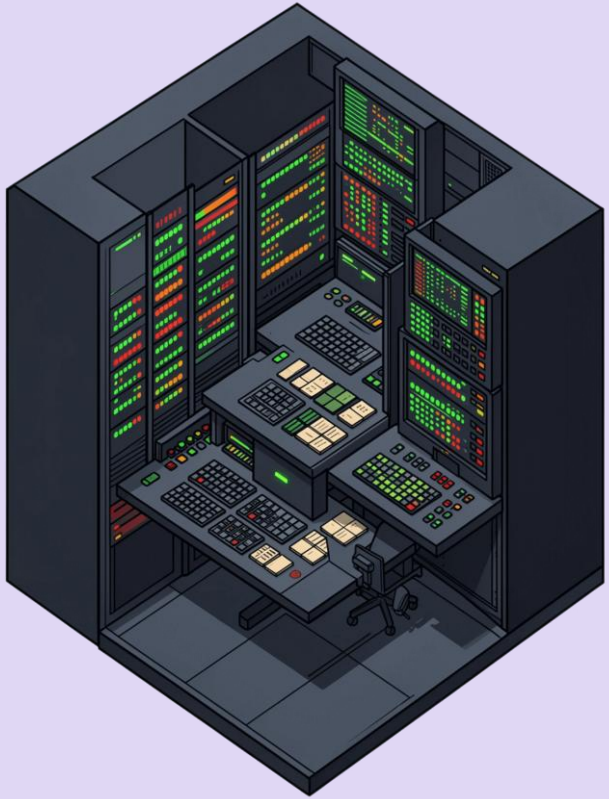


Introduction of Computer Fundamentals

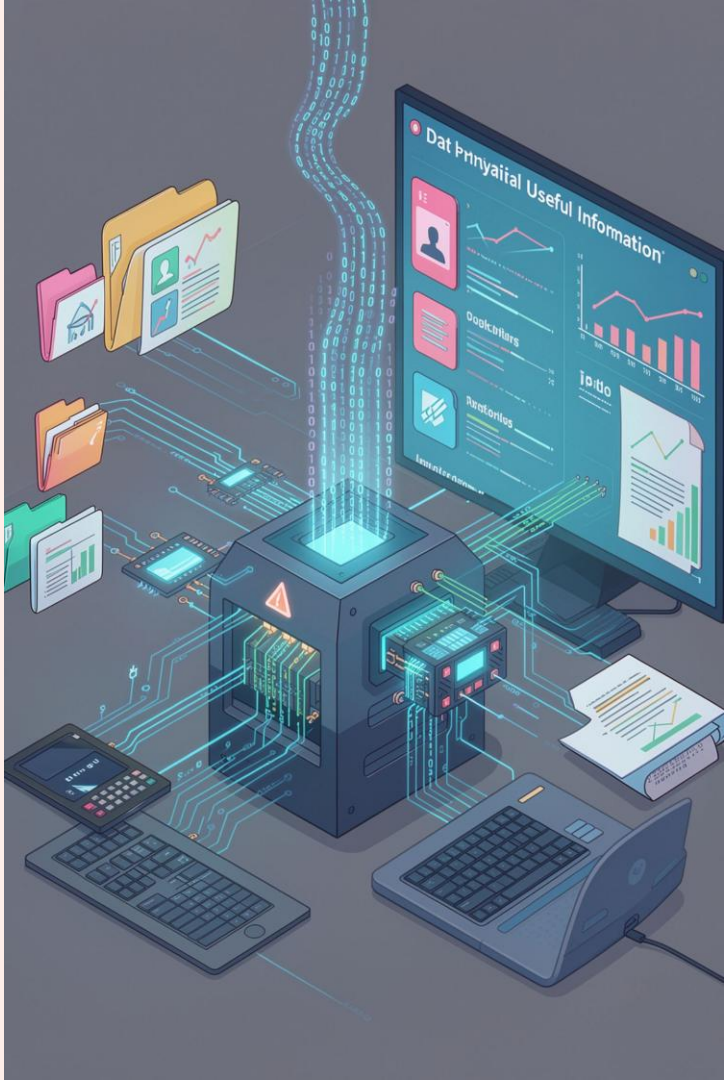
BY:-ER RANJEET RANJAN



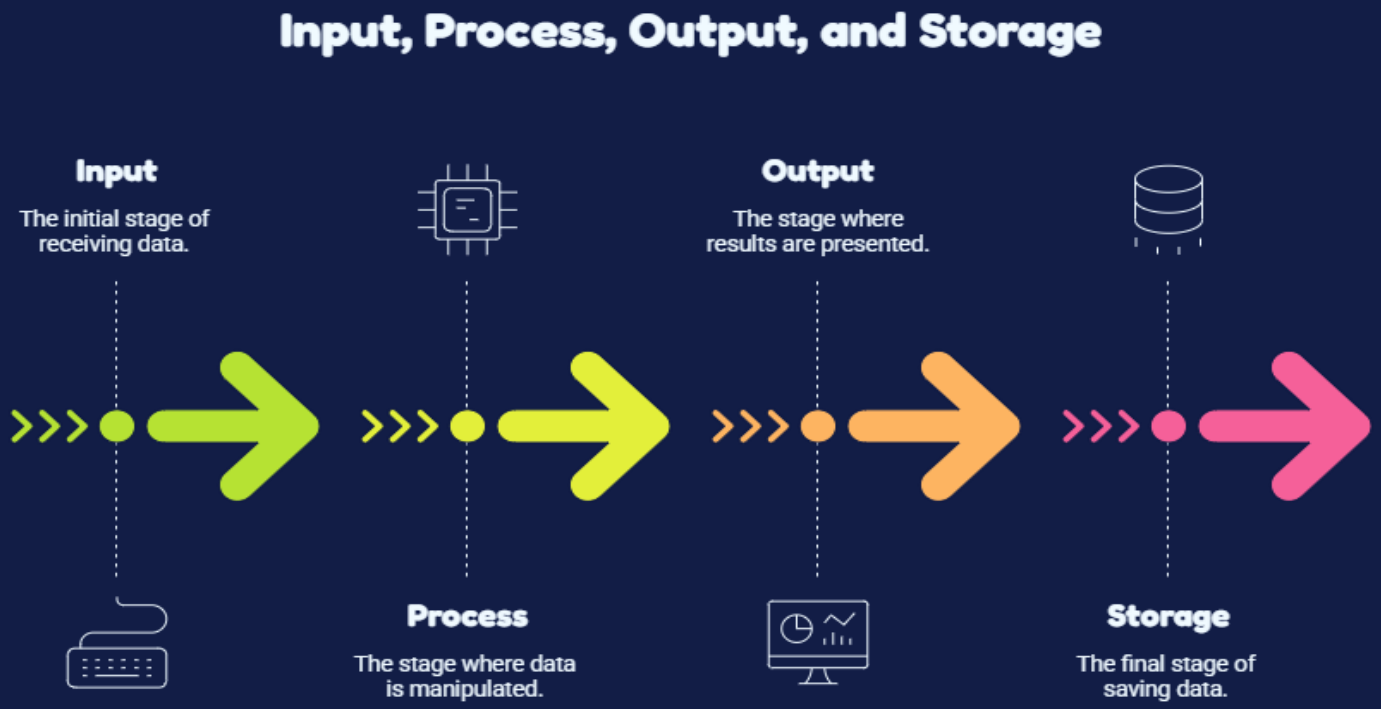
What is a Computer?

❖ A computer is an electronics digital device , Which takes data & instruction to us , After processing on it we get a result.

- Meaning of the Word "Computer“
- The word Computer is derived from the word Compute.
- Compute means to calculate.

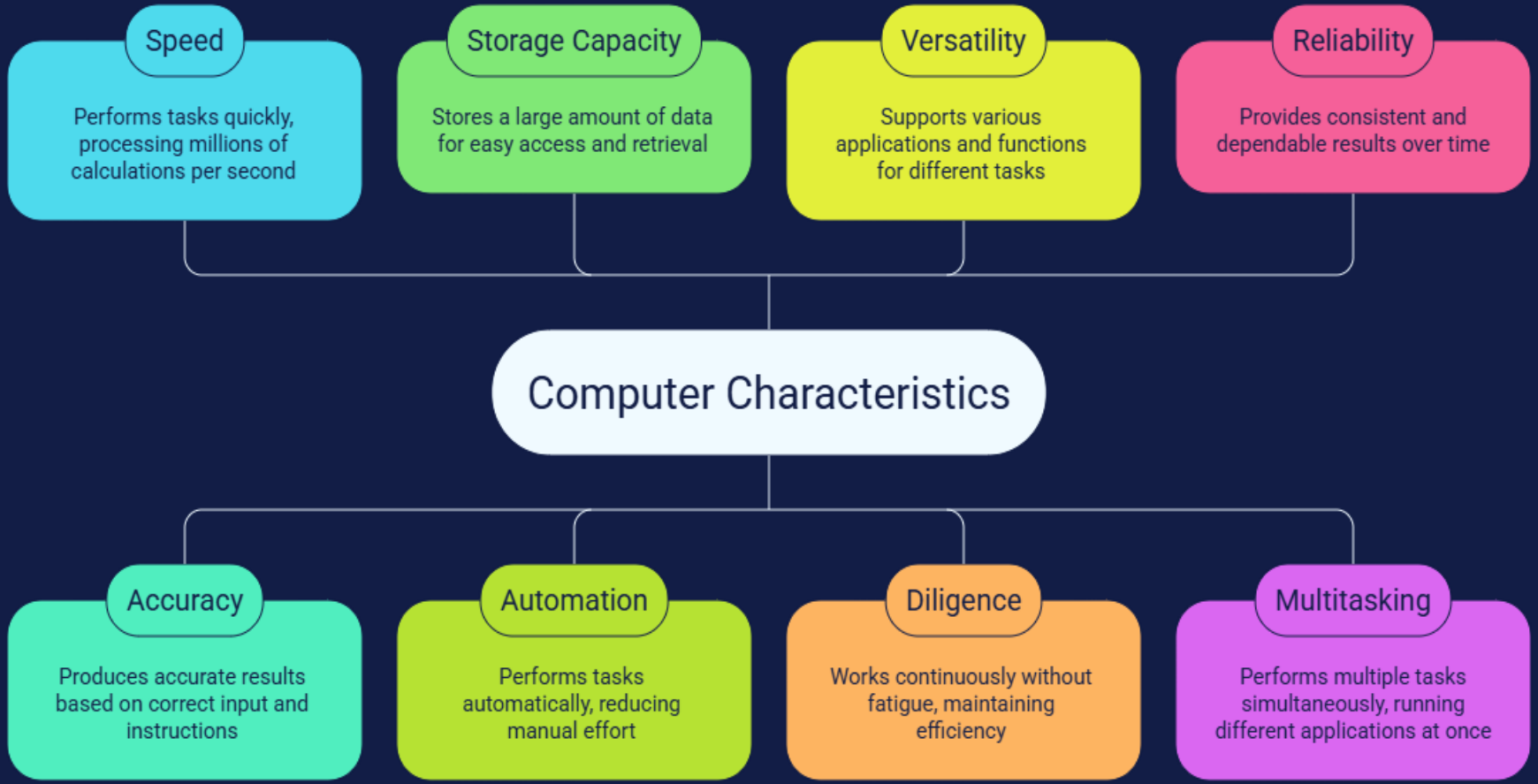


Data: Raw facts and figures.
Information: Processed and meaningful data.



Made with Napkin

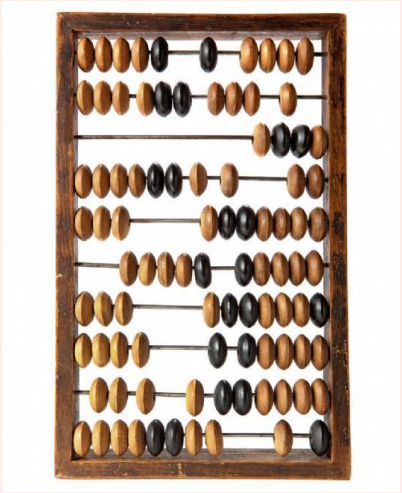
Key Characteristics of Computers



Made with Napkin

History of Computers

1. Early Computing Devices (Prarambhik Ganana Upkaran)

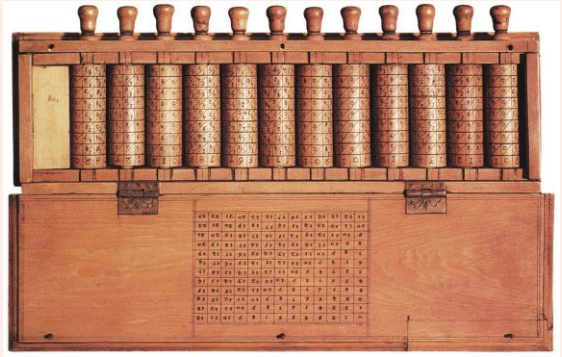


Abacus (3000 BC)

- The first calculating device.
- Invented in ancient China.
- Used for basic calculations such as addition, subtraction, multiplication, and division.

Napier's Bones (1617)

- Invented by John Napier.
- Used for multiplication and division.
- Made calculations easier and faster.



Pascaline (1642)

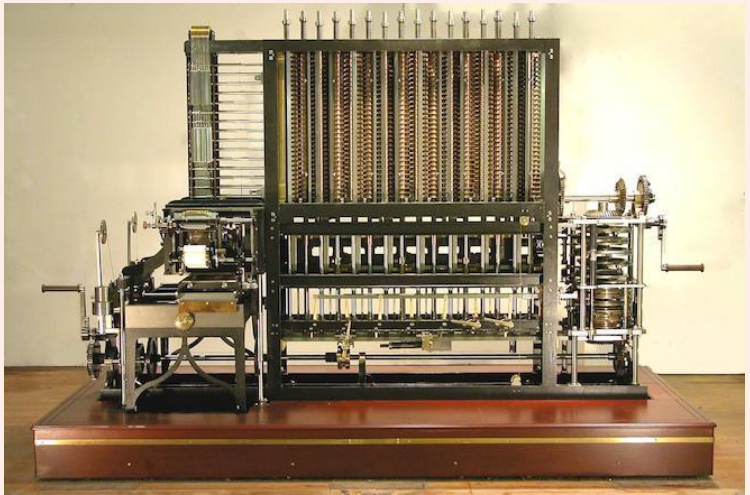
- Invented by Blaise Pascal.
- The first mechanical calculator.
- Used for addition and subtraction.



2. Mechanical Computer Era

Difference Engine (1822)

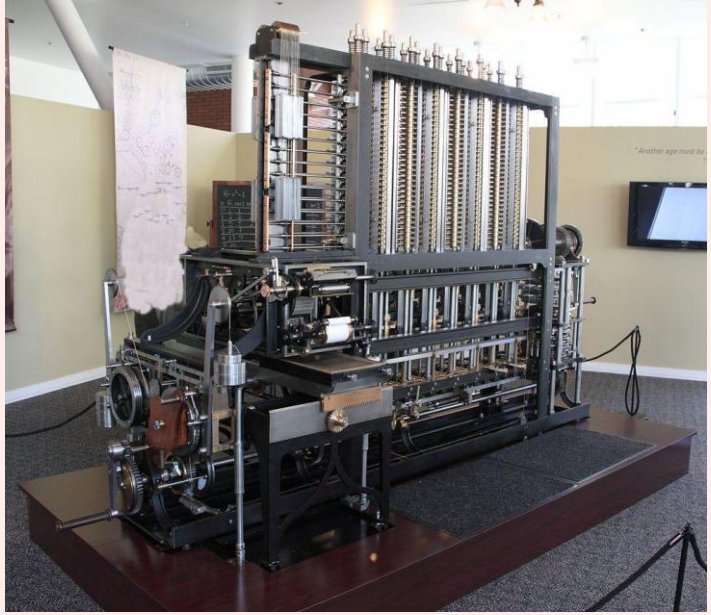
- Invented by Charles Babbage.
- Designed to perform mathematical calculations.
- Considered the beginning of modern computers.



Analytical Engine (1837)

- Designed by Charles Babbage.
- Included input, memory, processing, and output units.
- Charles Babbage is known as the "Father of the Computer."

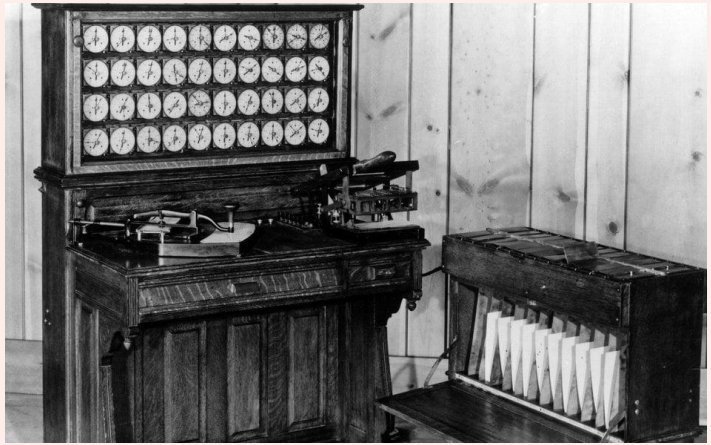
Ada Lovelace 1st programmer.



3. Electro-Mechanical Era

Tabulating Machine (1890)

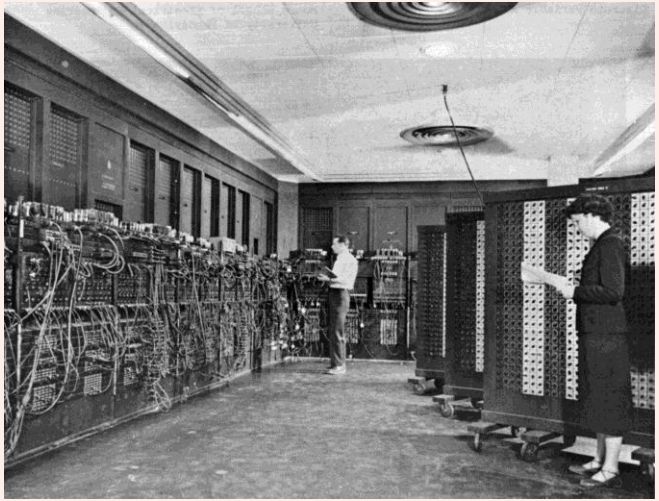
- Invented by Herman Hollerith.
- Used punched cards for data processing.
- Used in the U.S. Census



4. Electronic Computer Era

ENIAC (1945) Electronic Numerical Integrator and Computer

- The first general-purpose electronic computer.
- Used vacuum tubes.
- Very large and consumed a lot of electricity.



UNIVAC (1951) Universal Automatic Computer

- The first commercial computer.
- Used in government and business organizations.
- Improved data processing.



Timeline

Year	Computer	Inventor
3000 BC	Abacus	Ancient China
1617	Napier's Bones	John Napier
1642	Pascaline	Blaise Pascal
1822	Difference Engine	Charles Babbage
1837	Analytical Engine	Charles Babbage
1890	Tabulating Machine	Herman Hollerith
1945	ENIAC	Electronic Computer
1951	UNIVAC	Commercial Computer

HISTORY OF COMPUTERS – 8 IMPORTANT DEVICES

1 ABACUS

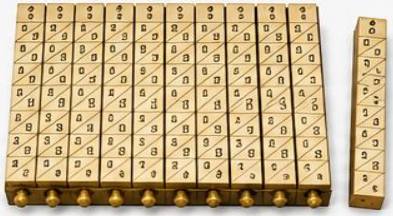
(3000 BC)



- The earliest calculating device.
- Invented in ancient China.
- Used for basic arithmetic operations.

2 NAPIER'S BONES

(1617)



- Invented by John Napier.
- Used for multiplication and division.
- Made calculations easier and faster.

3 PASCALINE

(1642)



- Invented by Blaise Pascal.
- The first mechanical calculator.
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4 DIFFERENCE ENGINE

(1822)



- Invented by Charles Babbage.
- Designed to perform mathematical calculations.
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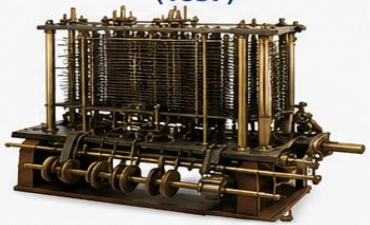
5 ANALYTICAL ENGINE

(1837)



- Designed by Charles Babbage.
- Included input, memory, processing and output units.
- Known as the concept of modern computer.

6 TABULATING MACHINE

(1890)



- Invented by Herman Hollerith.
- Used punched cards for data processing.
- Used in the U.S. Census.

7 ENIAC

(1945)



- First general-purpose electronic computer.
- Used vacuum tubes.
- Very large in size and consumed a lot of electricity.

8 UNIVAC

(1951)



- First commercial computer.
- Used in government and business organizations.
- Improved data processing.

TIMELINE SUMMARY

1 Abacus 3000 BC → 2 Napier's Bones 1617 → 3 Pascaline 1642 → 4 Difference Engine 1822 → 5 Analytical Engine 1837 → 6 Tabulating Machine 1890 → 7 ENIAC 1945 → 8 UNIVAC 1951

Evolution of Computers



1

Pre-Mechanical

Manual calculation tools



2

Mechanical

Gears and levers for calculation



3

Electro-Mechanical

Electricity powers mechanical parts



4

Electronic

Vacuum tubes and transistors

Made with Napkin

Generation of Computers

First Generation (1940–1956) – Vacuum Tubes

- Used **Vacuum Tubes**.
- Very **large in size**.
- Consumed **a lot of electricity**.
- **Slow processing speed**.

Ex-:

- ENIAC
- UNIVAC I

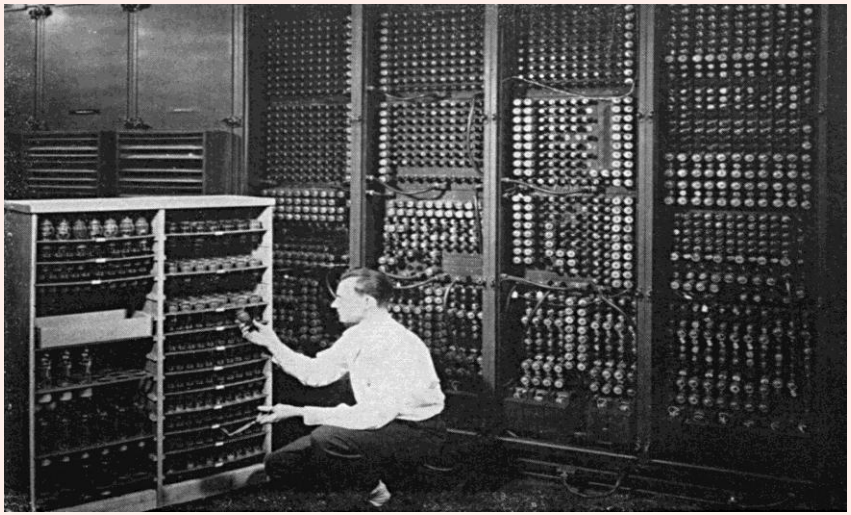
Second Generation (1956–1963) – Transistors

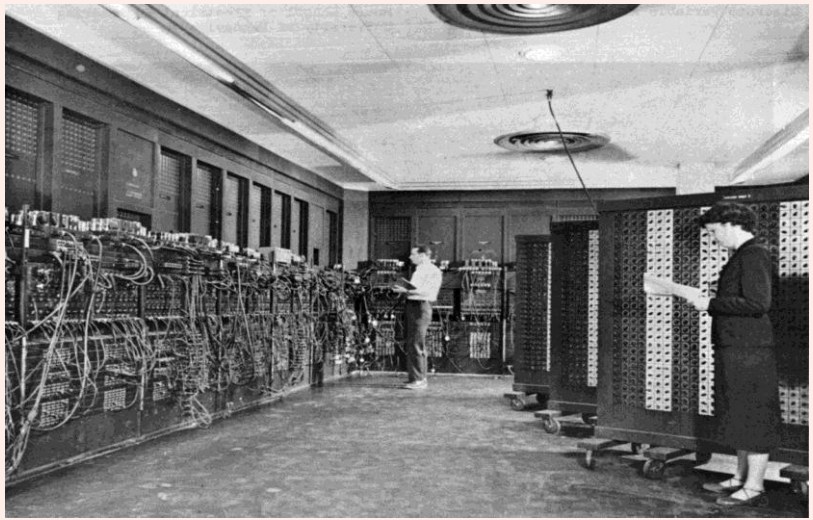
- **Transistors replaced vacuum tubes**.
- Computers became **smaller and faster**.
- **Lower power consumption**.

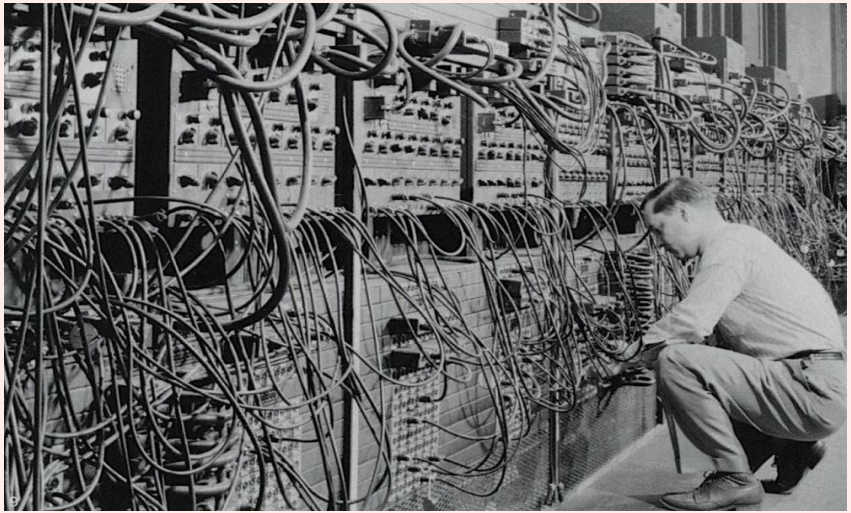
Ex-:

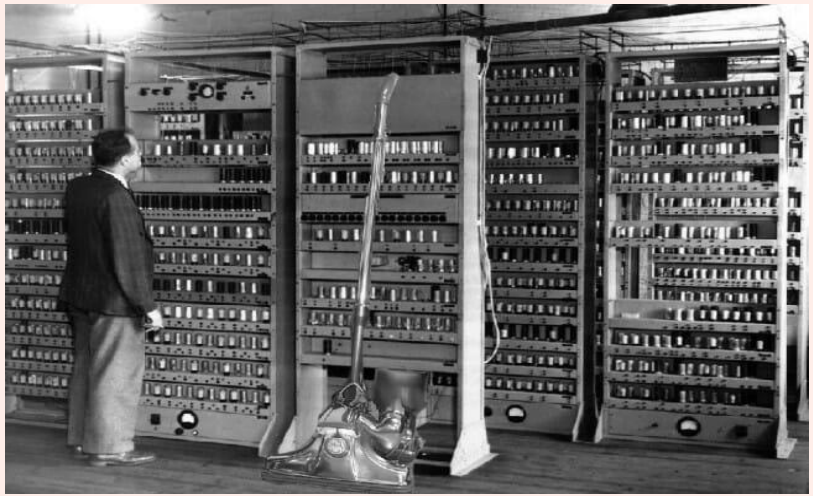
- IBM 1401
- IBM 7094

First Generation



















Second Generation

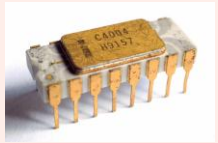
Third Generation (1964–1971) – Integrated Circuits (IC)

- Used **Integrated Circuits (ICs)**.
- More **reliable**.
- Use of **keyboard and monitor** increased.

Ex-:

- IBM System/360

Fourth Generation (1971–Present) – Microprocessors



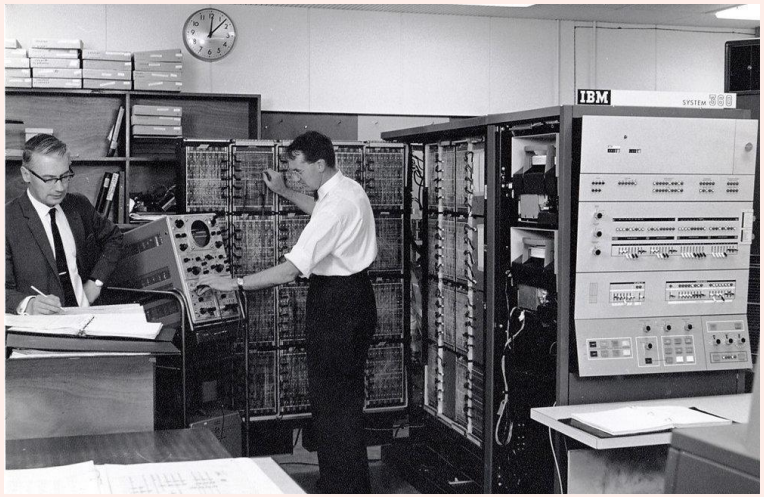
Used **Microprocessors**.
Development of **Personal Computers (PCs)**.
Desktops and laptops became popular.

Ex-:

- Intel 4004
- IBM PC















Third Generation

Fifth Generation (Present and Beyond) – Artificial Intelligence

- Based on **Artificial Intelligence (AI)** and **Machine Learning**.
- Uses **Natural Language Processing (NLP)**.
- Development of **Robotics and Intelligent Systems**.

Ex-:

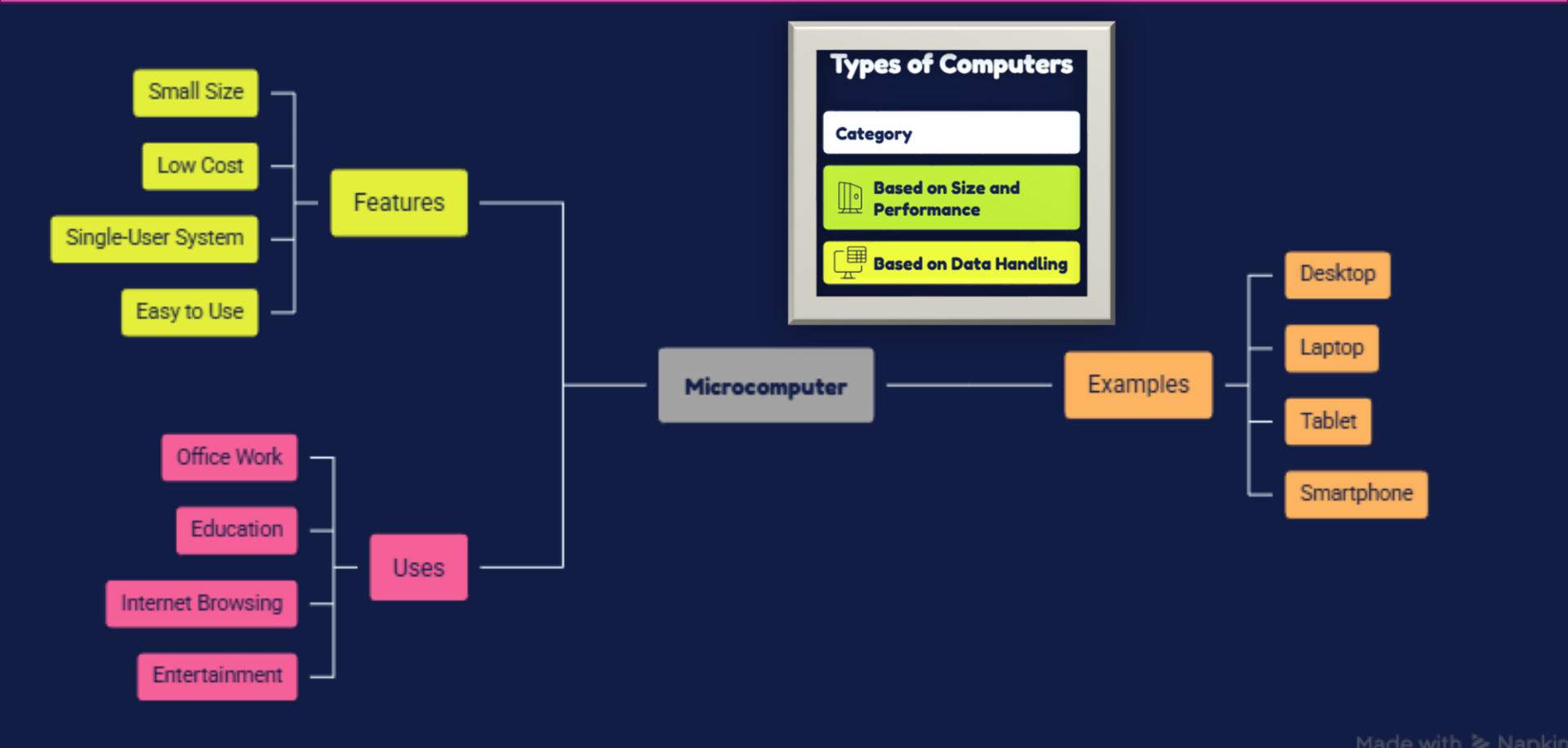
- AI systems
- Robotics
- Expert systems





Generation	Technology	Time
First	Vacuum Tubes	1940–1956
Second	Transistors	1956–1963
Third	Integrated Circuits	1964–1971
Fourth	Microprocessors	1971–Present
Fifth	Artificial Intelligence	Present–Future

1. Microcompute:- **A microcomputer is a small, single-user computer designed for personal use.**



1. Microcompute

A microcomputer is a small, single-user computer designed for personal use.





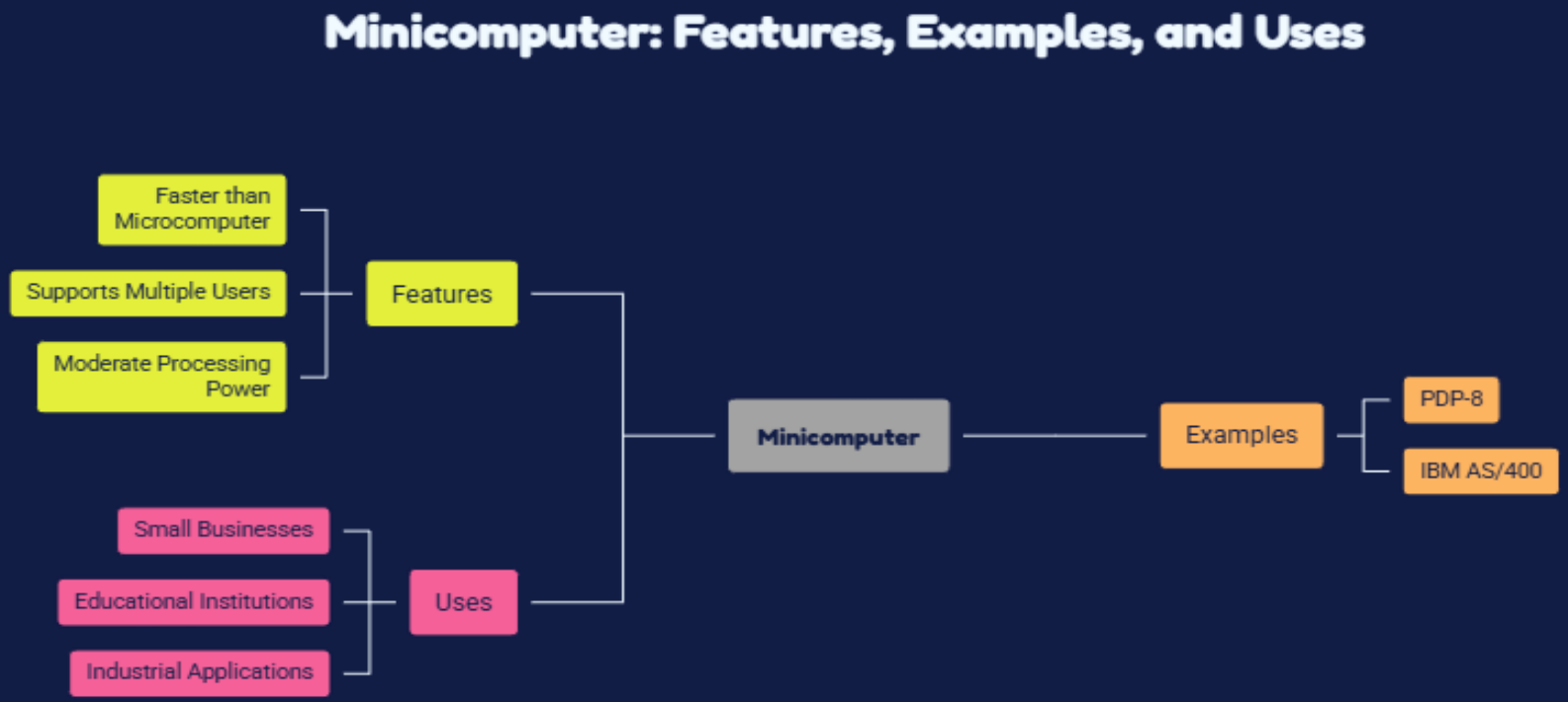
Features:

- Small in size
- Low cost
- Single-user system
- Easy to use





2. Minicomputer:- A minicomputer is a medium-sized computer that supports multiple users simultaneously.



2. Minicomputer

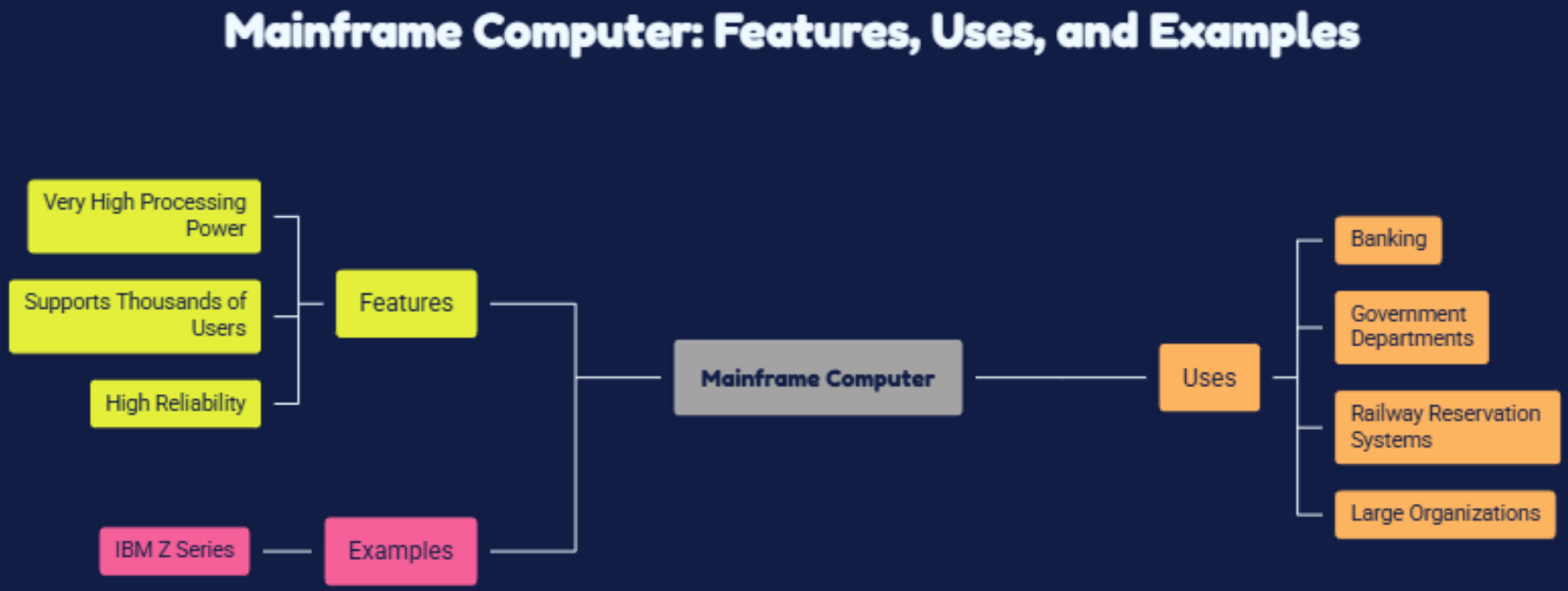








3. Mainframe Computer:- A mainframe computer is a powerful computer designed to process large amounts of data.

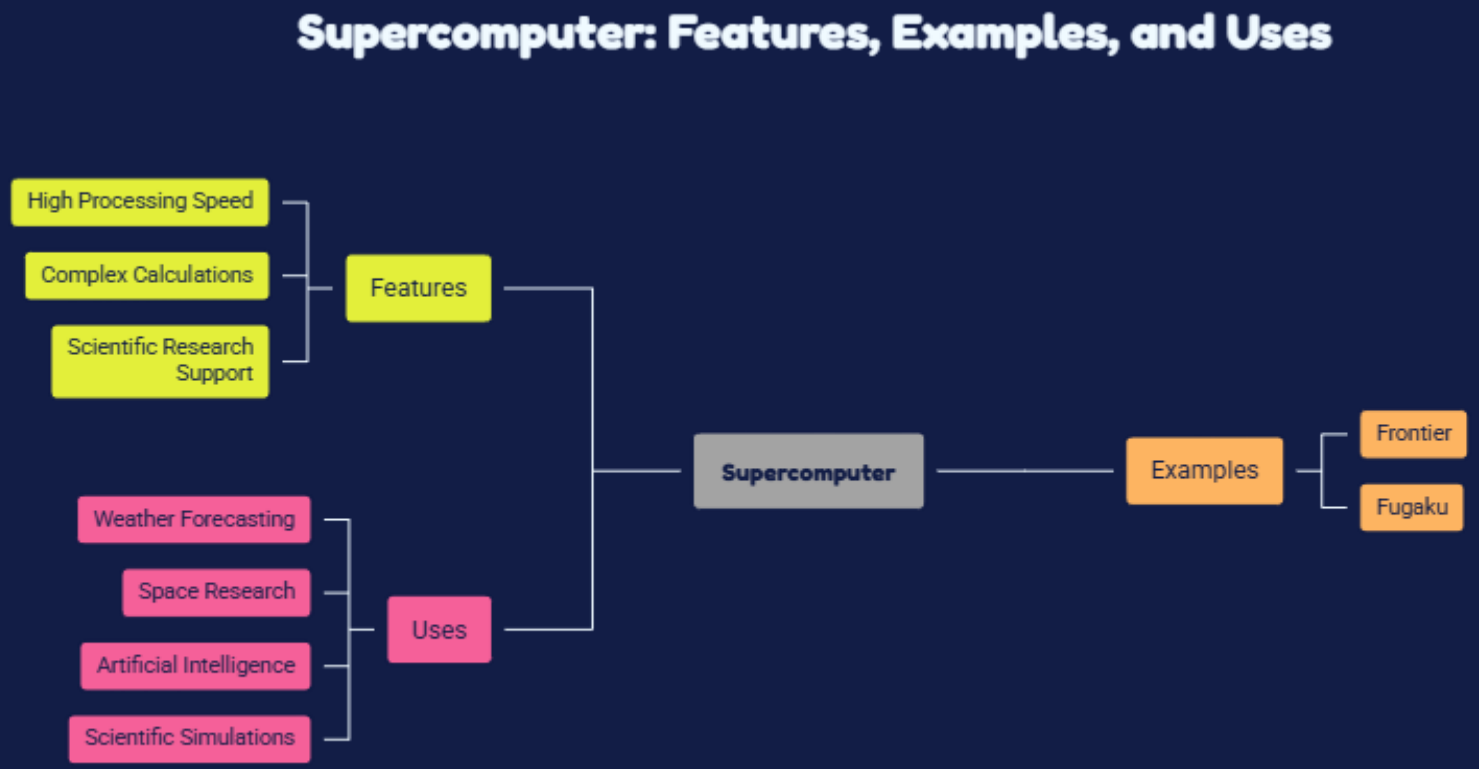


3. Mainframe Computer





4. Supercomputer:-A supercomputer is the fastest and most powerful type of computer.

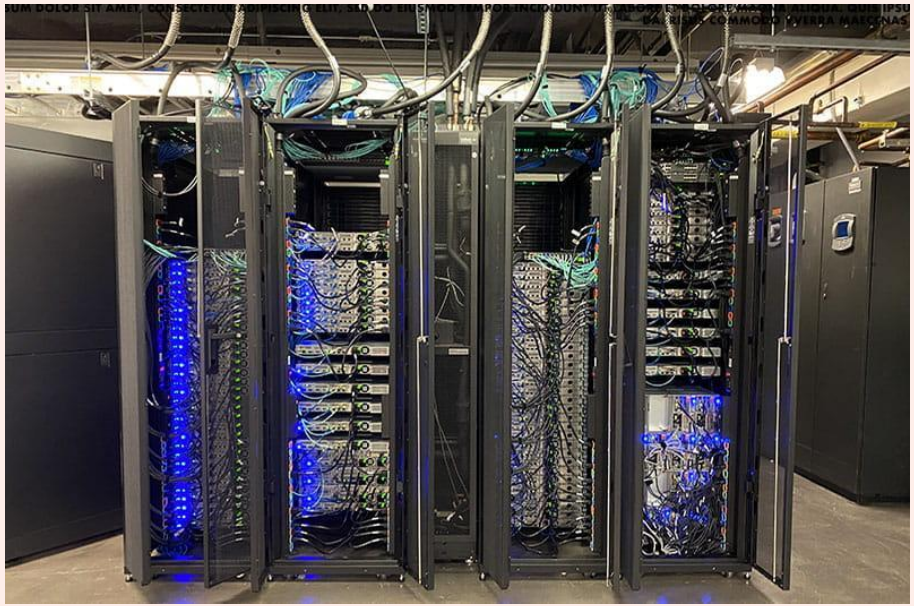


4. Supercomputer









2. Types of Computers Based on Data Handling

Analog Computer

- Processes continuous data.
- Measures physical quantities such as temperature and pressure.

Example:

- Speedometer
- Analog thermometer

Digital Computer

- Processes data in binary form (0 and 1).
- Most modern computers are digital computers.

Example:

- Desktop computer
- Laptop
- Smartphone

Hybrid Computer

- Combines the features of analog and digital computers.

Example:

- ECG machines
- ICU monitoring systems

Comparison Table

Type	Users	Speed	Example
Microcomputer	One	Moderate	Laptop
Minicomputer	Multiple	High	PDP-8
Mainframe	Thousands	Very High	IBM Z
Supercomputer	Thousands	Extremely High	Frontier

❑ Embedded System

An embedded system is a specialized computer designed to perform a specific task within a larger device.

Unlike a desktop or laptop, an embedded system is **built into another machine** and performs only the functions for which it is designed.







Features of an Embedded System

- Designed for a specific task
- Small in size
- Fast and efficient
- Low power consumption
- Usually works automatically
- Integrated into a larger device

Basic Components of an Embedded System

- Microprocessor or Microcontroller
- Memory
- Input Devices (Sensors)
- Output Devices (Display, Motor, Speaker)
- Software (Firmware)

Example:

- Washing machine
- Car control system
- Smart TV
- Microwave oven
- ATM machine
- Printer
- Digital camera
- Air conditioner
- Traffic signal controller
- Smartwatch

Government Sector Examples

- Biometric attendance systems
- CCTV systems
- Smart traffic management systems
- EVM (Electronic Voting Machine)
- Aadhaar authentication devices

Components of a Computer:-
1.Hardware 2.Software

- Input Unit
- Processing Unit (CPU)
- Memory Unit
- Output Unit

CPU (Central Processing Unit)

- ALU (Arithmetic Logic Unit)
- CU (Control Unit)
- Registers

Memory and Storage

- RAM
- ROM
- Cache Memory
- HDD
- SSD

Input Devices

- Keyboard
- Mouse
- Trackball
- Touchpad
- Graphics Tablet
- Scanner
- Barcode Scanner
- QR Code Scanner
- OMR
- OCR
- MICR
- Microphone
- Webcam
- Biometric Scanner
- Joystick

Output Devices

- Monitor
- Printer
- Speaker
- Projector

Software

- System Software
- Application Software
- Utility Software

9. Operating System

- Windows
- Linux
- Android
- iOS

File Management

- File kya hai?
- Folder kya hai?
- Copy, Cut, Paste
- Rename
- Delete
- File Extension (.docx, .xlsx, .pdf, .pptx)

ALU
Arithmetic Logic Unit

- Arithmetic operations:
  - Addition
  - Subtraction
  - Multiplication
  - Division
- Logical operations:
  - $<$
  - $>$
  - $=$

Booting
- **Booting = Starting the computer.**
- Loads the **Operating System (OS)**.

Cold Boot
- Computer is **OFF → Power ON**.
- Example: Starting the computer after shutdown.

Warm Boot
- Computer is already **ON → Restart**.
- Example: Using the Restart option.

POST
- **POST = Power-On Self-Test**
- Checks basic **hardware** when the computer starts.

BIOS
- **BIOS = Basic Input/Output System**
- Firmware that **initializes hardware** and helps start the boot process.

UEFI
- **UEFI = Unified Extensible Firmware Interface**
- Modern **firmware interface** that initializes hardware and helps load the OS.

Easy Revision
Cold Boot → OFF → ON
Warm Boot → Restart
POST → Hardware Check
BIOS/UEFI → Startup Firmware

Programming Languages

1. Machine Language

- Uses **Binary (0 and 1)**.
- Lowest-level language.
- Directly understood by the computer.

2. Assembly Language

- Uses **Mnemonics**.
- Examples:
  - ADD
  - SUB
- Needs an **Assembler**.

3. High-Level Language

- **Human-readable** and programmer-friendly.
- Examples:
  - C
  - C++
  - Java
  - Python

18. Translators

Compiler

- Translates the **entire program** at once.

Interpreter

- Translates/executes the program **line by line**.

Assembler

- Converts **Assembly Language → Machine Code**.

Source Code

- **Human-readable code** written by the programmer.

Object Code

- **Machine-level code** generated after translation.

Algorithm & Flowchart

Algorithm

- A **step-by-step procedure** to solve a problem.

GUI

GUI = Graphical User Interface

- Uses **Windows**
- Uses **Icons**
- Uses **Menus**
- Uses **Pointer/Mouse**

CLI

CLI = Command Line Interface

- User types **commands** to operate the computer.

Kernel

- **Core part of the Operating System.**
- Directly interacts with **hardware**.

Shell

- Accepts and interprets **user commands**.
- Passes commands to the **Kernel**.

Easy way to remember
GUI → Click 🖱️
CLI → Type ⌨️
Shell → Takes command → Kernel
Kernel → Talks to Hardware

Computer Memory

1. Primary Memory

- **Primary Memory** is memory that the **CPU can directly access**.
- Examples:
  - **RAM**
  - **ROM**

2. RAM

RAM = Random Access Memory

- It is **temporary memory**.
- It is **volatile memory**.
- Data is lost when the **power is turned off**.
- It stores **running programs and data**.

Types of RAM

SRAM = Static RAM

- Faster than DRAM.
- Commonly used in **Cache Memory**.

DRAM = Dynamic RAM

- Commonly used as main memory.
- Requires **refreshing** to retain data.

3. ROM

ROM = Read Only Memory

- It is **non-volatile memory**.
- Data is retained even when the **power is turned off**.
- Commonly used to store **firmware/instructions** that need to remain available.

Types of ROM

PROM = Programmable ROM

- Can generally be **programmed once**.

EPROM = Erasable Programmable ROM

- Can be **erased using UV (ultraviolet) light**.
- Can then be programmed again.

EEPROM = Electrically Erasable Programmable ROM

- Can be **erased and updated electrically**.

Flash Memory

- A type of **non-volatile memory technology**.
- Examples:
  - USB drives
  - Memory cards
  - SSDs

4. Cache Memory

- Cache is **very fast memory**.
- It is located between the **CPU and RAM**.
- It helps the CPU access frequently needed data/instructions faster.

Cache Levels

L1 → L2 → L3

- **L1:** Fastest and closest to the CPU.
- **L2:** Larger than L1 but generally slower.
- **L3:** Larger and generally slower than L1/L2.

Easy Trick

CPU → Cache → RAM

Virtual Memory

- Sometimes **RAM is not sufficient** for the required workload.
- The operating system can use some space on the **storage drive** as an extension of RAM.
- This is called **Virtual Memory**.
- It is **slower than actual RAM** because storage is slower than RAM

Storage Devices

HDD

HDD = Hard Disk Drive

- Uses **magnetic storage**.
- Contains **spinning platters**.
- Used for long-term data storage.

SSD

SSD = Solid State Drive

- Uses **NAND flash memory**.
- Has **no spinning platters**.
- Generally **faster than HDD**.
- Used for storing the OS, applications and files.

Optical Disc

- Uses a **laser** to read/write data.
- Examples:
  - **CD**
  - **DVD**
  - **Blu-ray**

Magnetic Tape

- Uses **magnetic storage**.
- Provides **sequential access**.
- Useful for **large archival storage and backups**.

Quick Revision

Topic	Important Point
Primary Memory	Directly accessible by CPU
RAM	Temporary + Volatile
SRAM	Fast + commonly used in Cache
DRAM	Requires refreshing
ROM	Non-volatile
PROM	Generally programmed once
EPROM	Erased using UV light
EEPROM	Electrically erased/updated
Flash Memory	Non-volatile
Cache	Very fast memory near CPU
Virtual Memory	Storage used as an extension of RAM
HDD	Magnetic + spinning platters
SSD	NAND flash + generally faster than HDD
Optical Disc	Laser-based storage
Magnetic Tape	Sequential access + archival storage

Printer – Short Summary

- **Printer** → An output device that converts digital information into a **hard copy**.

1. Impact Printer

- Physically strikes the **ribbon/paper**.
- **Example:** Dot Matrix
- Noisy.
- Useful for forms and multi-copy documents.

2. Non-Impact Printer

- Does **not physically strike** the paper.
- **Examples:** Inkjet, Laser
- Quieter and generally provides better print quality.

3. Dot Matrix Printer

- Uses **pins + ink ribbon**.
- Impact printer.
- Noisy and lower print quality.
- Useful for forms and multi-part documents.

4. Inkjet Printer

- Sprays **tiny ink droplets** onto paper.
- Good for **colour and photo printing**.
- Commonly used at home.

5. Laser Printer

- Uses **laser + toner + heat**.
- Fast printing.
- Produces sharp text.
- Commonly used in offices.

6. Plotter

- Used for **large and precise drawings**.
- Examples: CAD drawings, maps, engineering designs.

7. Thermal Printer

- Uses **heat** to produce the print.
- Commonly used for receipts, tickets and labels

Important Terms ⭐

- **DPI (Dots Per Inch)** → Print resolution/detail.
- **PPM (Pages Per Minute)** → Printing speed.
- **Hard Copy** → Physical/printed document.
- **Soft Copy** → Digital document.