Computer and Information Technology

Part 1

➤ **Secondary Memory**

Secondary Memory

Bulk Storage

Secondary Storage

External Memory

Auxiliary Storage

Backup Storage

Removable Storage

Secondary Memory

Secondary memory is non-volatile and long-term storage for the purpose of keeping all software (both application and system software) and user data that would be lost the moment the computer is switched off if stored in volatile primary memory. Secondary storage is not directly accessible by the CPU. The computer usually uses its input/output channels to access secondary storage and transfer the desired data to the primary storage before it can be used.
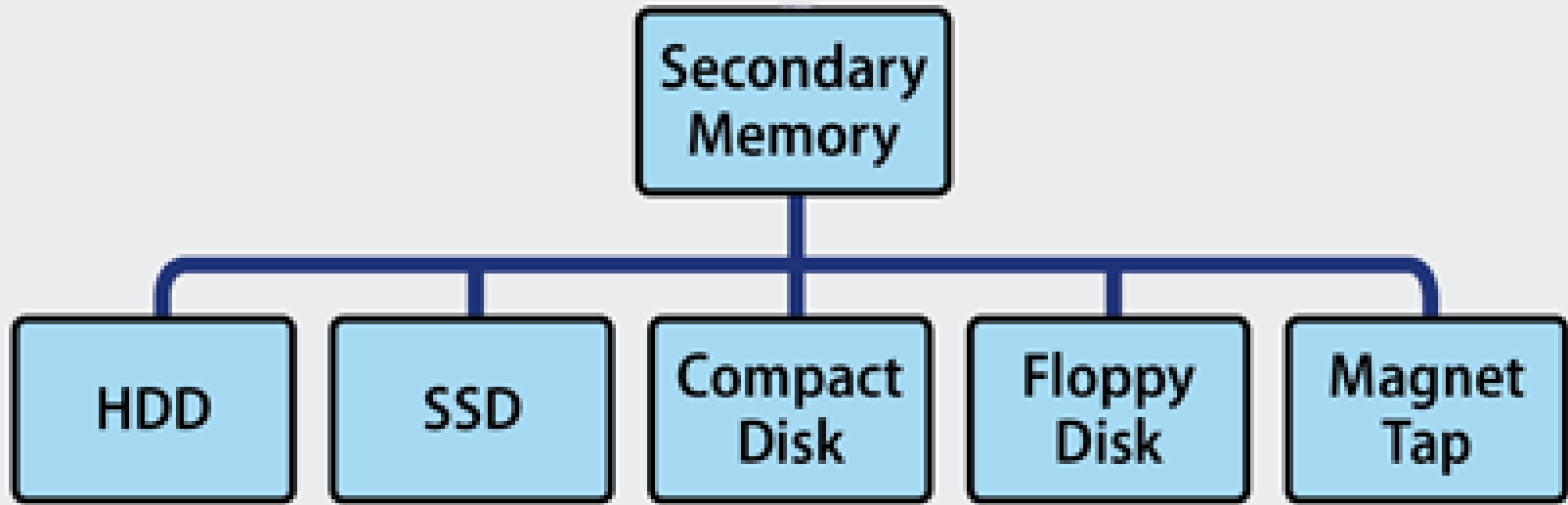
Secondary storage are:
- ❖ Non-volatile
- ❖ Not directly accessed
- ❖ Massive capacity
- ❖ Slower read/write speed
- ❖ Cost effective
- ❖ Removable

Examples:
- ○ Thumb/Pen Drive
- ○ Hard Disk Dive
- ○ Solid State Drive
- ○ CD/DVD
- ○ SD cards

Types of Secondary Storage

Primary vs. Secondary Memory

Primary Memory	Secondary Memory
CPU accessed it directly.	Data from these storages are moved into primary memory first.
Volatile (ROM is an exception).	Non-volatile.
Stores instruction and data for programs and services currently in running status.	Bulk storage for all softwares and user data.
Faster read/write speed.	Slower read/write speed compared to primary storage.
Limited capacity due to cost consideration	Cheap massive storage.
Low packing density.	High packing density.

Tape Drive

Tape drives were among the cheapest options for bulk secondary storage. Polymer tapes with mainly iron oxide coating were packed inside cartridge/cassette or wound in spools and these cassette/cartridge or spool were used to store digital data in analog form by magnetizing the coating on the tape surface.

Magnetic tape is cheap and still see some uses as digital data storage for various other devices.

Tape Spool
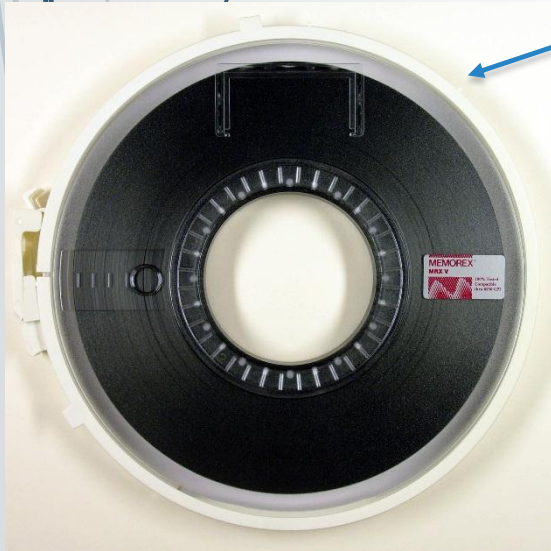
Tape Drive

Generations [edit]

Format	Date	Tape width (mm)	Track pitch (μm)	Tape length (m)	Native capacity (GB)	Capacity assuming 2:1 compression (GB)	Drum rotation speed (RPM)	Data transfer speed (MB/s)
DDS-1	1989	3.81	13.6	60/90	1.3/2.0	2.6/4	2000, 2551	0.183
DDS-2	1993	3.81	9.1	120	4.0	8	4000, 4400, 5737, 8500	0.360-0.720
DDS-3	1996	3.81	9.1	125	12.0	24	3825, 4252	<1.5
DDS-4	1999	3.81	6.8	150	20.0	40	11400	1.0-3.2
DAT-72	2003	3.81	5.4	170	36.0	72	8609.7, 10000	3.2
DAT-160	2007	8	6.8	154	80	160	6457	6.9
DAT-320	2009	8		153[2]	160	320		12
(Gen 8)	canceled	8			~300	~600		≥16

Magnetic Disk: Floppy

Floppy disks were made from flexible polymer disk with iron oxide coating and were housed inside plastic casings. Instead of linear access delay, these disks support faster cyclic access sacrificing capacity. There were some variants of magnetic floppy disks as per their diameter and data density.

Popular Magnetic Disks

Disk Diameter	Capacity (highest)
8 inch	1.2 MB
5.25 inch	1.2 MB
3.5 inch	1.38 MB

Windows
A drive
B Drive

Survived(!) till 2006

Magnetic Disk: Floppy
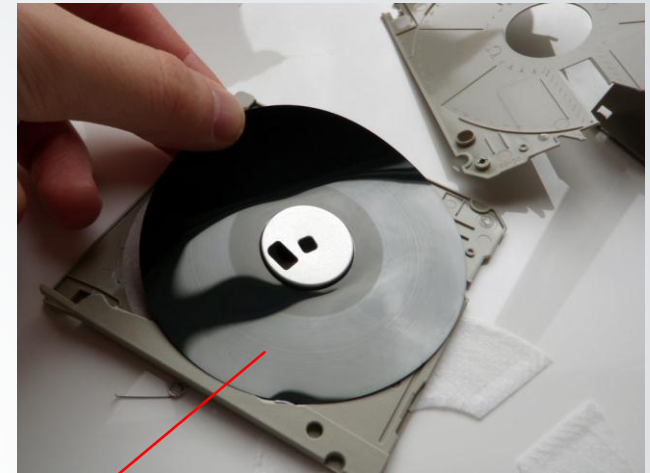
Disk Diameter	Capacity (highest)
8 inch	1.2 MB
5.25 inch	1.2 MB
3.5 inch	1.38 MB

3.5" Floppy Disk Drive

Magnetic Disk: Hard Disk Drive

Magnetic Hard Disks are non removable and come inside the disk drive which is environmentally and magnetically shielded.
This 70 year old technology is still the number one choice for secondary bulk storage for both consumer computers and commercial data centers.
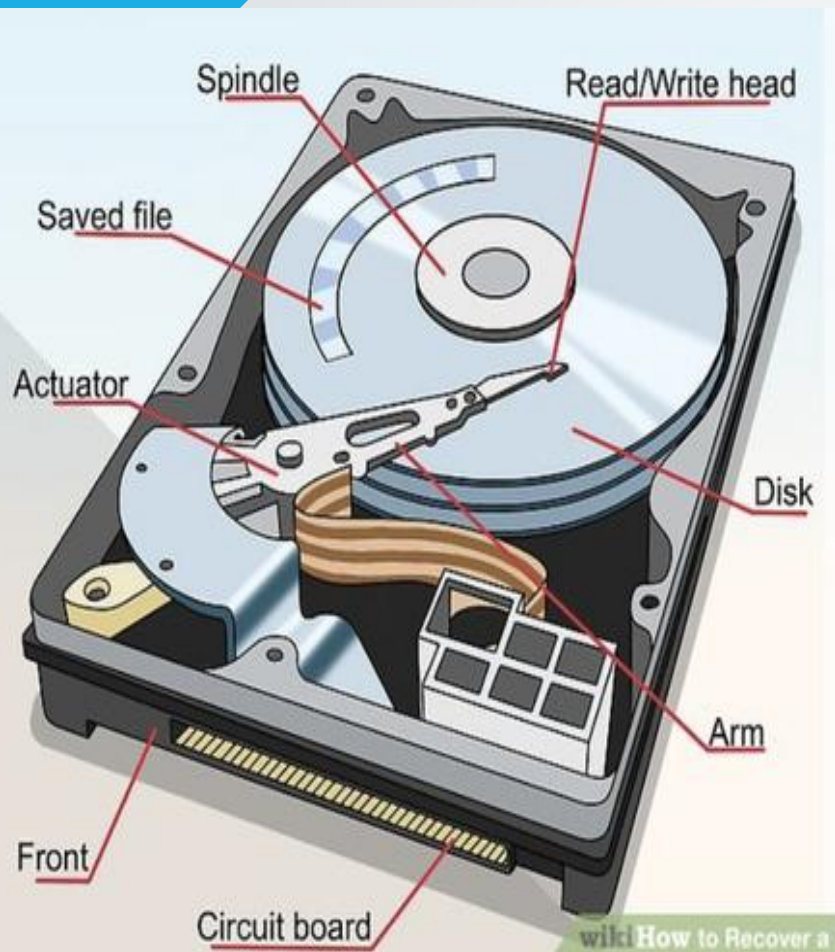
Smaller HDDs are used in Laptops

2.5-inch

3.5-inch

Magnetic Disk: Hard Disk Drive

Spindle
Read/Write head
Saved file
Actuator
Disk
Arm
Front
Circuit board

wikiHow to Recover a

<u>Inside an Hard Disk Drive</u>
Hard disk plates or just platters are made from Aluminum or glass or ceramic and are coated with non magnetic metal or alloys. Upon that the actual magnetic coating is applied. A read/write head capable of magnetizing the platters (data write) or just sensing (data read) the magnetic field moves from edge to center with the help from an arm and actuator.

The platters are rotated constantly using spindle motor and during its operation, the head never actually touches the platters. Circuit board holds the buffer memory and controller for interfacing.
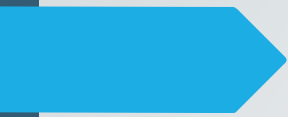
Magnetic Disk: Hard Disk Drive

Magnetic Disk: Hard Disk Drive

Parameter	Started with (1957)	Developed to (2019)	Improvement
Capacity (formatted)	3.75 megabytes[17]	18 terabytes (as of 2020)[18]	4.8-million-to-one[19]
Physical volume	68 cubic feet (1.9 m^3)[c][6]	2.1 cubic inches (34 cm^3)[20][d]	56,000-to-one[21]
Weight	2,000 pounds (910 kg)[6]	2.2 ounces (62 g)[20]	15,000-to-one[22]
Average access time	approx. 600 milliseconds[6]	2.5 ms to 10 ms; RW RAM dependent	about 200-to-one[23]
Price	US$9,200 per megabyte (1961)[24]	US$0.024 per gigabyte by 2020[25][26][27]	383-million-to-one[28]
Data density	2,000 bits per square inch[29]	1.3 terabits per square inch in 2015[30]	650-million-to-one[31]
Average lifespan	c. 2000 hrs MTBF[citation needed]	c. 2,500,000 hrs (~285 years) MTBF[32]	1250-to-one[33]

*Source Wikipedia

Stay Home, Stay Safe Always put on a mask when you are in public!