Storage and Memory

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- ROM
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- Storage
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- DVD-R, DVD+R, DVD-RW, and DVD+RW disc.
- Flash memory
- Flash memory devices
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- Memory card
- SD card
- SSD
- Other types of storage systems

Memory

- A memory is just like a human brain.
- It is used to store data and instructions.
- Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored.
- Memory is primarily of three types −
  - Cache Memory
  - Primary Memory/Main Memory
  - Secondary Memory

Cache Memory

- Cache memory is a very high speed semiconductor memory which can speed up the CPU.
- It acts as a buffer between the CPU and the main memory.
- It is used to hold those parts of data and program which are most frequently used by the CPU
- Advantages
  - Cache memory is faster than main memory.
  - It consumes less access time as compared to main memory.
  - It stores the program that can be executed within a short period of time.
  - It stores data for temporary use.

Cache Memory

- Disadvantages
  - Cache memory has limited capacity.
  - It is very expensive.

Storage devices

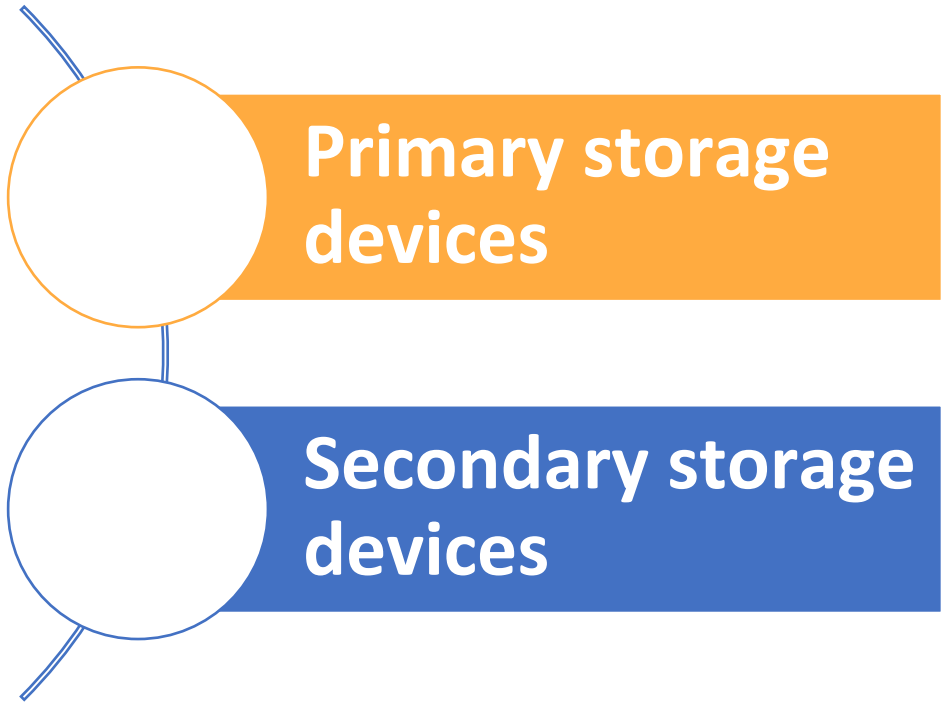
- A storage device is any type of computing hardware that is used for
  - **storing, porting or extracting data files and objects.**
- Storage devices can hold and store information both temporarily and permanently.
- They may be internal or external to a computer, server or computing device.
- Storage devices are one of the core components of any computing device.

Storage devices

- Storage devices are available in different forms, depending on the type of underlying device.
- For example, a standard computer has multiple storage devices including RAM, a cache, and a hard disk.
- The same device may also have optical disk drives and externally connected USB drives.

Types of storage Devices

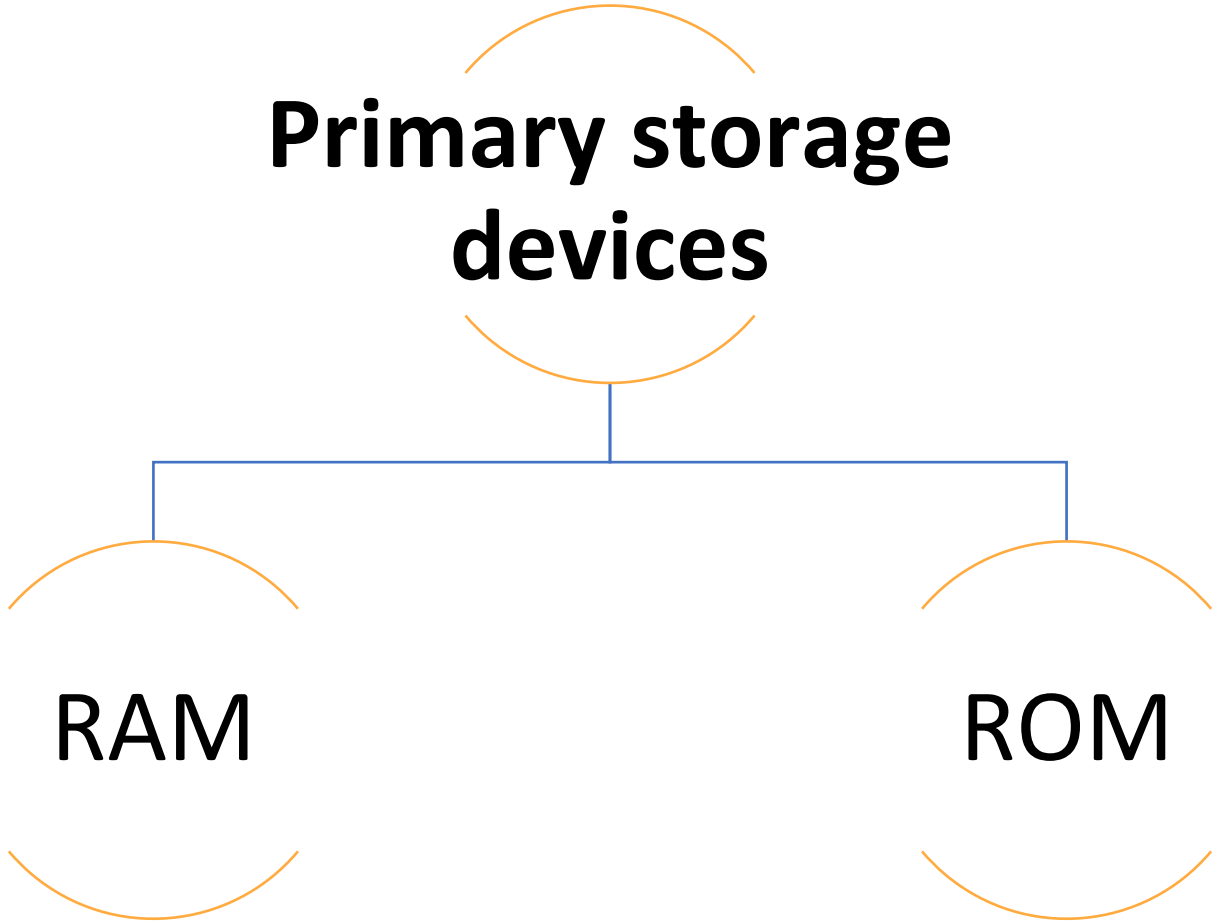
- There are two different types of storage devices:



Primary Memory (Main Memory)

- Generally smaller in size,
- It is designed to hold data temporarily
- It is internal to the computer (Internal Memory)
- It has the fastest data access speed.

Types of storage Devices



Primary Storage Devices: RAM

- computer’s primary memory.
- It is a very fast solid state storage medium that is directly accessible by the CPU.
- Any open programs or files on a computer are temporarily stored in RAM whilst being used.
- Volatile Memory

Primary Storage Devices: RAM

- VOLATILE MEMORY
- Being volatile, any data stored in RAM will be lost when power is removed. This makes RAM totally unsuitable for the long term permanent storage of data – that is the role of a HDD or SSD instead.
- RAM is a relatively expensive storage device and typical capacities are measured in Gigabytes (GB).

Primary Storage Devices: RAM

- Types of RAM
  - SRAM – Static RAM
  - DRAM – Dynamic RAM

Benefits of RAM

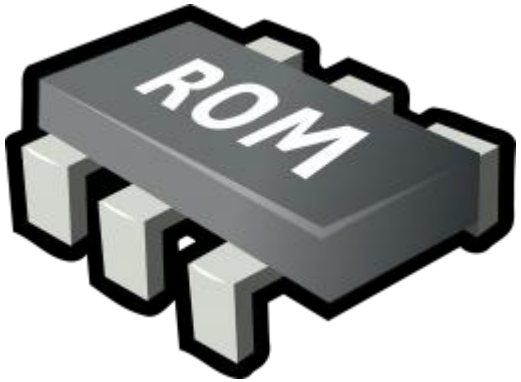
- Directly accessible to the CPU, making processing data faster
- Fast solid state storage, making processing data faster

Drawbacks of RAM

- Relatively expensive memory
- Volatile – any data stored in RAM is lost when power is removed

Primary Storage Devices: ROM

- Read Only Memory
- ROM is a non-volatile memory chip whose contents cannot be altered (changed).
- It is often used to store the start up routines in a computer (e.g. the BIOS).



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EC5274 SS/SD
ИЗОТ
СДЕЛАНО В БОЛГАРИИ
boedem
FLOPPY DISK
5,25" HD,DS
HD
BASF
WRITE ENABLE
WRITE PROTECT

Secondary storage devices:

- Secondary storage devices usually have larger storage capacity, and they store data permanently.
- They can be either internal or external to the computer.
- These types of devices include the hard disk, the optical disk drive and USB storage device.

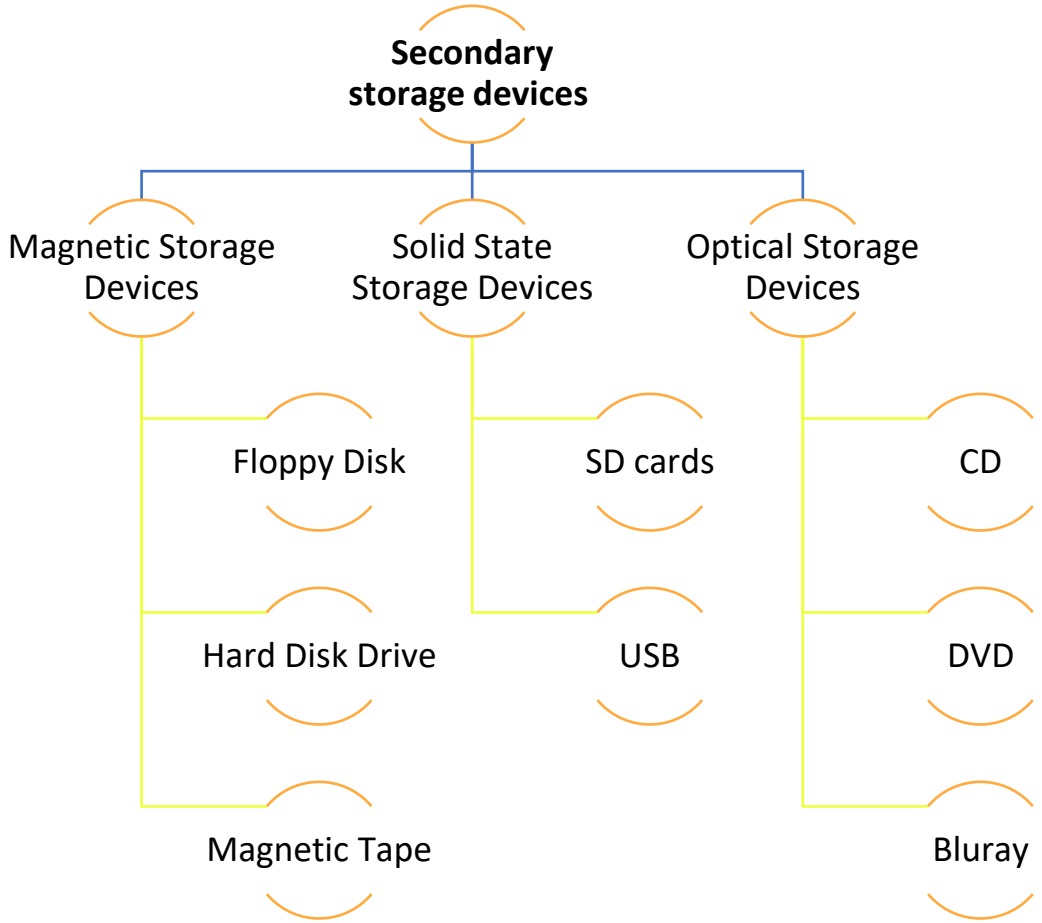
Brief History of Storage Devices [Extra Reading]

- In order to really understand what storage devices used to look like and what they look like now, it can be helpful to look at a history of evolving storage devices in general.
- Early storage devices were primitive mechanical systems based on items like punch cards and later, magnetic tape. They presented binary through physical media.
- These became largely obsolete when other digital media was created. First, there were floppy disks and diskettes, then there were compact discs that could hold large amounts of binary in digital formats.
- At the same time, computers and other devices continued to be made with primary hard drives, where a traditional platter is read by an arm in order to read and write data.
- Eventually, a new option emerged called the solid-state drive or SSD.

Storage Devices

- The New Paradigm: Solid-State Drives and Storage Devices
- Cloud and Virtual Storage

Types of storage Devices



Magnetic Storage devices

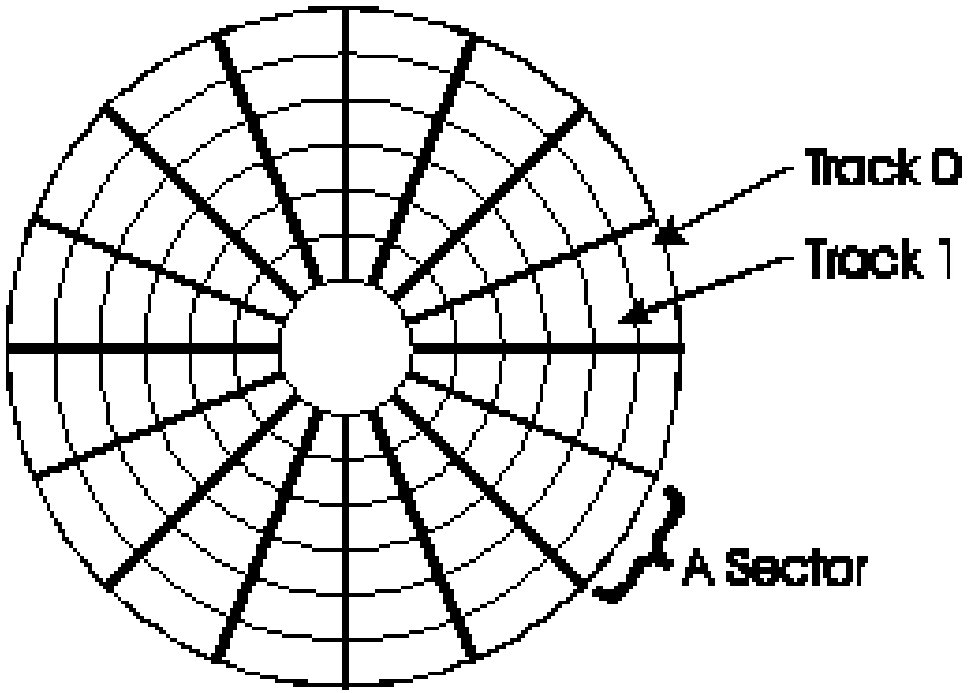
Magnetic Storage Devices

- Most common form of storage
- It uses magnetic technology to read/write the data
- Examples may include: Hard drives, floppy drives, Magnetic tape

Floppy Disk

- Also known as Diskettes
- Read with a disk drive (no longer used today, can be connected as an external drive)
- Spins at 300 RPM (revolutions per minute)
- Takes .2 second to find data
- A typical 3 ½ floppy disk holds 1.44 MB

Floppy Disk

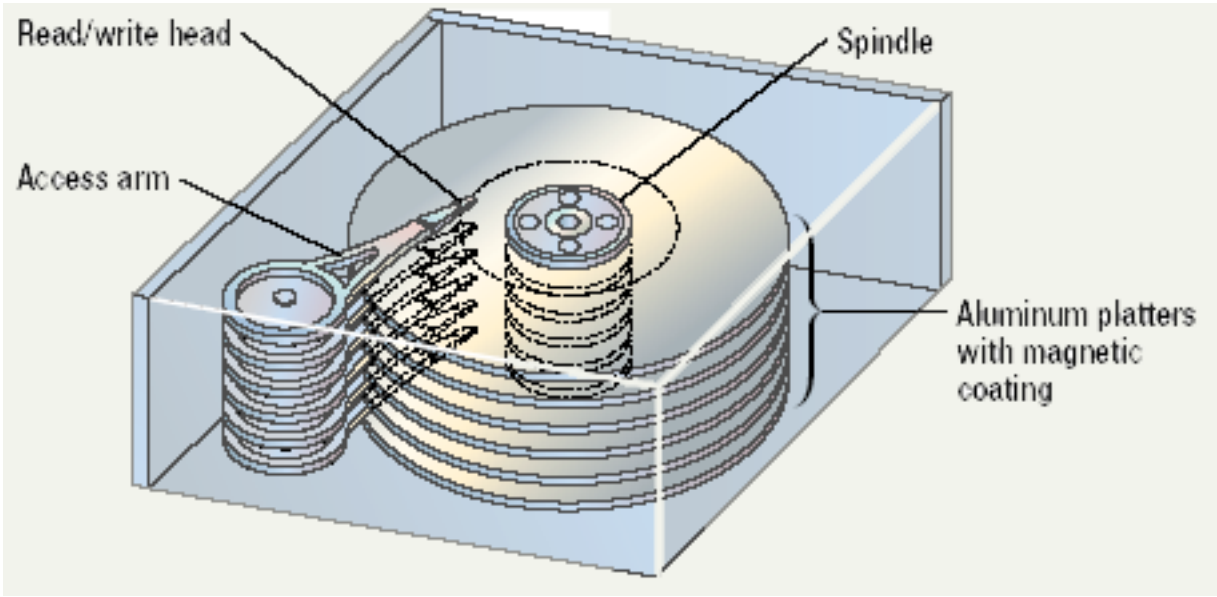


- Data is stored on tracks and sectors
  - 80 tracks
  - 18 sectors

HDD

- HDD, or hard disk drive, is a type of storage device for computers.
- They are sometimes called a hard disk or hard drive
- HDDs consist of one or more magnetic platters
- It has moving parts
  - Noise
  - Fragile
- **Magnetic Head**
  - There is a magnetic head attached to an arm that moves across the rotating platter and writes data to it.
  - The same magnetic head can also read data that was written to the disk.
- HDDs are often inside a computer attached to the motherboard, or in an external case connected by a USB cable.

HDD


Read/write head
Spindle
Access arm
Aluminum platters
with magnetic
coating

Magnetic Tap

- Tape drives
  - Best used for
    - Infrequently accessed data
    - Back-up solutions
  - Slow sequential access
  - Capacity exceeds 200 GB

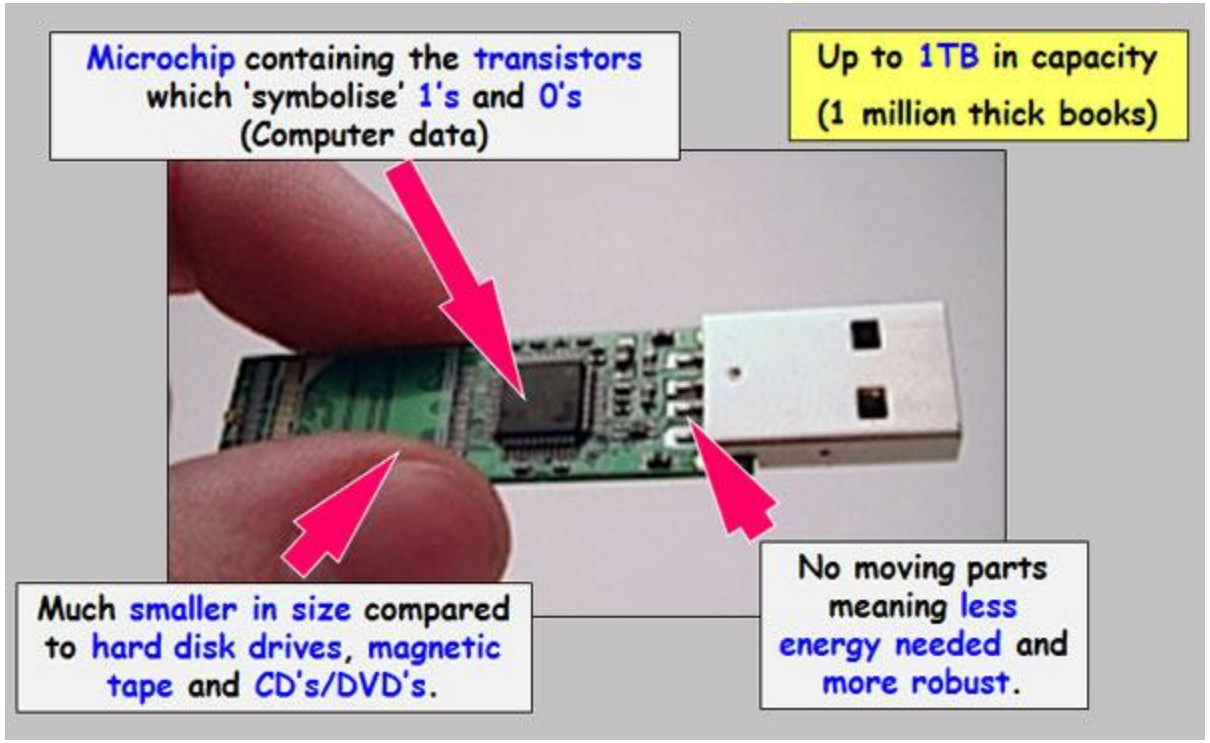
Solid State Storage Devices

Solid State Storage Devices

- Any memory device with no moving parts and are based on electronic circuits.
- No reels of tape, no spinning disks, no moving laser beams etc.
- SSD technology is known as 'flash memory' and this is the smallest form of data storage.
  - Examples include memory sticks, memory cards etc.
- They store data as 1’s and 0’s within millions of electrical transistors instead of on films of magnetic substance or as dots on discs.
- SSDs are often inside a computer attached to the motherboard. But there are some external SSDs that connect to the computer with a USB cable.


Transcend
Transcend
SanDisk
SanDisk
SDHC Card
128GB

SSD


Microchip containing the transistors which 'symbolise' 1's and 0's (Computer data)
Up to 1TB in capacity (1 million thick books)
Much smaller in size compared to hard disk drives, magnetic tape and CD's/DVD's.
No moving parts meaning less energy needed and more robust.

Advantages of SSD

- They hold several advantages over Magnetic Disc Drives:
- Much smaller
- Use less power (no moving parts means less power needed)
- Faster data access and transfer times
- Much more robust (harder to damage)

Examples of Solid State Media

- The table below shows you some examples of solid state storage media.
- Solid State Hard Drives
- Memory Stick / Pen Drive
- Flash Memory Cards
- Micro Flash Memory Cards

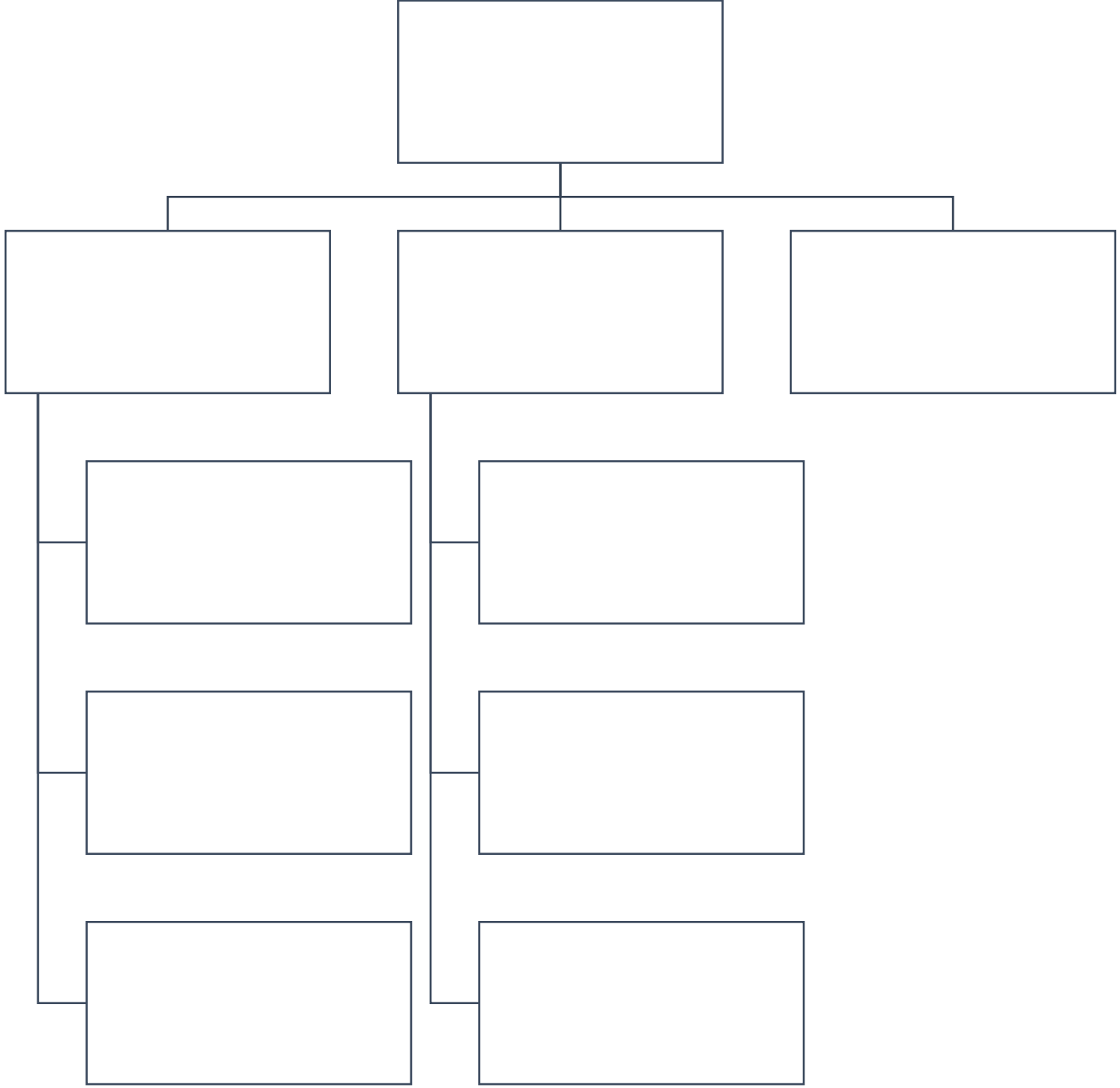
Optical Storage Devices

Optical Storage Devices

- The most popular alternative to magnetic storage systems are optical storage media.
- Optical storage devices are flat, round disks that spins around its center.
- The difference with magnetic storage device is that in optical storage devices LASER light is used to read and write data in disks.
  - Examples are CD, DVD etc.
- There are two types of optical disks; one that can be written for one time only and another which can be used to write data more than one time, these are called re-writable disks. Some optical disks can store data on both sides of the disk.

Magnetic storage devices vs Optical Storage Devices

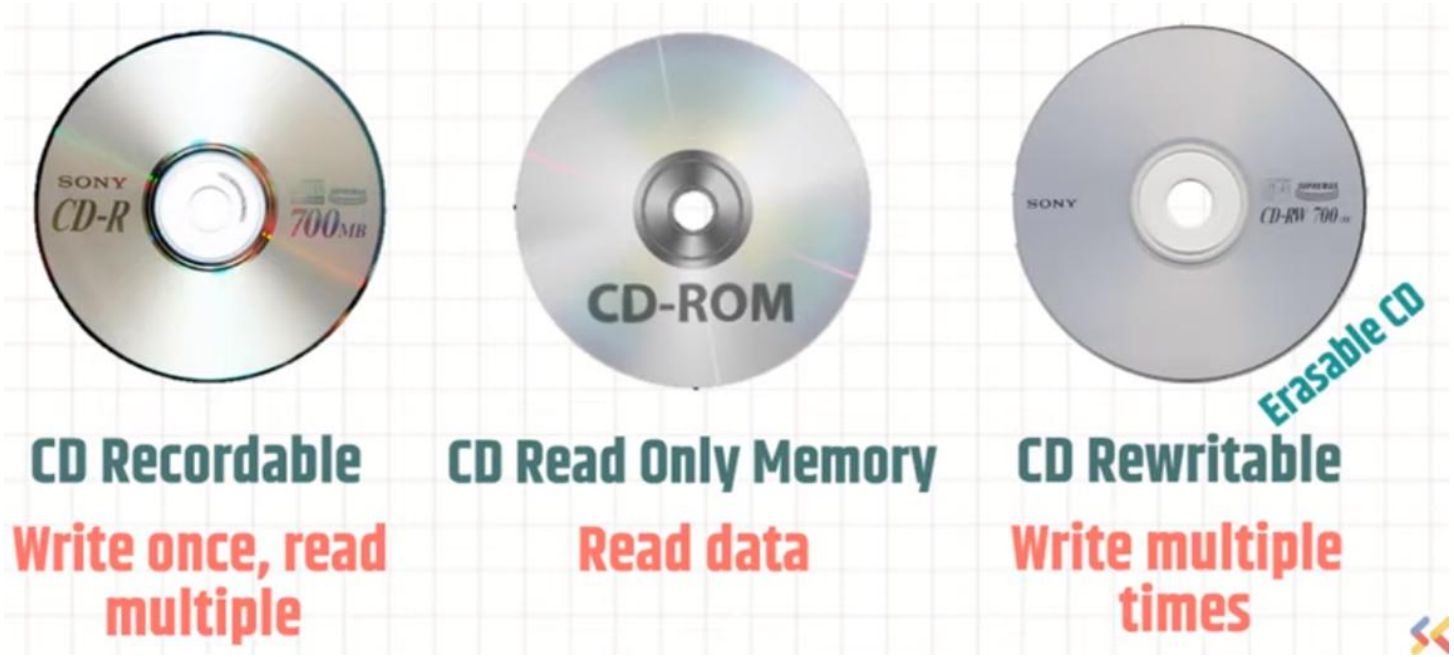
- Optical disks are cheaper than magnetic storage devices. But data stability of these disks depends on their use and maintenance. Optical disks do not provide huge storing capacity like magnetic devices. However, now a days, Blue-ray disks are coming up with nearly 20 GB of space which is huge.



CD

- Compact Disk
- Portable
- 700 Mbs of Data

Types of CDs


SONY
CD-R
700MB
CD-ROM
SONY
Erasable CD
CD Recordable
Write once, read multiple
CD Read Only Memory
Read data
CD Rewritable
Write multiple times

DVD

- Digital video Disk / Digital versatile Disk
- Storage capacity is 10 times more than CD
- 20 times faster than CD

Types of DVD

DVD Recordable

Write once, read multiple

DVD Rewritable

Write multiple times

Blu-ray Disc

- It uses blue laser rather than the red laser
- It stores more data
- 25GB of data per layer
- It can be dual layer, triple layer

Disc Capacities

CD	DVD	Blu-ray
700MB	4.7GB	25GB – 128GB

Typical applications for optical media

- CD – Audio and small amounts of data
- DVD – Standard definition movies and data
- Blu-Ray – HD video and large amounts of data

CD-ROM, DVD-ROM, Blu-Ray-ROM

- Read only – the data is permanently written to the disc at the point of manufacture.

CD-R, DVD-R, BD-R

- Recordable – blank discs that can be burnt (written to) once.

CD-RW, DVD-RW, BD-RE

- Re-writable – blank discs that can be burnt (written to) over and over again (can be erased and reused many times).