



**COMPUTER  
ARCHITECTURE  
& MEMORY**

**COMPUTER  
AWARENESS**

**EPIISODE-2**



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# Computer Awareness



Part 1    Intro/Generation/ Classification of Computers

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Next Part




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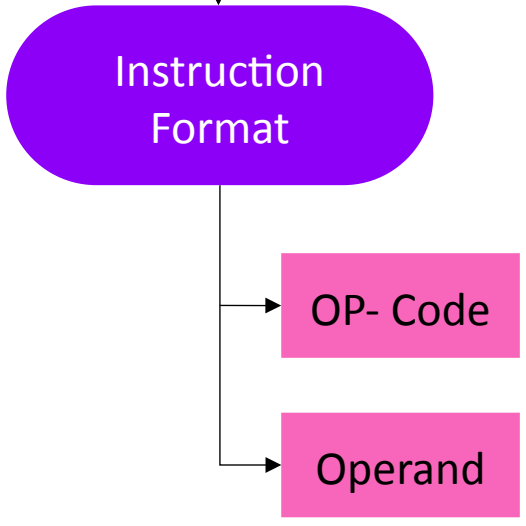
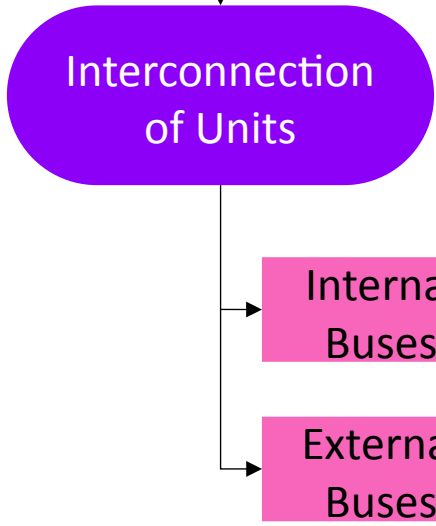
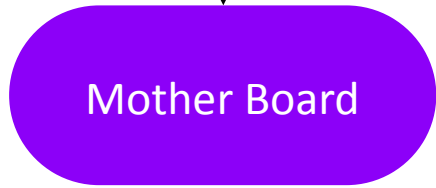
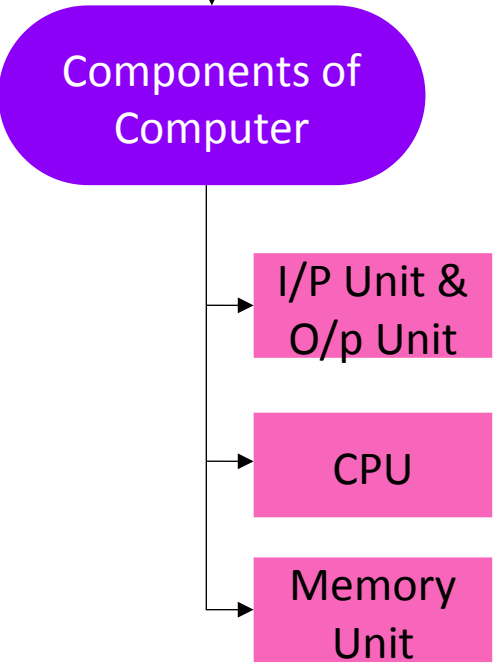
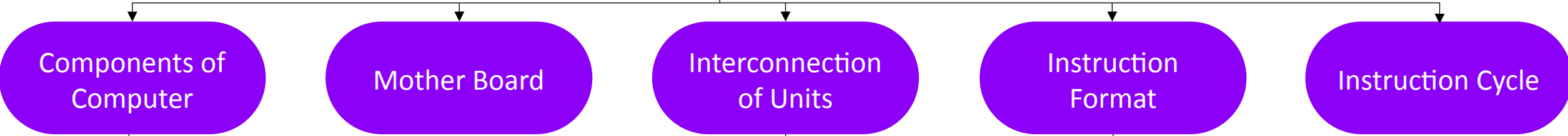
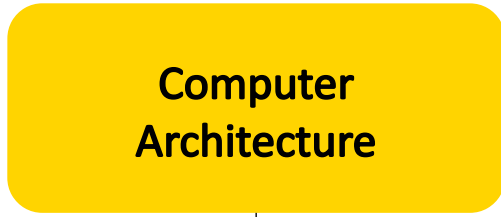
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# Computer Architecture





# Computer Architecture



The computer architecture forms the backbone for building successful computer systems.

Diagram





# Computer Architecture

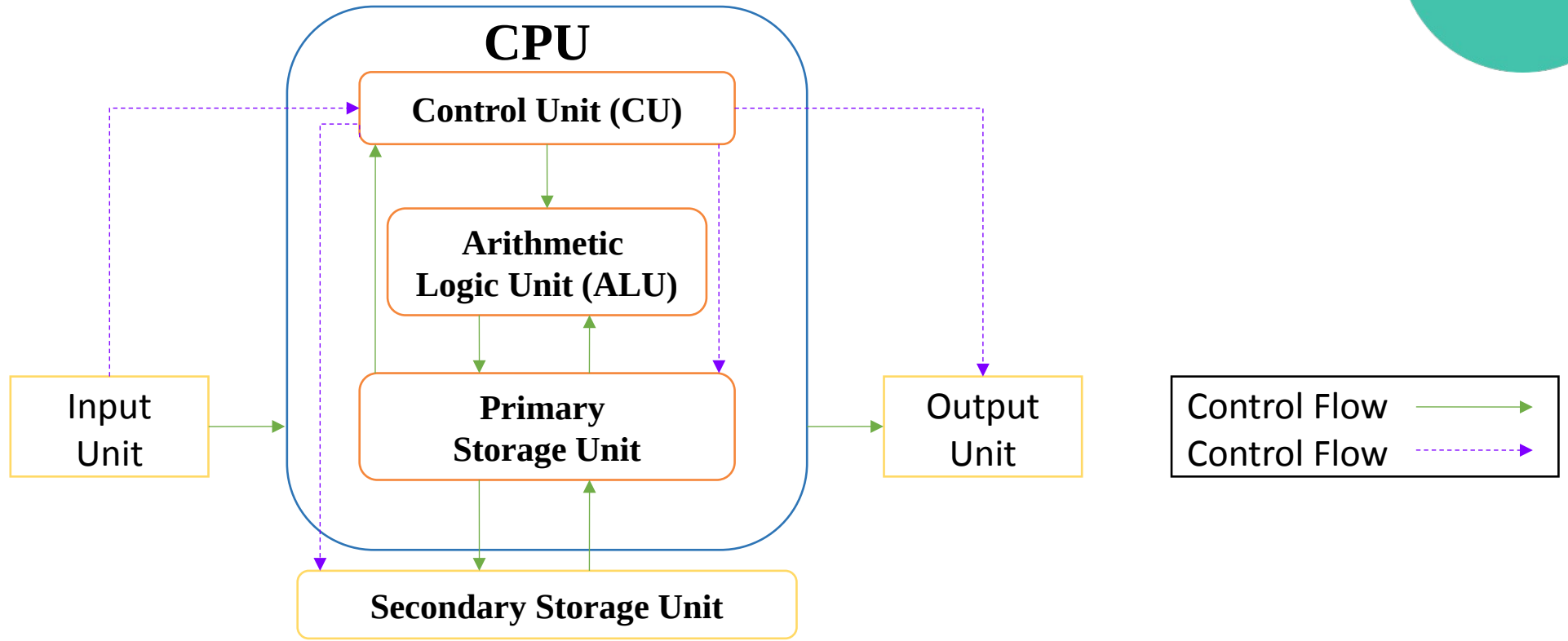


Fig 1 : **Computer Architecture**

Computer Architecture  
Flow Chart





## Input Unit



It accepts data and instructions from the outside world.



It is a device that is used to give required information to the computer.



E.g. keyboard, mouse.

## Output Unit



This unit sends the processed results to the user.



It converts these coded results to human acceptable form.



E.g Monitor, printer, plotter, etc

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## Central Processing Unit



- ⟨⋯⟩ The central processing unit is fabricated as a single Integrated Circuit (IC) and is also known as **microprocessor**.
- ⟨⋯⟩ The CPU is often called the **BRAIN OF COMPUTER**.
- ⟨⋯⟩ The CPU transfers instructions and input data from main memory to registers, i.e. internal memory.
- ⟨⋯⟩ The CPU executes the instructions in the stored sequence.
- ⟨⋯⟩ When necessary CPU transfers output data from registers to main memory.
- ⟨⋯⟩ It consists a set of **Registers, Arithmetic Logic Unit, Control Unit**, which together interpret and execute instructions in assembly language.

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## Arithmetic Logic Unit (ALU) :

- ⟨...⟩ An arithmetic logic unit (ALU) is a combinational digital electronic circuit that performs arithmetic and bitwise operations on integer binary numbers.
- ⟨...⟩ ALU perform logical operations AND, NOT, NOR, XOR
- ⟨...⟩ ALU perform Bit- shifting operations
- ⟨...⟩ ALU perform comparison operations ( $=$ ,  $<$ ,  $>$ ,  $=>$ ,  $=<$ )
- ⟨...⟩ ALU perform arithmetic operations addition, subtraction, multiplication, division.

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CPU

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# Registers



A processor register is a quickly accessible location available to a computer's processors.



Registers usually consist of a small amount of fast storage, although some registers have specific hardware functions, and may be read-only or write-only.



These registers are the top of the memory hierarchy and the fastest way for the system to manipulate data.



The number and size of registers vary from processor to processor.

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## Control Unit (CU)



It tells the computer's memory, arithmetic and logic unit and input and output devices how to respond to the instructions that have been sent to the processor.

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CPU



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## Memory Unit



This unit supplies information to other units of the computer when needed.



It is also known as internal storage unit or the main memory or the primary storage or Random Access Memory (RAM).



It stores all the data and the instructions required for processing.

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# Motherboard



A motherboard is the main printed circuit board in general-purpose computers and other expandable systems.



It holds, and allows communication between, many of the crucial electronic components of a system, such as the central processing unit and memory, and provides connectors for other peripherals.

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# Components of Mother Board

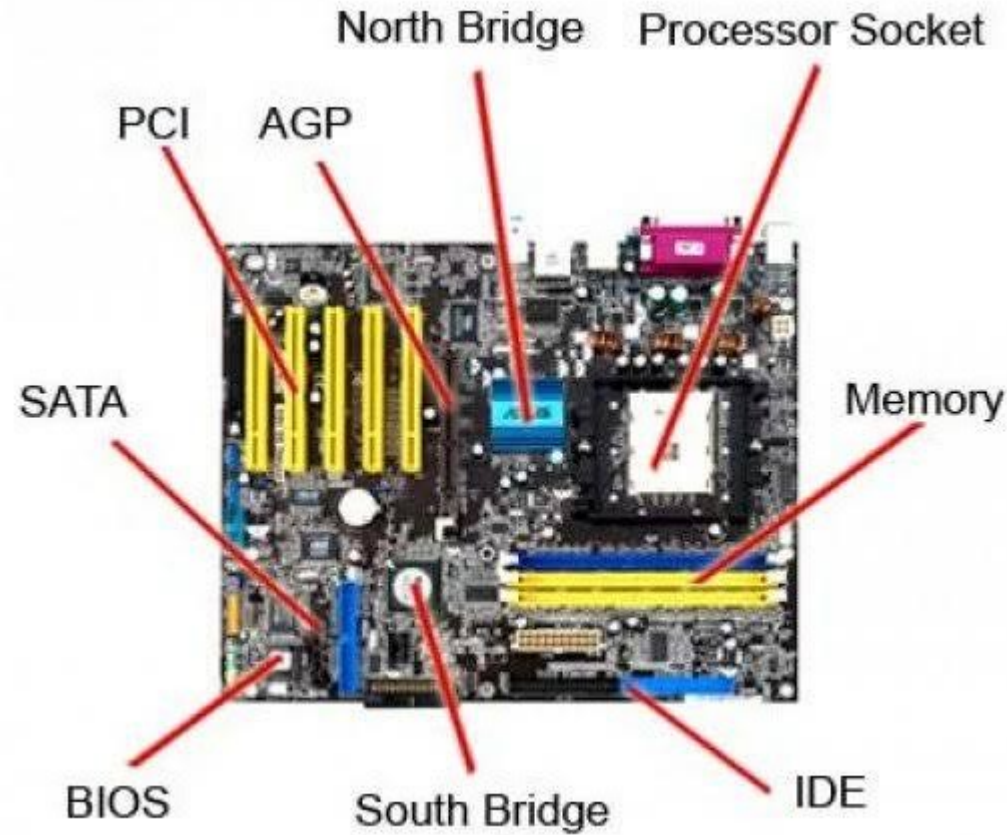


Fig 1 : **Components of Mother board**

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## Interconnection of Units



CPU sends data instructions and information to the components inside the computer as well as to the peripheral devices attached to it.



A bus is a set of wires used for interconnection, and also bus is a set of electronic signal pathways that allows information and signals to travel between components inside or outside of a computer.



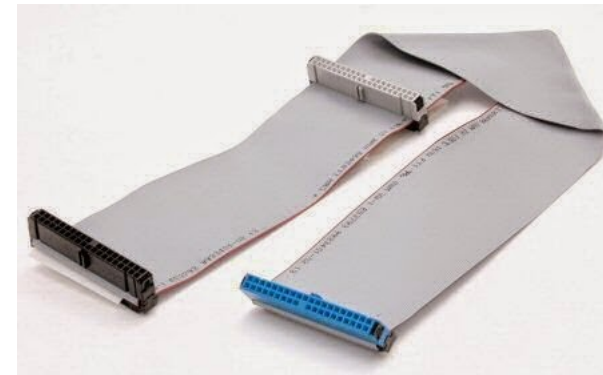
A computer bus can be divided into two types,



**Internal Buses**



**External Bus**



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## Internal Buses



- ◀⋯▶ The internal bus connects components inside the motherboard like CPU and system memory.
- ◀⋯▶ It is also called the system bus. Internal bus includes following buses,
- ◀⋯▶ The command to access the memory or the I/O devices is carried by the **Control Bus**.
- ◀⋯▶ The address of I/O devices or memory is carried by the **Address Bus**.
- ◀⋯▶ The data to be transferred is carried by the **Data Bus**.

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## External Bus



An external bus is a type of data bus that enables external devices and components to connect with a computer.



It enables connecting devices, carrying data and other control information, but is only restricted to be used external to the computer system.



It is also referred to as the **Expansion Bus**.



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## Instruction Cycle



It represents the sequence of events that takes place as an instruction is read from memory and executed.



**Fetching** the instruction from the memory.



**Decoding** the instruction for operation.



**Executing** the instruction.



**Storing** in memory.



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## Instructions Format



Computer understands instructions only in terms of 0's and 1's which is called the **Machine Language**.



The instructions tell the processor what actions are needed to be performed on the data.



An instruction is further divided into two parts.



**OPERATION (OP-CODE)** represents action that the processor must execute.



**OPERAND** defines the parameters of the action and depends on the operation.

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# Computer Memory



In computing, memory refers to a device that is used to store information for immediate use in a computer or related computer hardware device.



The computer memory is one of the most important elements in a computer system.

**Computer Memory**  
Flow Chart



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# Classification of Computer Memory

Computer Memory

Parameter of Memory

Storage Capacity

Access Modes

Access Times

Physical Characteristics

Permanence of Storage

**BASIC UNITS OF MEMORY MEASUREMENTS**

Types of Memory

Primary or Main Memory

Second or Aux Memory



## Parameters of Memory



## Storage Capacity



It is representative of the size of memory.



The capacity of internal memory or main memory can be expressed in terms of number of words or bytes.

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## Parameters Of Memory



## Access Modes



A memory is comprised of various memory locations.



The information from these memory locations can be accessed randomly, sequentially and directly.

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## Parameters Of Memory



### Access Time



The access time is the time required between the desired modes for a read or write operation till the data is made available or written at the desired location.

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## Parameters Of Memory



## Physical Characteristics



The devices can be categorized into four main categories as electronic, magnetic, mechanical and optical.

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## Parameters Of Memory



## Permanence Of Storage



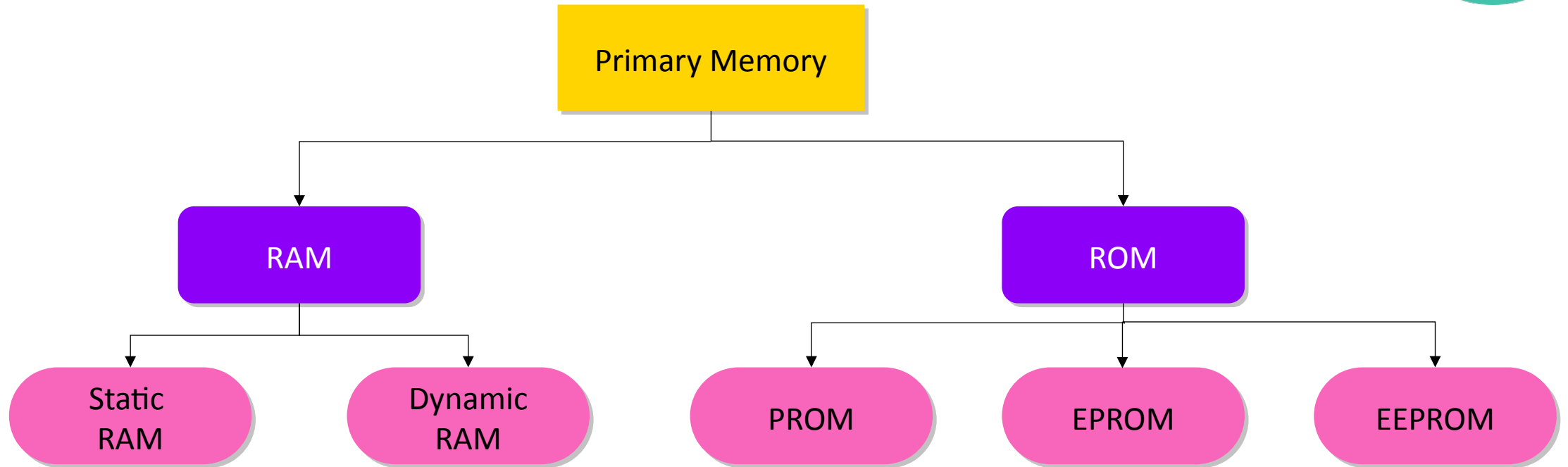
Its permanence is high for future use in magnetic materials.

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# Primary Memory or Main Memory








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# Types Of Memory

## Primary Memory or Main Memory

- 
 Primary memory is computer memory that is accessed directly by the CPU
- 
 The primary memory allows the computer to store data for immediate manipulation and to keep track of what is currently being processed.
- 
 It has limited storage capacity
- 
 Main memory is volatile in nature, it means that when the power is turned OFF the contents of this memory are lost forever.
- 
 Primary memory can be further classified in two categories.




**Random Access Memory (RAM)**



**Read Only Memory (ROM)**

Primary Memory  
Flow Chart



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Computer Memory 





# RAM



Random-access memory is a form of computer memory that can be read and changed in any order, typically used to store working data and machine code.



A random-access memory device allows data items to be read or written in almost the same amount of time irrespective of the physical location of data inside the memory.



There are two categories of RAM as follows



**Static RAM**



**Dynamic RAM**

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**Primary Memory**



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## Types of RAM

### Static RAM

- Static random-access memory is a type of random-access memory that uses latching circuitry to store each bit.
- SRAM is volatile memory; data is lost when power is removed.
- The term static differentiates SRAM from DRAM which must be periodically refreshed.
- It uses multiple transistors for each memory cell.
- It does not use capacitor.
- SRAM is more expensive and faster than DRAM.

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## Types of RAM



### Dynamic RAM



Dynamic random-access memory is a type of random access semiconductor memory that stores each bit of data in a memory cell consisting of a tiny capacitor and a transistor, both typically based on metal-oxide-semiconductor technology.



DRAM is slower, less expensive, and occupies less space on the computer's motherboard.

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## Types Of Memory



### Read Only Memory (ROM)

- Read-only memory (ROM) is a type of non-volatile memory used in computers and other electronic devices.
- Data stored in ROM cannot be electronically modified after the manufacture of the memory device
- ROM can have data and instructions written to it only one time.
- There three categories of ROM as follows,

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## Read Only Memory (ROM)

## Programmable Rom (PROM)



A programmable read-only memory is a form of digital memory where the setting of each bit is locked by a fuse or antifuse.



It is one type of ROM.



The data in them are permanent and cannot be changed.



These types of memories are found in video game consoles, mobile phones, implantable medical devices and high definition multimedia interfaces.

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## Read Only Memory (ROM)

## Erasable Programmable Rom (EPROM)



It is similar to PROM BUT whose contents can be erased by ultraviolet light is called EPROM.



It is also known as Ultraviolet Erasable Programmable ROM.

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## Read Only Memory (ROM)



## Electrically Erasable Programmable Rom (EEPROM)



It is similar to EPROM, but it can be erased electrically, then rewritten electrically and the burning process is reversible by exposure to electric pulse.



It Is the most flexible type of ROM, and is now commonly used for holding BIOS.

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# Types Of Memory

## Secondary Memory Or Auxiliary Memory

- 
 Secondary memory is where programs and data are kept on a long-term basis.
- 
 Common secondary storage devices are the hard disk and optical disks.
- 
 The hard disk has enormous storage capacity compared to main memory.
- 
 The hard disk is usually contained inside the case of a computer.
- 
 Secondary memory devices include as follows,



**Magnetic Storage**



**Optical Storage**



**Solid State Storage**

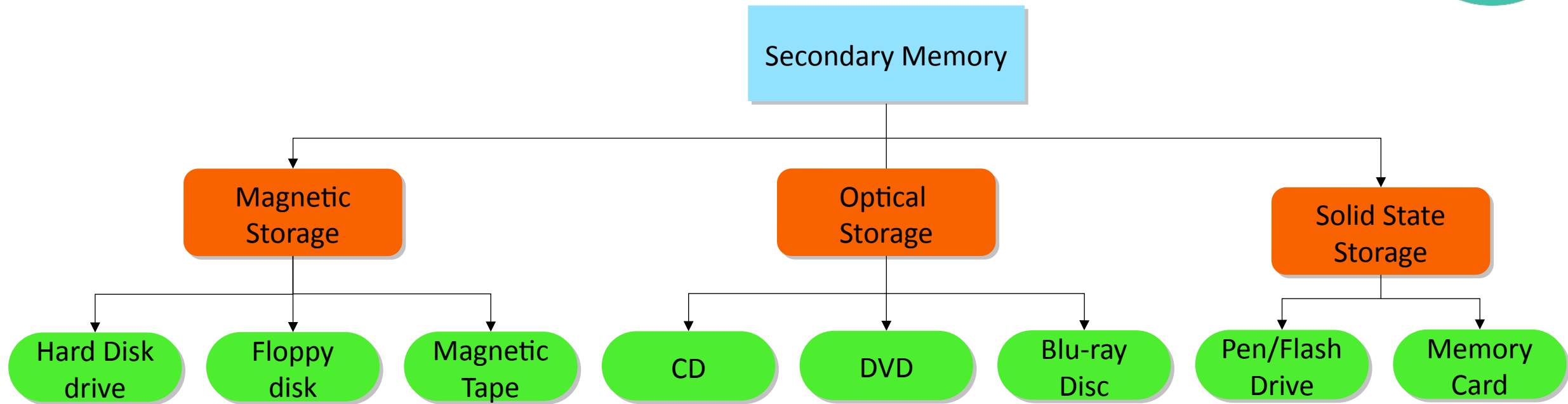
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Secondary Flowchart



# Secondary Memory



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## Secondary Memory Or Auxiliary Memory



### Magnetic Storage



Magnetic storage is the manipulation of magnetic fields on a medium in order to record audio, video, or the data.



It includes

**Hard Disk Drive**

**Floppy Disk**

**Magnetic Tapes**

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# Magnetic Storage



## Hard Disk Drive (HDD)



It is a non volatile and random access digital data storage device.



HDD is a data storage device used for storing and retrieving digital information using rotating disks (platters) coated with magnetic material.



All programs of a computer are installed in hard disk.



It is a fixed disk i.e. cannot be removed from the drive.



It consists of a **Spindle** that holds non-magnetic flat circular disks, called **Platters**, which hold the recorded data.



The information is recorded in bands, each band of information is called a **Track**.



Each platter has the same number of tracks and a track location that cuts across all platters is called a **Cylinder**.

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# Magnetic Storage



## Floppy Disk



It is used to store data but it can store small amount of data and it is slower to access than hard disks.



Floppy disk rounds in shape and a thin plastic disk coated with iron oxide.



Data is retrieved or recorded on the surface of the disk through a slot on the envelope.



Floppy disk is removable form the drive.



Floppy disk is available in three sizes, 8 inch, 5 ¼ inch, 3 ½ inch.

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# Magnetic Storage



## Magnetic Tape



It is sequential memory which contains thin plastic ribbon to store data and coated by magnetic oxide.



Data read/write speed is slower because of sequential access.



It is highly reliable which requires magnetic tape drive writing and reading data.

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# Optical Storage



Optical storage is any storage type in which data is written and read with a laser.



It includes **CD**, **DVD** and **Blu-ray disc**.

**CD**

**DVD**

**Blu-ray disc.**



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# Optical Storage



## Compact Disc (CD)



It is the most popular and the least expensive type of optical disc.



A CD is capable of being used as a data storage device along with storing of digital audio.



The files are stored on this particular contiguous sectors



CD's are categorized by three main types as follows,

- 1.CD-ROM ( compact disc ROM),**
- 2.CD-R (compact disc-Recordable),**
- 3.CD-RW ( compact disc – Rewritable).**

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# Optical Storage

## Digital Video Disc (DVD)



DVD is also known as super density disc or digital versatile disc.



It is an optical disc storage media.



DVD's offer higher storage capacity than CD's while having the same dimensions.



They are not rewritable media. DVDs come in three varieties as follow,

- 1.DVD-ROM**
- 2.DVD-R**
- 3.DVD-RW**

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# Optical Storage



## BLU-RAY DISC



It is an optical disc storage medium designed to re-capture the data normally in DVD format.



RAY can hold almost 5 times more data than a single layer DVD.



The variations in the formats are as follows,

- 1. **BD-ROM (read only)**
- 2. **BD-R (Recordable)**
- 3. **BD-RW (Rewritable)**

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# Solid State Storage



Solid state is a type of storage technique that employs storage devices built using silicon microchip based storage architecture.



It includes  
**1.Pen/Flash Drive**  
**2.Memory Card.**



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## Solid State Storage

## Pen/Flash Drive



Pen drive is a data storage device that includes flash memory with an integrated USB interface.



It is typically removable, rewritable and much smaller than an optical disc.



Most weigh less than 30 g.



Pen drive is also known as flash drive.



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# Solid State Storage

## Memory Card



These are the data storage devices in a chip shaped which can store the data in it.



They are commonly used in many electronic devices, including digital cameras, mobile phones, laptop comp.



They are small, re-recordable, easily portable, and very light weighted.



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## Basic Units Of Memory Measurements



1 Bit	=	Binary Digit
8 Bits	=	1 Byte
1024 Bytes	=	1 KB (Kilo Byte)
1024 KB	=	1 MB (Mega Byte)
1024 MB	=	1 GB (Giga Byte)
1024 GB	=	1 TB ( Terra Byte)
1024 TB	=	1 PB (Peta Byte)
1024 PB	=	1 EB (Exa Byte)
1024 EB	=	1 ZB ( Zetta Byte)
1024 ZB	=	1 YB (Yotta Byte)
1024 YB	=	1 (Bronto Byte)
1024 Bronto Byte	=	1 (Geop Byte)

**4 BIT = 1 NIBBLE**

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Geop Byte is the Highest Memory







# 'Hurrah!'

## We completed this section.



Next Section  
Coming  
Soon...

