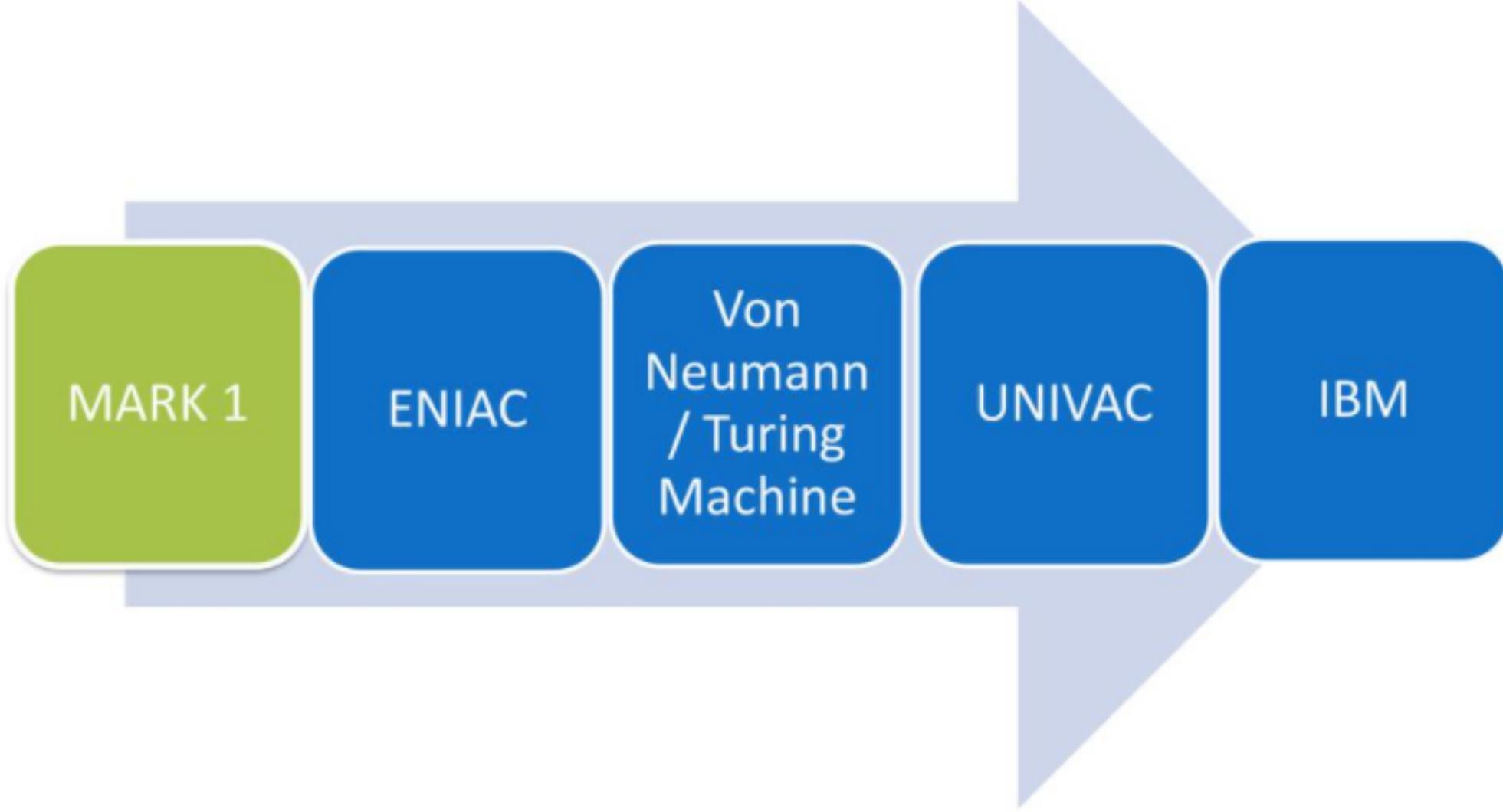
# After 1940



# Evolution







# Mark 1

- Created on 1941 by Dr. Howard Aikern in conjunction with IBM.
- Was the first electro-mechanical computer.
- Size : 55 feet long, 8 feet height and connected with 800 km of wire.

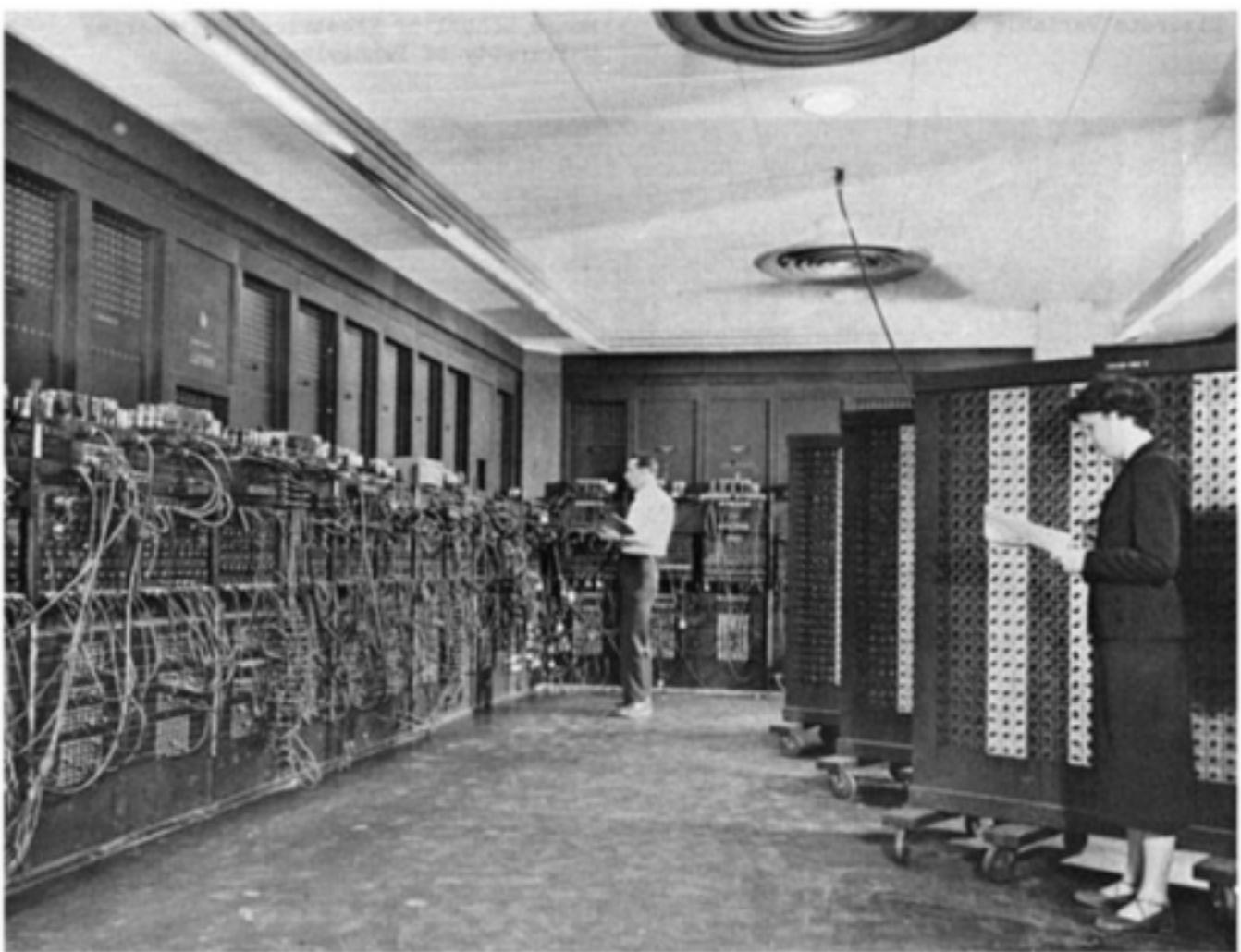


# ENIAC

- Electronic Numerical Integrator And Computer
- Eckert and Mauchly
- University of Pennsylvania
- Trajectory tables for weapons
- Started 1943
- Finished 1946
  - ENIAC was created to help with the war effort against German forces. Used until 1955

# ENIAC

- Decimal (not binary)
- 20 accumulators of 10 digits
- Programmed manually by switches
- 18,000 vacuum tubes
- 30 tons
- 15,000 square feet
- 140 kW power consumption
- 5,000 additions per second
- 1000 times faster than Mark 1.



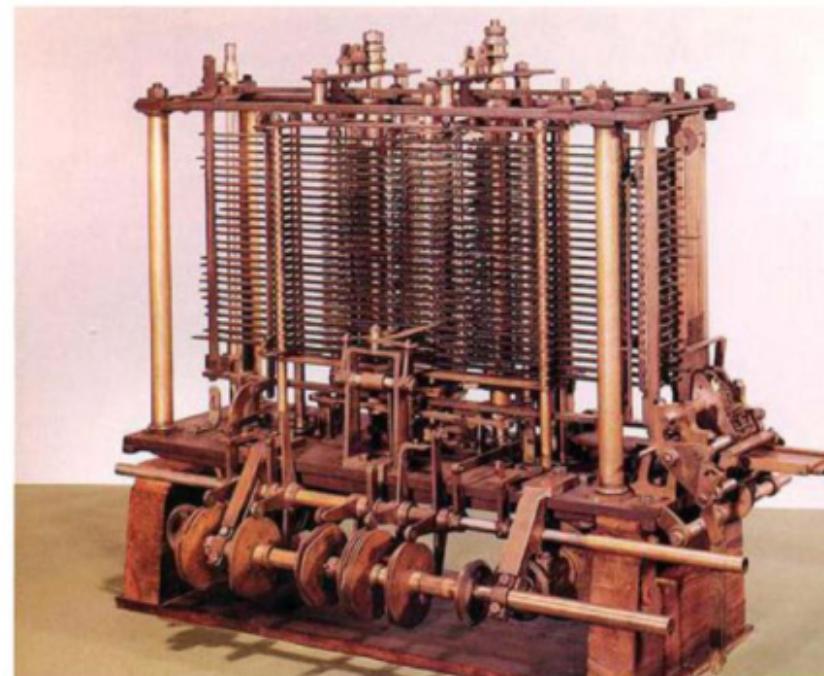
# Stored-program concept

- The task of entering and altering program is tedious for ENIAC. Suppose a program could be represented in a form suitable for storing in memory alongside data. Then computer could get its instruction by reading them from memory and program could be set or altered by settings the values of a portion of memory. This idea is known as stored-program concept an developed by Von Neumann referred to IAS computer.

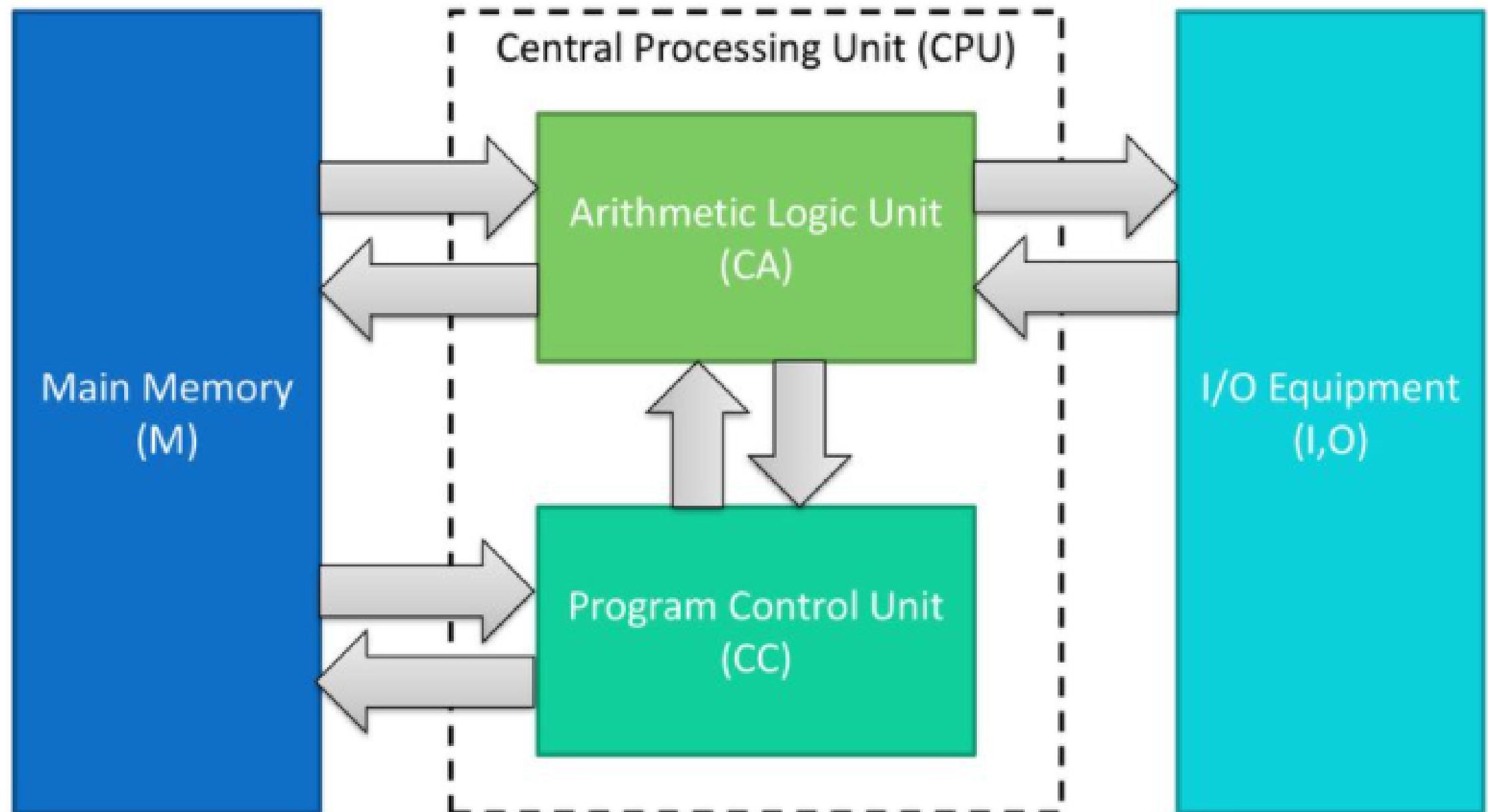
# Von Neumann / Turing Machine

- Stored Program concept
  - Main memory storing programs and data
  - ALU operating on binary data
  - Control unit interpreting instructions from memory and executing
- Input and output equipment operated by control unit

## Von Neumann / Turing Machine - Example



# Von Neumann Machine - Structure



# Von Neumann earlier proposal

- First – since the device is primarily a computer, it will have to perform addition, subtraction, multiplication or division therefore it need special organs to do it, therefore come the CA
- Second- The logical control of the device that is the proper sequencing of its operation, carried out by central control organ, therefore come the second part, CC

- Third – Any device that is to carried out long and complicated operation need considerable memory, therefore come the third specific part of the device, M
- These three specific part called CC, CA and M correspond to the associative neurons nervous system
- Fourth- The device need an organ to transfer from R to specific part of C or M, these organ form its input called, I.
- Fifth – The device must have an organ to transfer from C or M to R outside specific medium. These organ form O, output.

# Universal Automatic Computer (UNIVAC)

A large blue arrow points from left to right, containing two circular markers. The first marker is blue and positioned near the start of the arrow, corresponding to the year 1947. The second marker is cyan and positioned further along the arrow, corresponding to the late 1950s. The text for each marker is aligned to its right.

1947  
UNIVAC I  
Eckert-Mauchly Formed  
Computer Corporation  
(to manufacture computer  
commercially)

Late 1950  
UNIVAC II  
Part of  
Sperry-Rand  
Corporation

- Faster & more  
memory

# UNIVAC

- UNIVAC I – the first successful commercial computer. Used for scientific and commercial application ie, matrix algebraic computation, statistical problem, premium billings, or life insurance company and logistic problem.
- UNIVAC II – greater memory capacity and higher performance

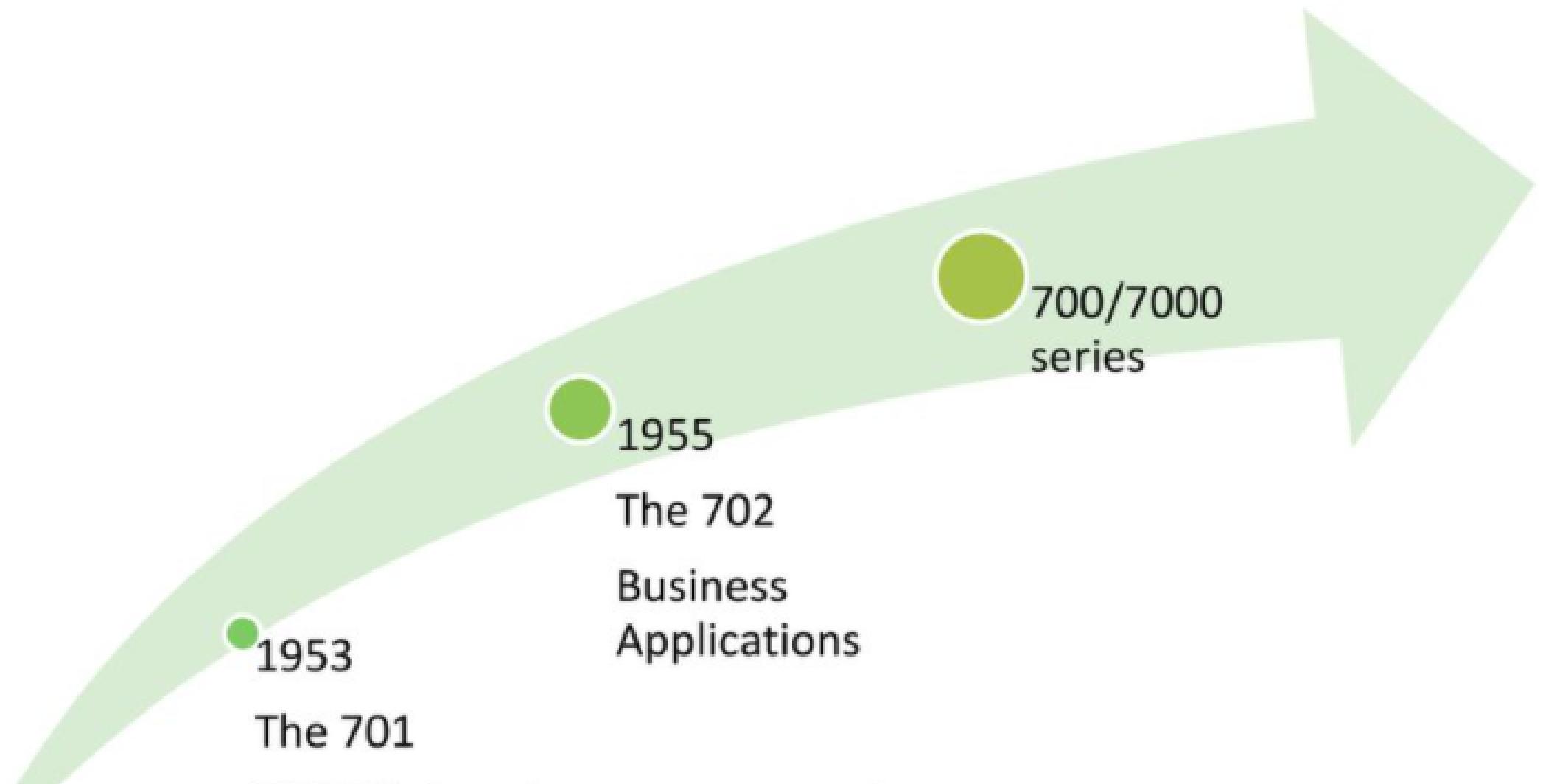
## UNIVAC - Example



# **Second Generation Machine**



# IBM



# IBM 701



# IBM 702

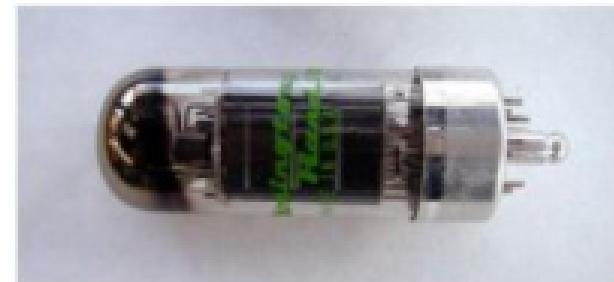


# IBM 700/7000



# Transistors

- Made from Silicon (Sand)
- Invented 1947 at Bell Labs
- William Shockley et al.
- Replaced vacuum tubes: wires, metal plates, glass capsule and vacuum.
- Solid State device made from silicon.



# Advantages of Transistors

- Smaller
- Cheaper
- Less heat dissipation

# Transistors Based Computers

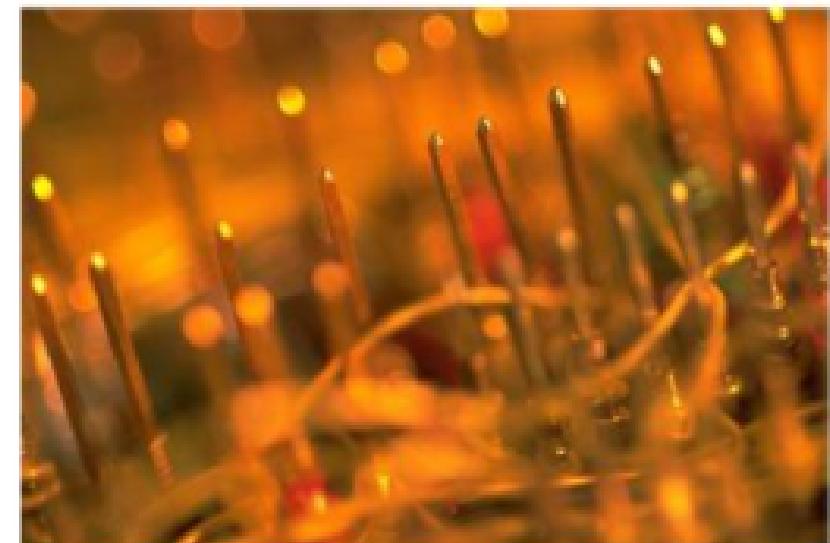
- Second generation machines
- NCR & RCA produced small transistor machines
- IBM 7000
- Digital Equipment Corporation(DEC) - 1957
  - Produced PDP-1 – first mini computer phenomenon.

# **Third Generation Machine**



# Integrated Circuit/Microelectronics

- Literally - “small electronics”
- Transistors were replaced by integrated circuits(IC)
- One IC could replace hundreds of transistors
- This made computers even smaller and faster.

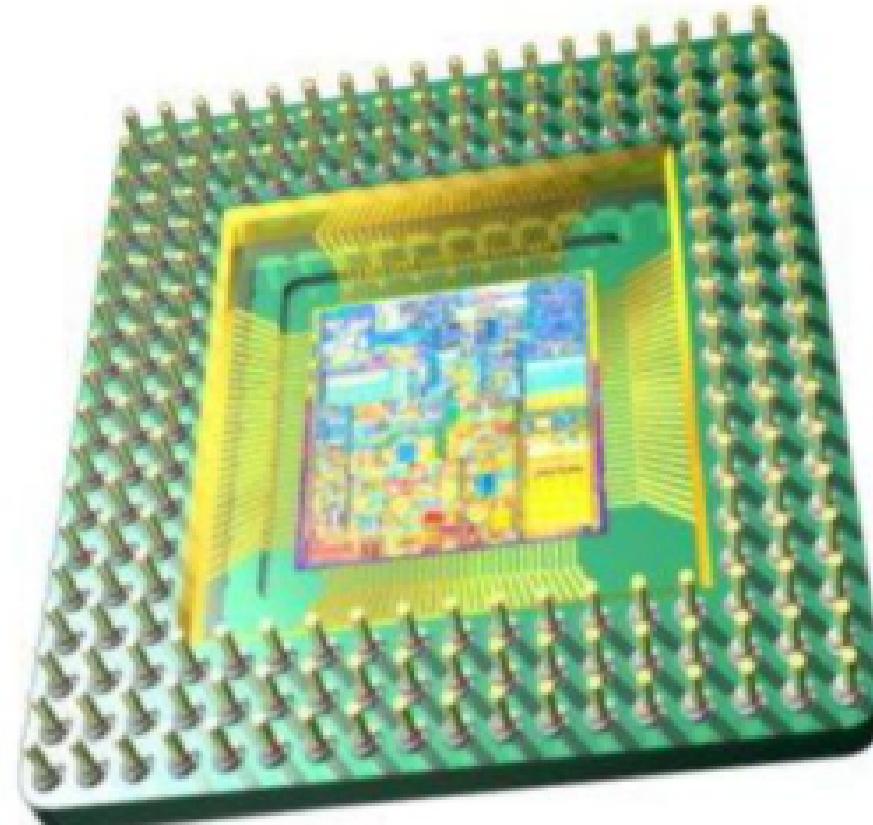


# Later Generation Computers



# Later Generation Computers

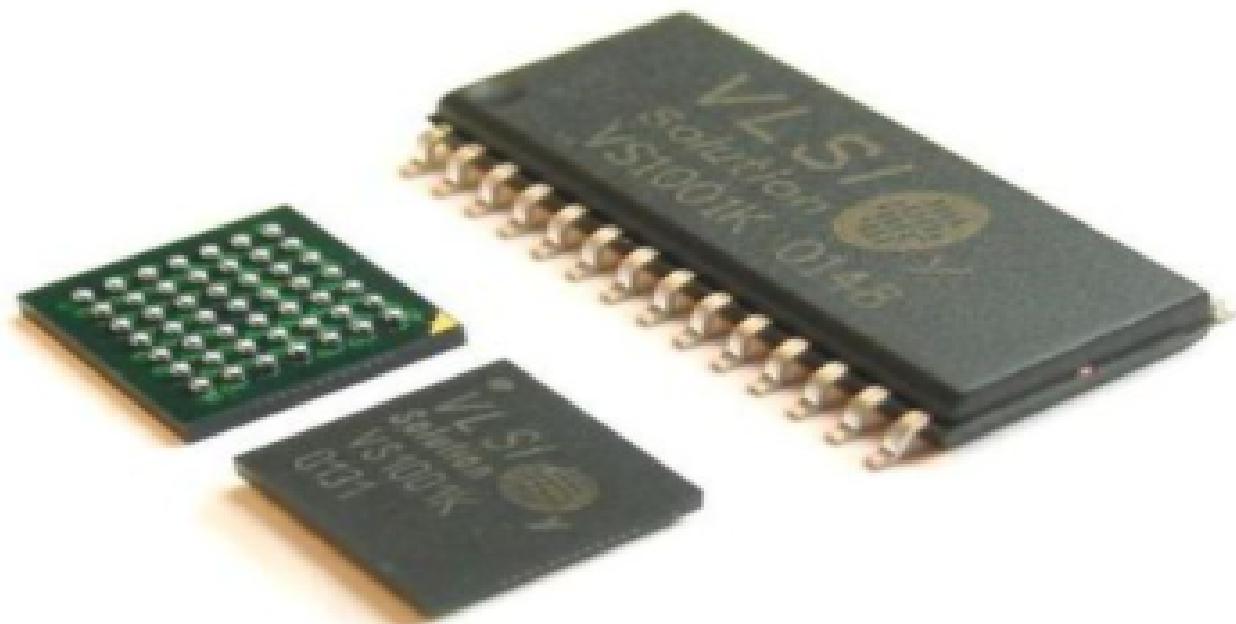
- In 1970 the Intel Corporation invented the Microprocessor: an entire CPU on one chip
- This led to microcomputers-computers on a desk



May 2014

# Later Generation Computers

- This transformation was a result of the invention of the ***microprocessor***.
- A microprocessor (uP) is a computer that is fabricated on an integrated circuit (IC).
- Computers had been around for 20 years before the first microprocessor was developed at ***Intel*** in 1971.



# Microprocessor

- More than 1000 component can be placed on a single integrated chip. VLSI achieved more than 10000 component on single chip.
- Just as density of element of memory chips has continue to rise, so has the density of elements on processor chips. As time went on, more and more elements were placed on each chip, so that fewer and fewer chips were needed to construct. a single computer processor. A breakthrough is achieved on 1971.

# Intel

Year	Computer Name	Description
1971	4004	<ul style="list-style-type: none"><li>• First microprocessor</li><li>• All CPU components on a single chip</li><li>• 4 bit</li></ul>
1972	8008	<ul style="list-style-type: none"><li>• 8 bit</li><li>• Both designed for specific applications</li></ul>
1974	8080	<ul style="list-style-type: none"><li>• Intel's first general purpose microprocessor</li></ul>

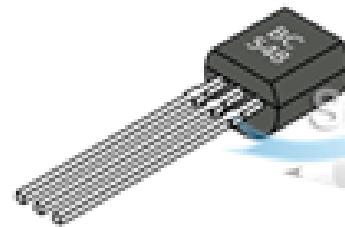
# Generation of Computer

First Generation  
( 1946-1959 )



Vacuum Tube

Second Generation  
( 1959-1965 )



Transistors

Third Generation  
( 1965-1971 )



Integrated Circuit

Fourth Generation  
( 1971-1980 )



Very Large Scale Integration

Fifth Generation  
( 1980-Present )

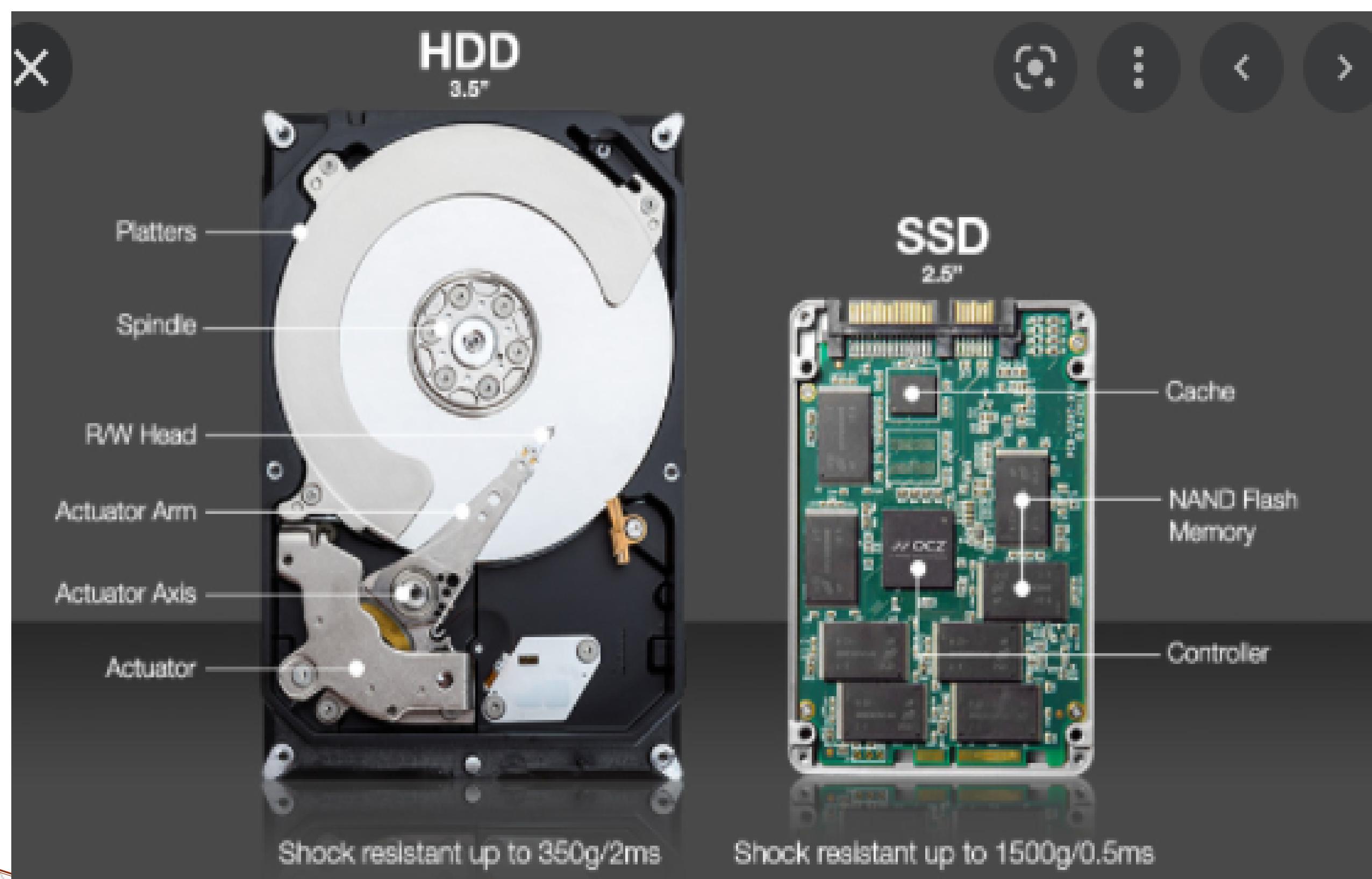


Sitesbay.com  
Ultra Large Scale Integration

# COMPUTER GENERATIONS

GENERATION	HARDWARE COMPONENTS	CHARACTERISTICS	COMPUTERS
<b>First Generation</b> (1942-1959)		<ul style="list-style-type: none"> <li>④ Vacuum Tubes</li> </ul>	<ul style="list-style-type: none"> <li>④ ENIAC</li> <li>④ UNIVAC</li> <li>④ EDVAC</li> <li>④ EDSAC</li> <li>④ IBM-701</li> </ul>
<b>Second Generation</b> (1959-1965)		<ul style="list-style-type: none"> <li>④ Transistors</li> <li>④ Magnetic Tapes</li> </ul>	<ul style="list-style-type: none"> <li>④ Batch processing, Multiprogramming OS</li> <li>④ Expensive</li> <li>④ FORTRAN, COBOL</li> </ul>
<b>Third Generation</b> (1965-1975)		<ul style="list-style-type: none"> <li>④ Integrated Circuits</li> </ul>	<ul style="list-style-type: none"> <li>④ Remote processing, time-sharing, Multiprogramming OS</li> <li>④ Faster, Compact &amp; Cheaper</li> <li>④ PASCAL, PL/I, BASIC, ALGOL-68</li> </ul>
<b>Fourth Generation</b> (1975-1988)		<ul style="list-style-type: none"> <li>④ VLSI Microprocessor circuits</li> </ul>	<ul style="list-style-type: none"> <li>④ Time-sharing, real-time networks, distributed, GUI OS</li> <li>④ Faster, Compact &amp; Affordable</li> <li>④ C, C++, DBASE</li> </ul>
<b>Fifth Generation</b> (1988-Present)		<ul style="list-style-type: none"> <li>④ ULSI Microprocessor circuits</li> </ul>	<ul style="list-style-type: none"> <li>④ Parallel Processing &amp; Artificial Intelligence technology</li> <li>④ C and C++, Java, Net</li> </ul>

<b>SSD</b>	<b>HDD</b>	<b>SDD</b>	<b>HDD</b>
<ul style="list-style-type: none"> <li>• SSD stands for 'Solid State Drive'.</li> </ul>	<ul style="list-style-type: none"> <li>• HDD stands for 'Hard Disk Drive'.</li> </ul>	<ul style="list-style-type: none"> <li>Less power</li> </ul>	<ul style="list-style-type: none"> <li>More power</li> </ul>
<ul style="list-style-type: none"> <li>• SSD consists of Electrical Parts, e.g., ICs.</li> </ul>	<ul style="list-style-type: none"> <li>• HDD consists of Moving Mechanical Parts, e.g., arm.</li> </ul>	<ul style="list-style-type: none"> <li>Expensive</li> </ul>	<ul style="list-style-type: none"> <li>Cheaper</li> </ul>
<ul style="list-style-type: none"> <li>• SSD is expensive.</li> </ul>	<ul style="list-style-type: none"> <li>• HDD is inexpensive.</li> </ul>	<ul style="list-style-type: none"> <li>Less than 1TB for notebooks and 4TB max for desktops</li> </ul>	<ul style="list-style-type: none"> <li>Minimum 500 GB and max at 2TB, 10 TB max for desktops</li> </ul>
<ul style="list-style-type: none"> <li>• SSD is available in compact sizes and is relatively fast.</li> </ul>	<ul style="list-style-type: none"> <li>• HDD is comparatively larger and is slower than SSD.</li> </ul>	<ul style="list-style-type: none"> <li>Operating system boot time is 10-13 seconds</li> </ul>	<ul style="list-style-type: none"> <li>Operating system boot time is 30-40 seconds</li> </ul>
		<ul style="list-style-type: none"> <li>No moving parts, so no sound</li> </ul>	<ul style="list-style-type: none"> <li>Clicks and spinning can be heard</li> </ul>
		<ul style="list-style-type: none"> <li>No vibrations</li> </ul>	<ul style="list-style-type: none"> <li>Spinning platter results in vibrations</li> </ul>
		<ul style="list-style-type: none"> <li>Little heat generation</li> </ul>	<ul style="list-style-type: none"> <li>Generates more heat</li> </ul>
		<ul style="list-style-type: none"> <li>File opening speed is faster</li> </ul>	<ul style="list-style-type: none"> <li>File opening speed is slower</li> </ul>
		<ul style="list-style-type: none"> <li>Safe from magnetic effect</li> </ul>	<ul style="list-style-type: none"> <li>Magnets can erase data</li> </ul>



# **Exercise**

- 1) What is stored-program concept?**
- 2) Before 1940, what kind of device that we are using to calculate,**
- 3) How many generation of computer do we have? Named three of them**
- 4) Based on Q3, describe and explain one of the generation of computer that you are interested and why?**
- 5) Describe the Von Neumann earlier proposal of a computer**
- 6) Explain how IAS send its instruction and execute them, i.e using MBR or IR, how's the flow?**
- 7) what is the advantage of integrated circuit?**

# What's a Computer?

A **computer** is an *electronic machine* that takes input from the *user*, processes the given input and generates output in the form of useful information.

**Charles Babbage:** A professor of mathematics in the Cambridge University is considered to be the father of modern computer.

# Evolution of Computer

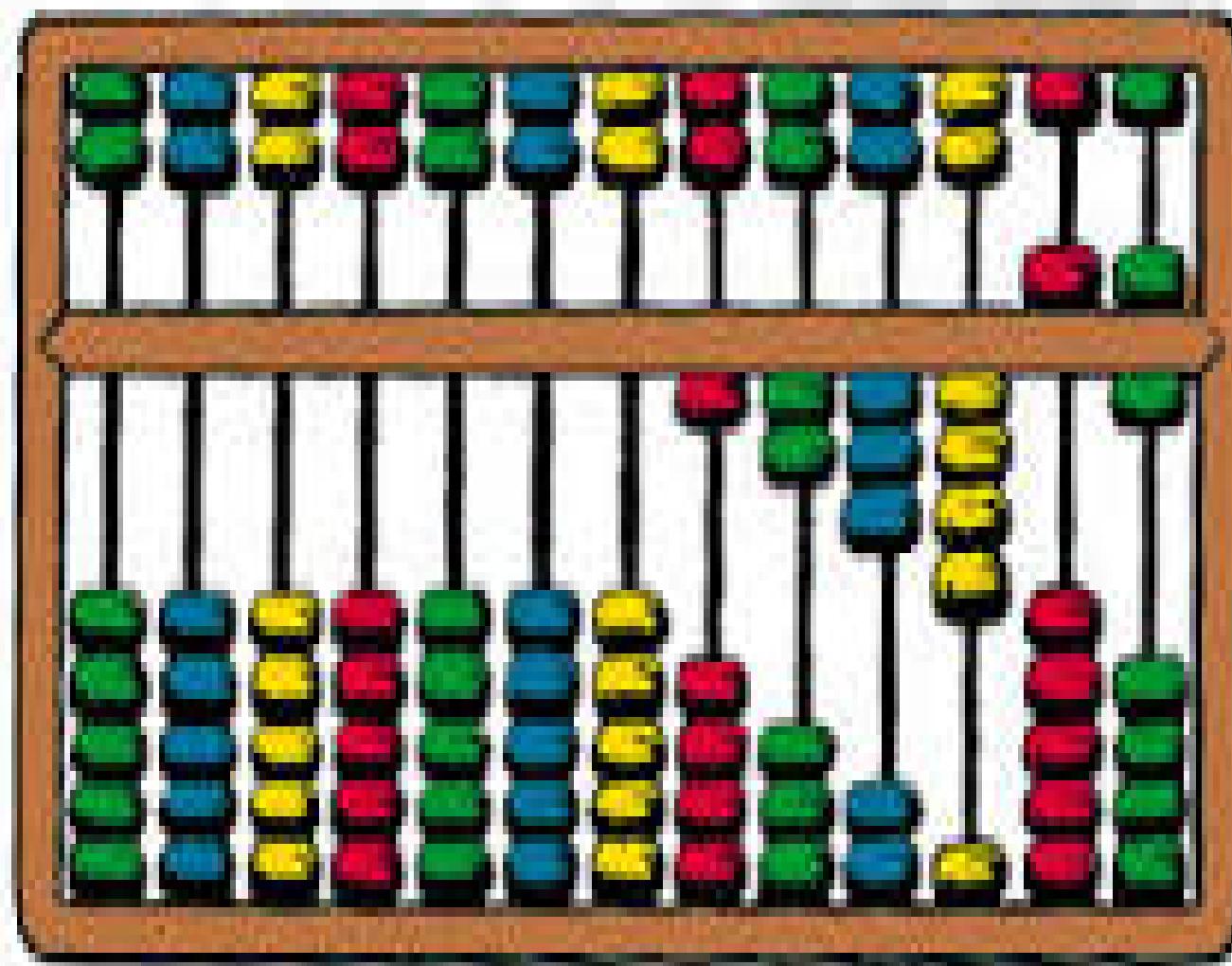
1. Manual Computing Devices
2. Automated Computing Devices

## Manual Computing Devices

- Sand table
- Abacus
- Napier Bones

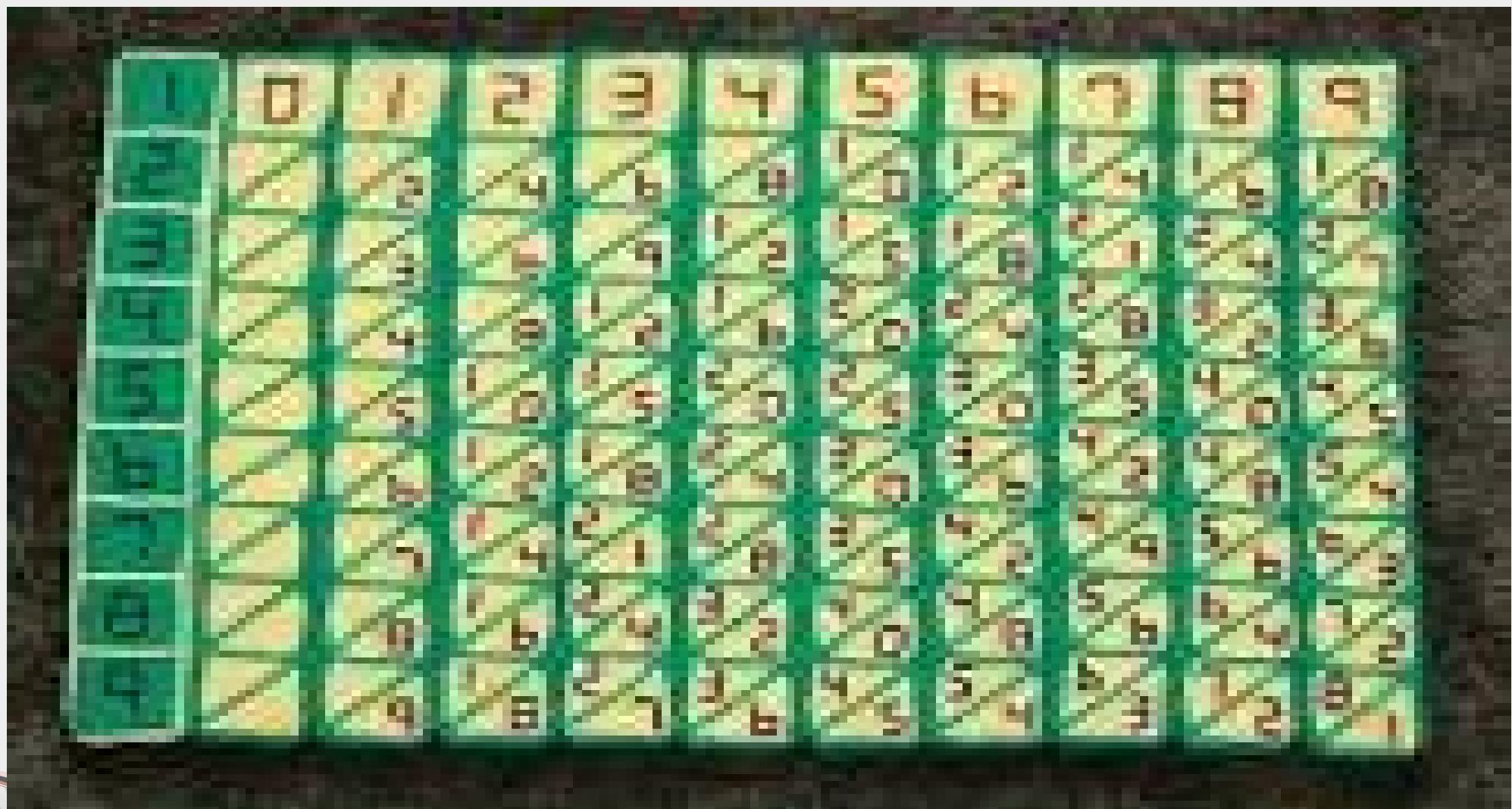
# Evolution of Computer

Abacus:



# Evolution of Computer

## Napier Bones:



# Evolution of Computer

## Automated Computing Devices:

- Difference engine,
- Analytical engine,

# Generations of Computers

## First Generation Computers

Employed during the period 1940-1956.

Used the vacuum tubes technology for calculation as well as for storage and control purpose.

### Advantages:

- (1) Fastest computing devices of their time;
- (2) These computers were able to execute complex mathematical problems in an efficient manner.

# Generation of Computer

## First Generation Computers:

### Disadvantages:

- (1) The functioning of these computers depended on the machine language.
- (2) There were generally designed as special-purpose computers.
- (3) The use of vacuum tube technology make these computers very large and bulky.
- (4) They were not easily transferable from one place to another due to their huge size and also required to be placed in cool places.
- (5) They were single tasking because they could execute only one program at a time.
- (6) The generated huge amount of heat and hence were prone to hardware faults.

# Generations of Computer

## Second Generation Computers:

Employed during the period 1956-1963

Use transistors in place of vacuum tubes in building the basic logic circuits.

### Advantages:

- (1) Fastest computing devices of their time;
- (2) Easy to program because of the use assembly language;
- (3) Could be transferred from one place to other very easily because they were small and light;
- (4) Require very less power in carrying out their operations;
- (5) More reliable, did not require maintenance at regular intervals of time.

# Generation of Computer

## Second Generation Computers:

### Disadvantages:

- (1) The functioning of these computers depended on the machine language.
- (2) There were generally designed as special-purpose computers.
- (3) The use of vacuum tube technology make these computers very large and bulky.
- (4) They were not easily transferable from one place to another due to their huge size and also required to be placed in cool places.
- (5) They were single tasking because they could execute only one program at a time.
- (6) The generated huge amount of heat and hence were prone to hardware faults.

# Generation of Computer

## Third Generation Computers:

Employed during the period 1964-1975. Use of Integrated Circuits

### Advantages:

- (1) Fastest computing devices.
- (2) Very productive.
- (3) Easily transportable from one place to another because of their small size.
- (4) Use high-level languages.
- (5) Could be installed very easily and required less space.
- (6) Can execute any type of application.
- (7) More reliable and require less frequent maintenance schedules.

# Generation of Computer

## Disadvantages:

- (1) The storage capacity of these computers was still very small.
- (2) The performance of these computers degraded while executing large applications, involving complex computations because of the small storage capacity.
- (3) The cost of these computers was very high.
- (4) They were still required to be placed in air-conditioned places.

# Generation of Computer

## Fourth Generation Computers:

Employed during 1975-1989 and Use of Large Scale Integration technology(LSI) and Very Large Scale Integration technology(VLSI).

The term Personal Computer (PC) became known to the people during this era.

### Advantages:

- (1) Very powerful in terms of their processing speed and access time.
- (2) Storage capacity was very large and faster.
- (3) Highly reliable and required very less maintenance.

# Generation of Computer

## Fourth Generation Computers

### Advantages:

- (4) User-friendly environment;
- (5) Programs written on these computers were highly portable;
- (6) Versatile and suitable for every type of applications;
- (7) Require very less power to operate.

### Disadvantages:

- (1) The soldering of LSI and VLSI chips on the wiring board was not an easy task and required complicated technologies to bind these chips on the wiring board.
- (2) The working of these computers is still dependent on the instructions given by the programmer.

# Generation of Computer

## Fifth Generation Computers:

The different types of modern digital computers come under this category. Use Ultra Large Scale Integration technology(ULSI) that allows almost ten million electronic components to be fabricated on one small chip.

## Advantages:

- (1) Fastest and powerful computers till date.
- (2) Being able to execute a large number of applications at the same time and that too at a very high speed.

# **Generation of Computer**

## **Fifth Generation Computers:**

### **Advantages:**

- (3) Decreasing the size of these computers to a large extent.
- (4) The users of these computers find it very comfortable to use them because of the several additional multimedia features.
- (5) They are versatile for communications and resource sharing.

# Classification of Computer

We can classify the computers according to the following three criteria:

- (1) Based on operating principles
- (2) Based on applications
- (3) Based on size and capability

# Classification of Computer

**Based on operating principles:**

**Analog computers:** represent data in the form of continuous electrical signals having a specific magnitude

**Digital computers:** store and process data in the digital form.

**Hybrid computers:** a combination of analog computer and digital computer because it encompasses the best features of both.

# Classification of Computer

**Based on applications:**

**General purpose computers:** can work in all environments.

**Special purpose computers:** can perform only a specified task.

# Classification of Computer

**Based on size and capability:**

**Microcomputers:** Designed to be used by individuals.

**Mini Computers:** Can handle more data and more input and output than micro computers.

**Mainframe Computers:** A very large computer.

**Super Computers:** The fastest type of computer that can perform complex operations at a very high speed.

# Data and Information

Data consists of individual facts that are not organized in a meaningful way.

Information is the processed raw data.

# Bit and Byte

Bit is a single unit of binary data representation.

One byte is a string of 8 bits. One byte is used to represent a character.

1 Byte = 8 bits

# Parts of a Computer System

A complete computer system consists of following parts-

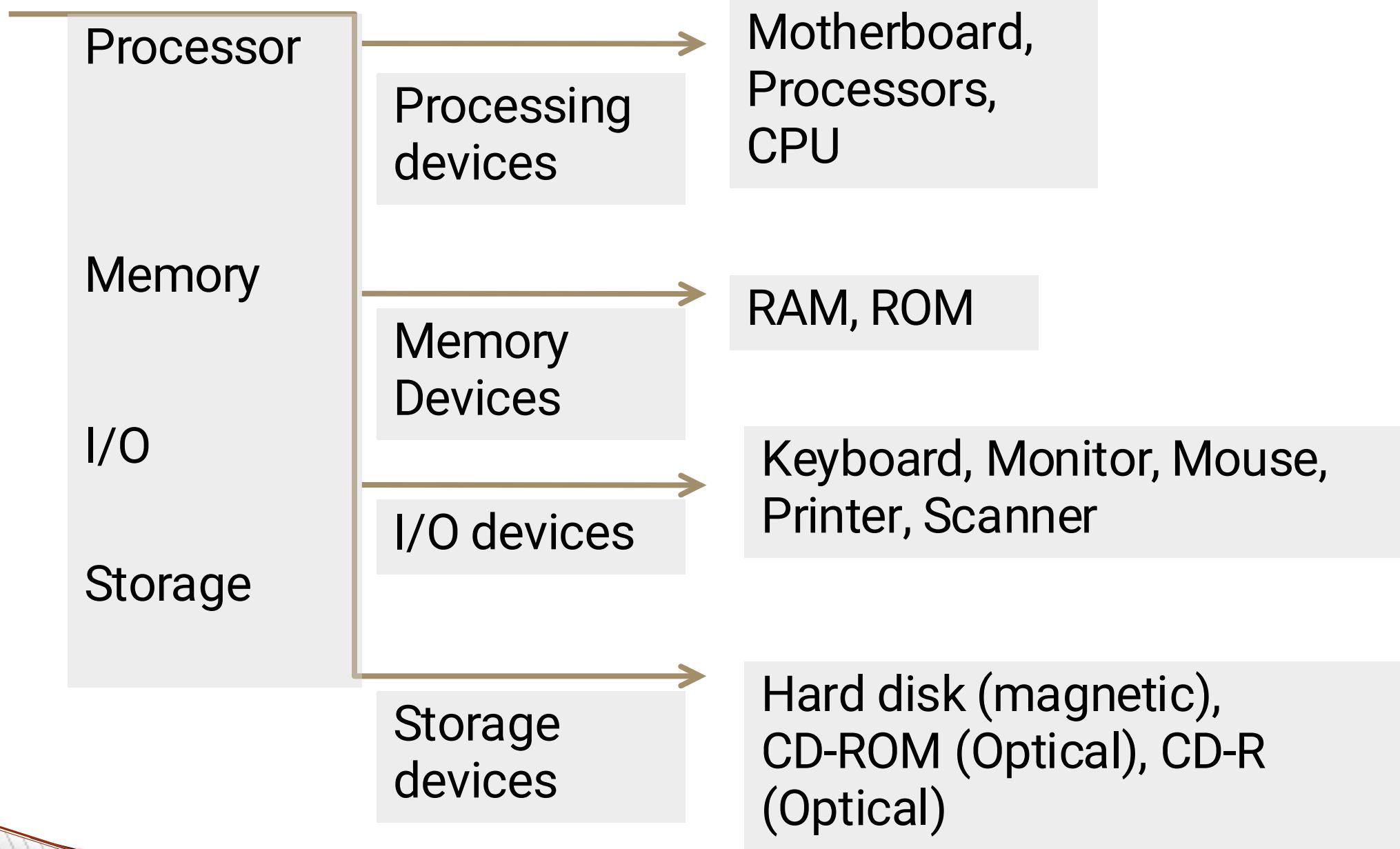
Hardware → The mechanical devices that make up the computer system is called hardware.

Software → Software is a set of instructions that are computer uses to perform different tasks.

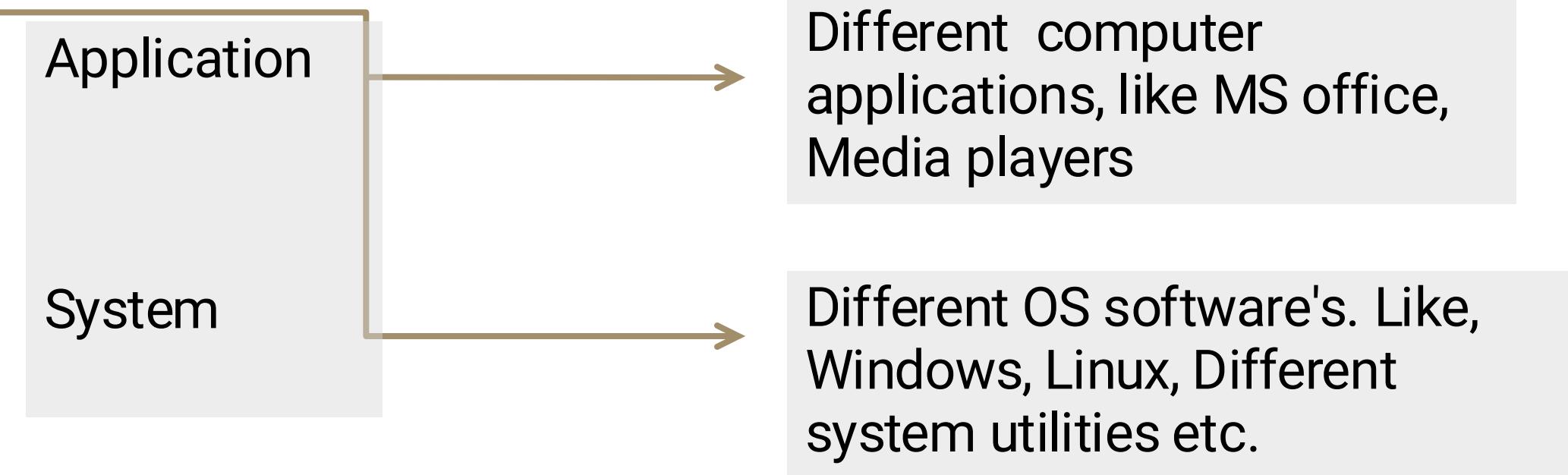
Data → Individual facts or piece of information.

Users → Computer operators.

# Hardwares



# Softwares



# Thank You!