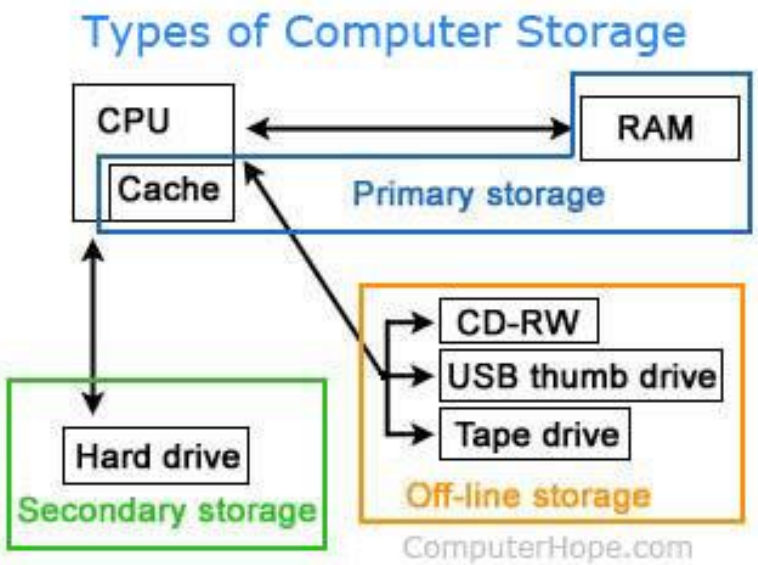


S.No	Volatile Memory	Non Volatile Memory
1	Volatile memory is the type of memory where data is lost when power is turned off	Non Volatile Memory is a type of memory where the data is not lost when a computer is switched off.
2	Data temporarily stored in volatile memory	Data permanently stored in non volatile memory
3	It is faster than non-volatile memory.	It is slower than volatile memory.
4	It has less storage capacity	It has more storage capacity than volatile memory
5	Data can be easily transferred	Data can not be easily transferred
6	It is more costly per unit size.	It is less costly per unit size.
7	CPU has direct access to data.	CPU has no direct access to data.
8	Process can read and write	Process can only read.
9	It has a high impact on the system's performance.	It has a high impact on a system's storage capacity.
10	Data and programs that are currently fetch by CPU are stored in Volatile memory	Any kind of data and programs are stored in Non Volatile memory
11	Example: RAM and Cache Memory	Example: ROM and HDD

The Evolution of Data Storage

8 Inch Floppy DIsk

5 1/2 Inch Floppy DIsk

USB Drive

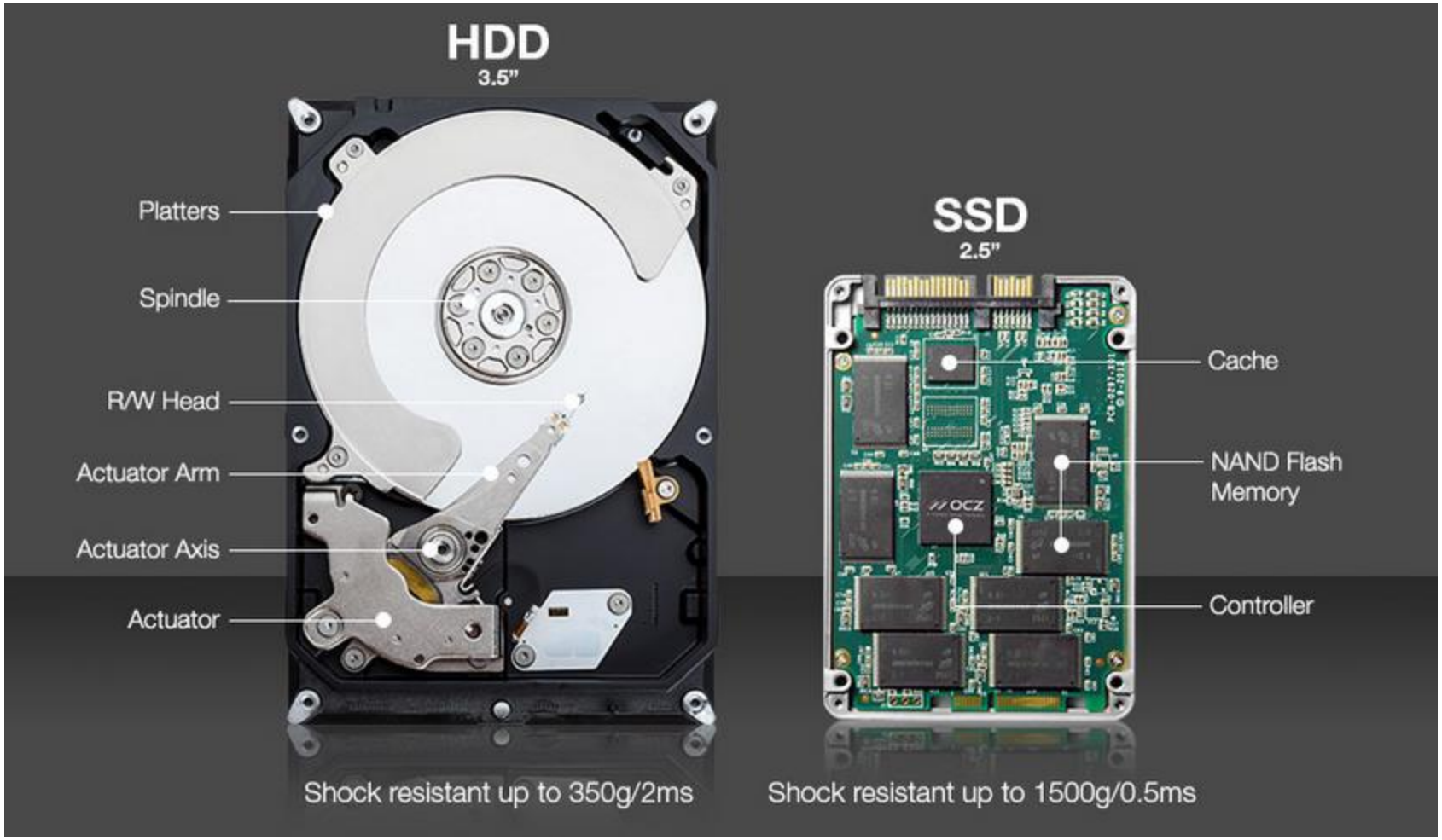
SD

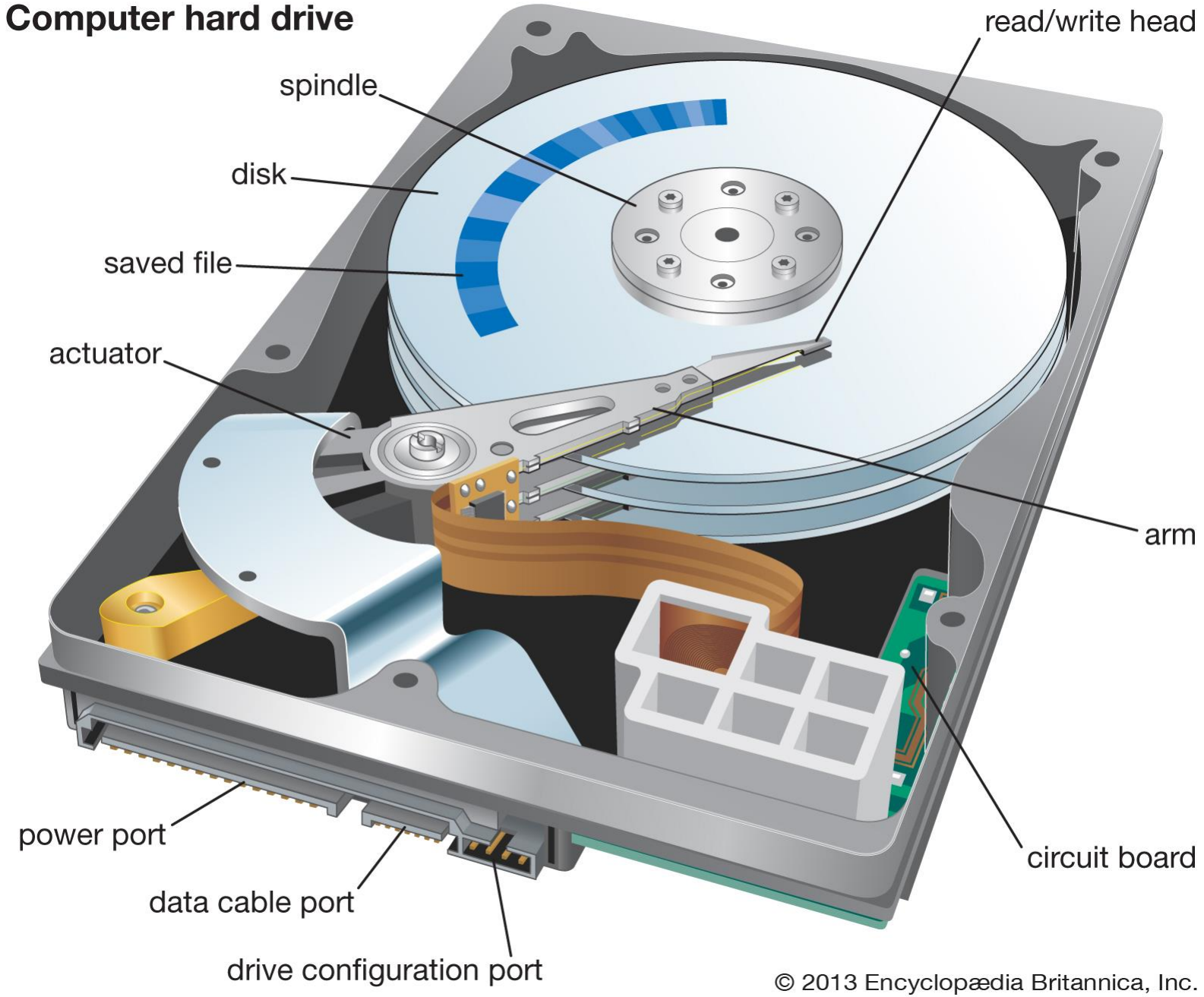
Micro SD

Cloud

Commercially available	1971	1976	2000	2010	2010	2009
Maximum capacity	1.2 mb	1.2 mb	2 tb	256 gb	128 gb	~5zb
Cost per gb	£1000	£800	£0.5	£0.8	£0.5	<50gb free

@vowlesyy @pixelpelican pixelpelican.co.uk samuelvowles.co.uk
sources: Wikipedia, Amazon, Ebay


HDD
3.5"
Platters
Spindle
R/W Head
Actuator Arm
Actuator Axis
Actuator
Shock resistant up to 350g/2ms
SSD
2.5"
Cache
NAND Flash Memory
Controller
Shock resistant up to 1500g/0.5ms


Computer hard drive
read/write head
spindle
disk
saved file
actuator
arm
power port
data cable port
drive configuration port
circuit board
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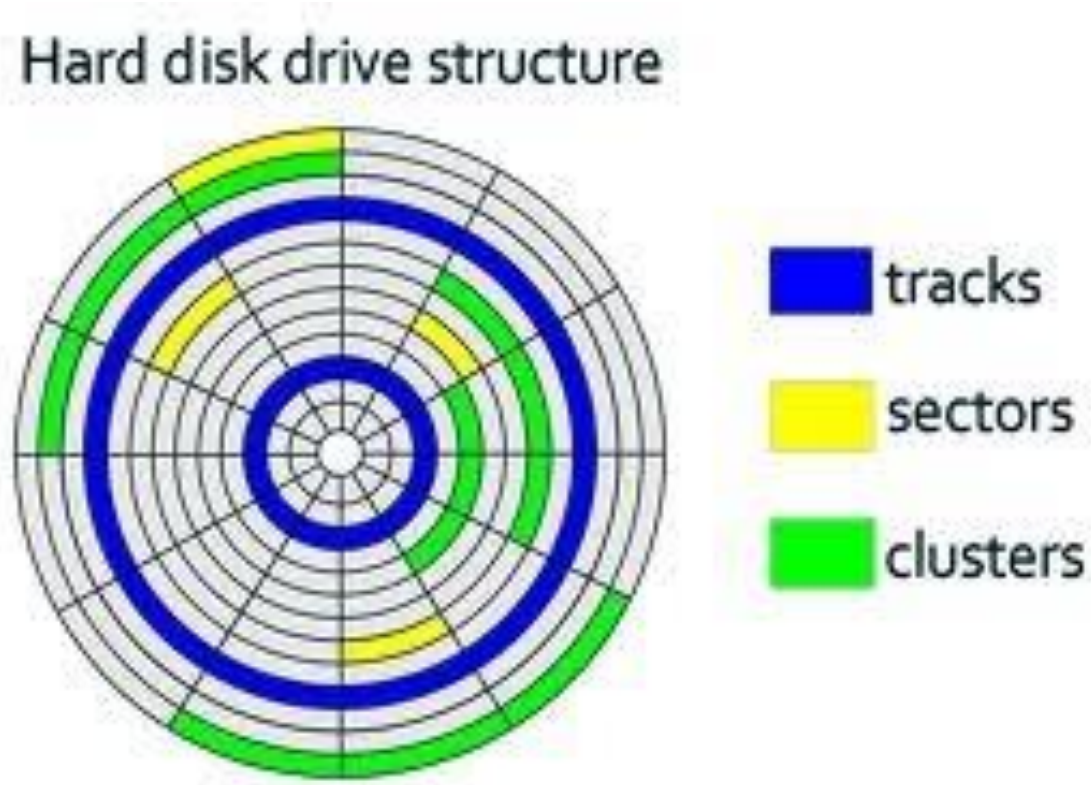
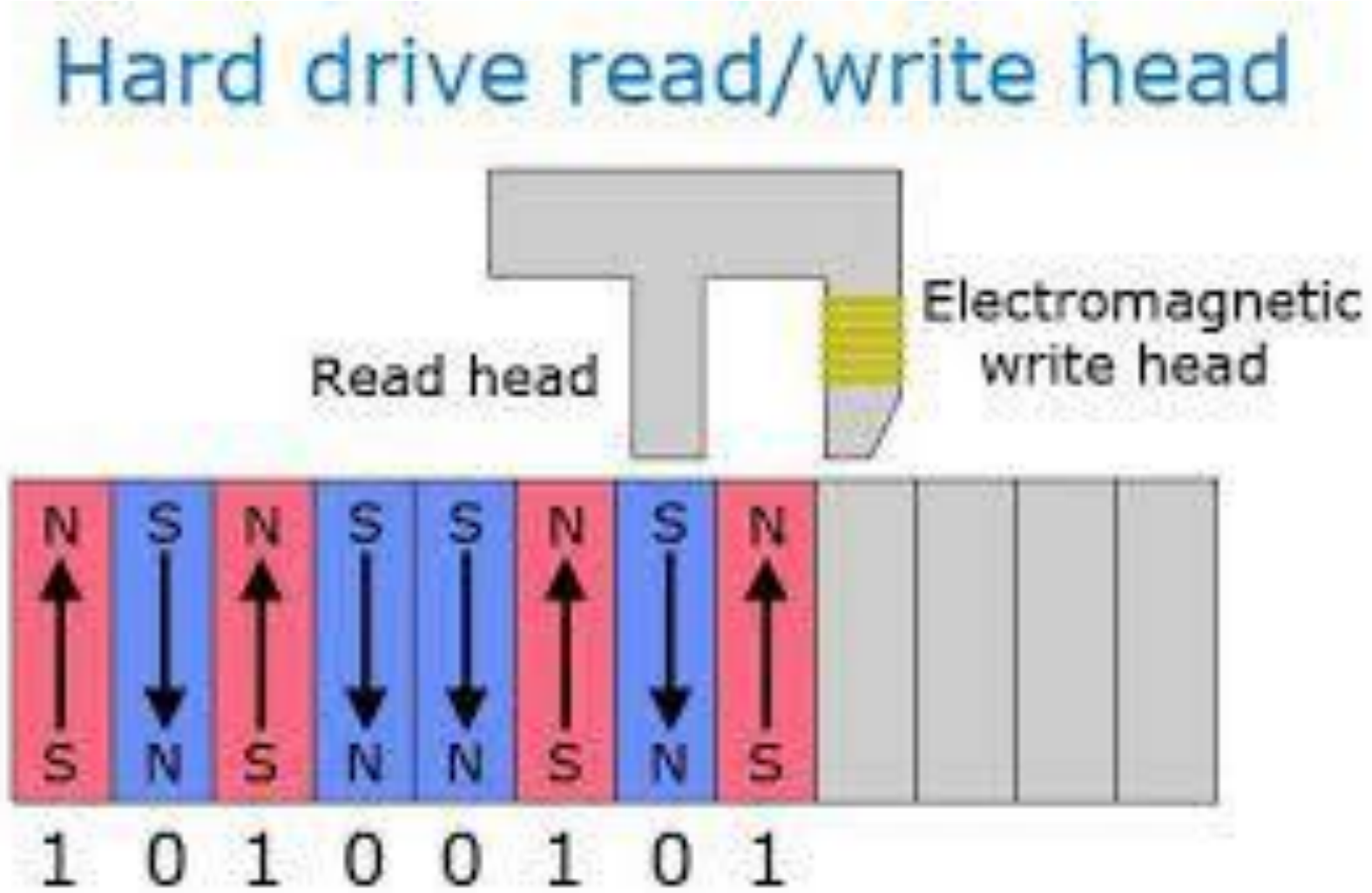
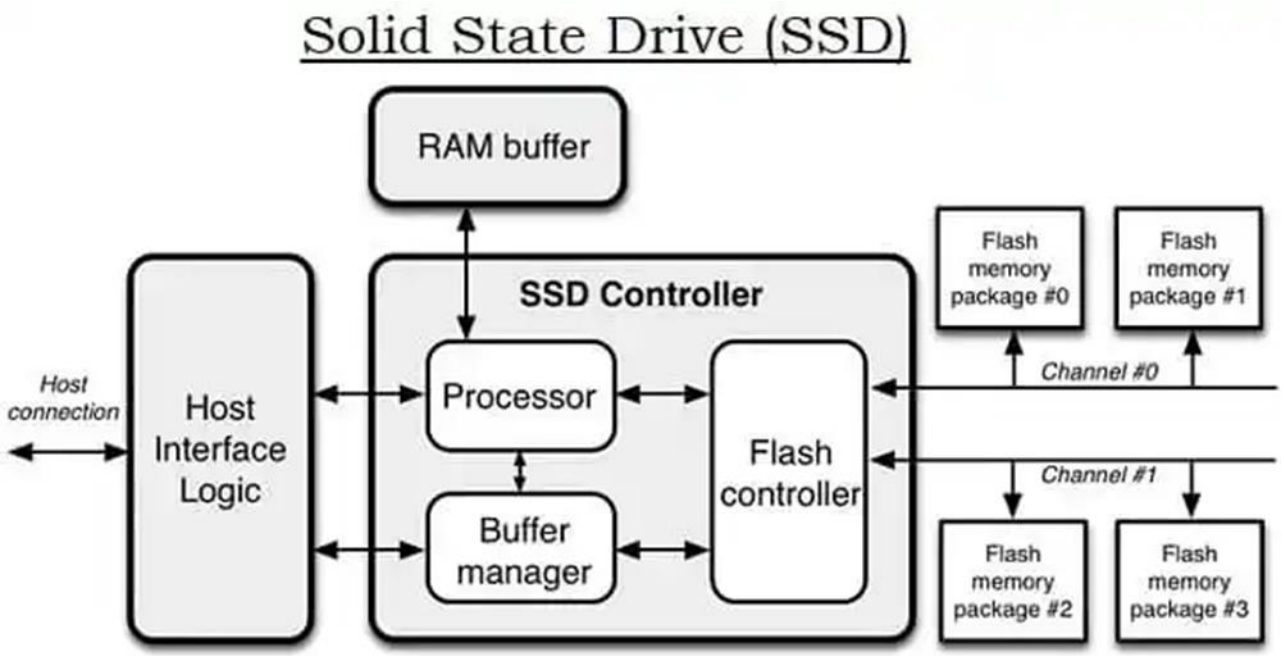
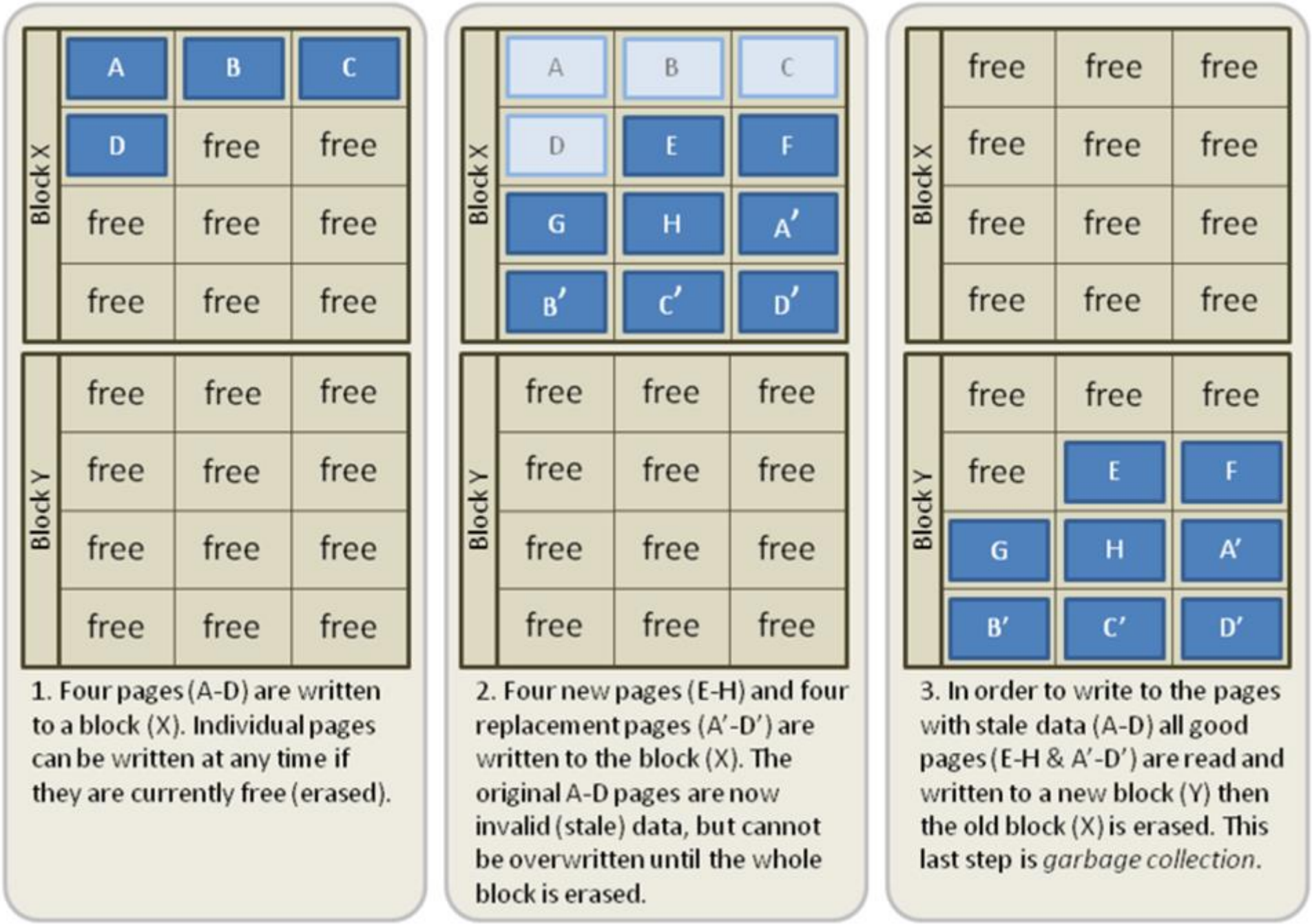
- Data is stored in circular paths called tracks, which is divided into sectors. The file allocation table (FAT) determines which sector is used.
- Each disk has 1024 (0 to 1023 tracks); storage begins in the 1023 track moving outward in the disk.
- A stack (2 or more platters) will have a minimum of 3 sides for data and 1 side for positioning information.
- Files can become fragmented when the disk is full.

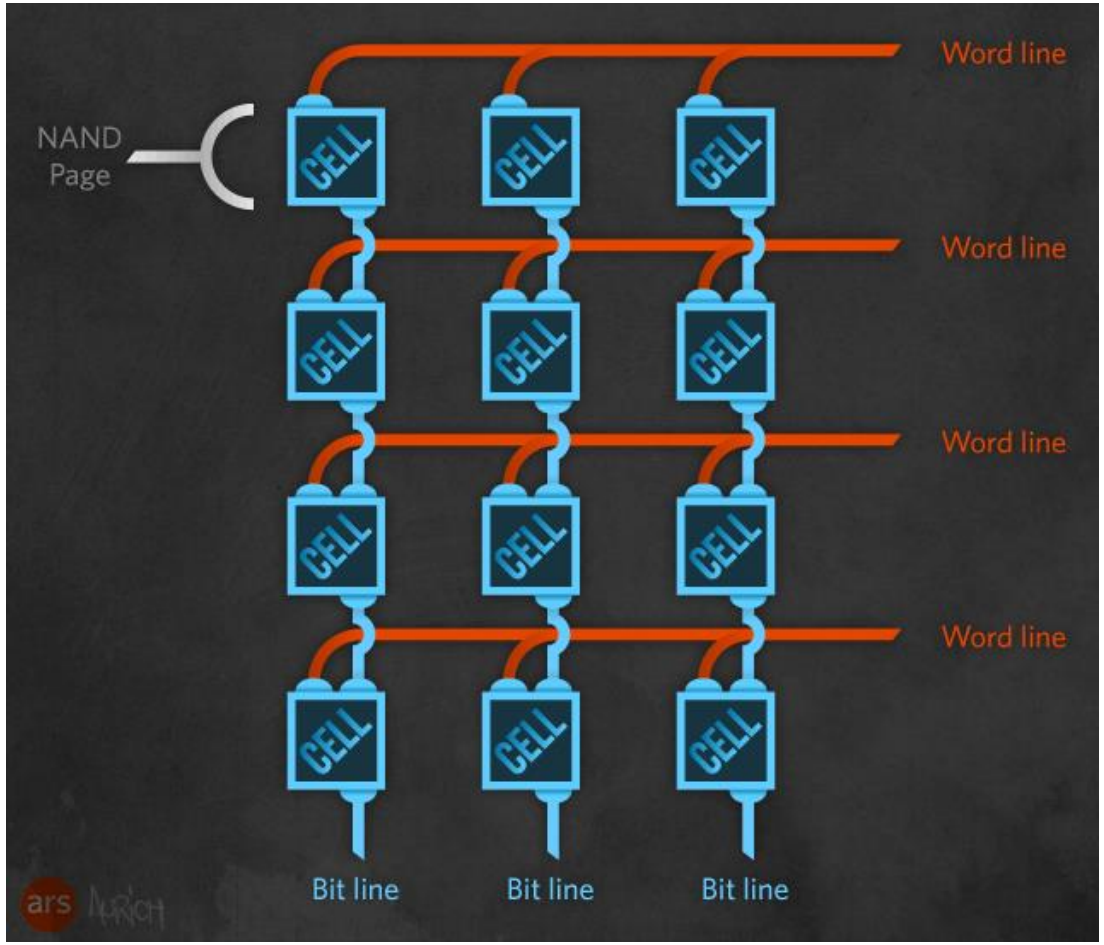



Hard drive read/write head
Read head
Electromagnetic write head
N S N S S N S N
S N S N N S N S
1 0 1 0 0 1 0 1

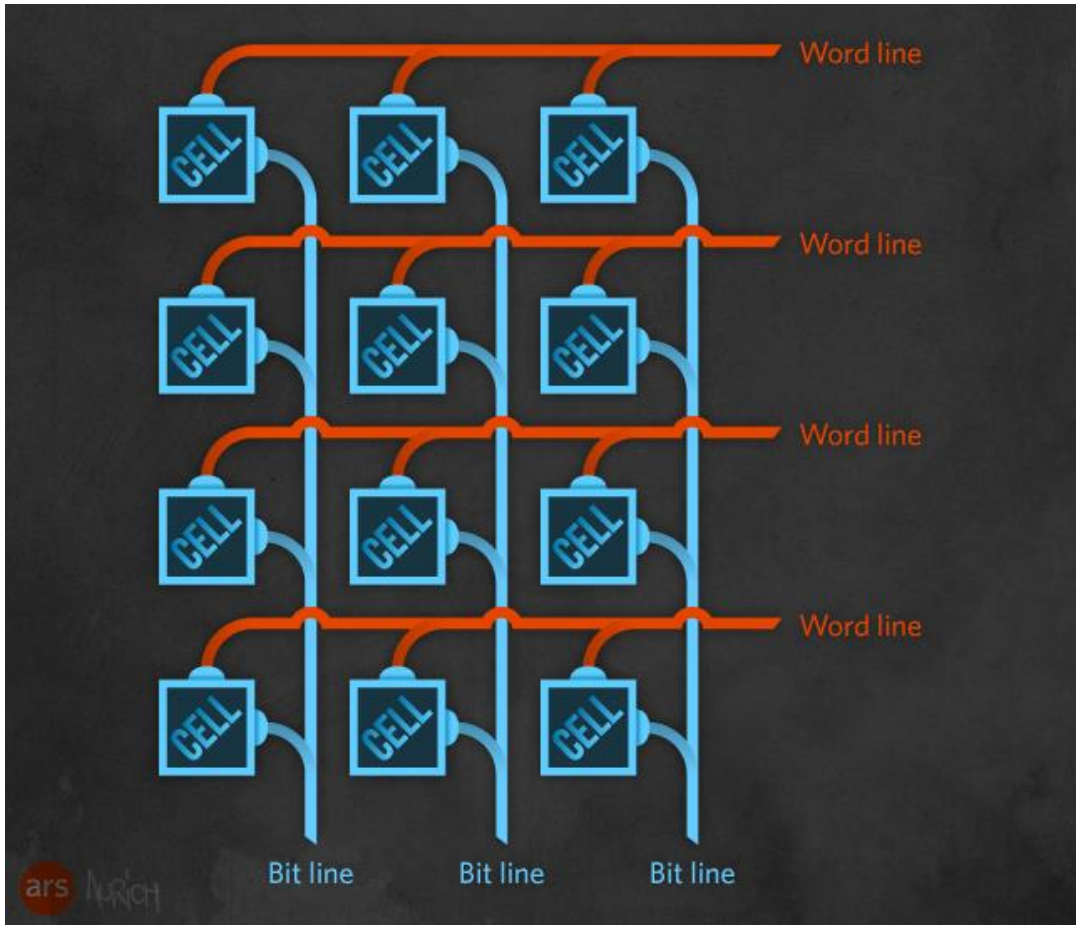

Solid State Drive (SSD)
RAM buffer
SSD Controller
Host connection
Host Interface Logic
Processor
Buffer manager
Flash controller
Flash memory package #0
Flash memory package #1
Channel #0
Channel #1
Flash memory package #2
Flash memory package #3


SSD
2.5"
Cache
NAND Flash Memory
Controller

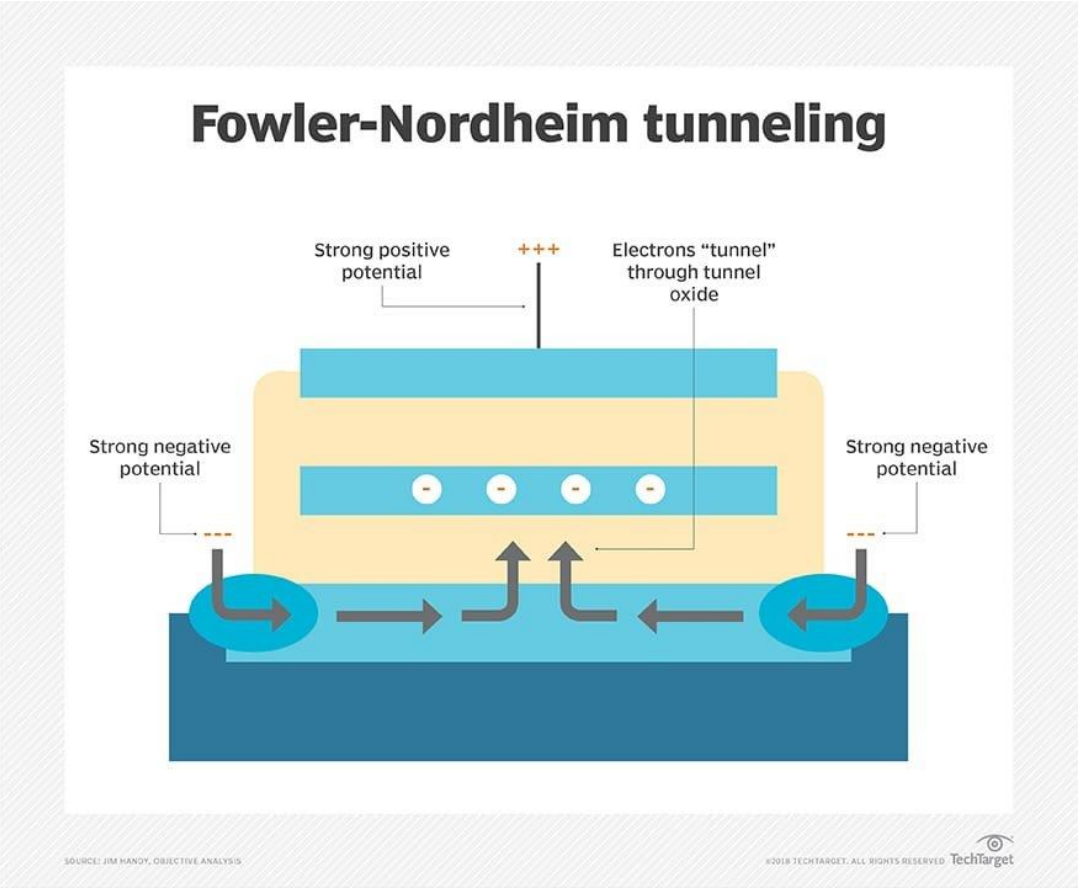

Block X
A
B
C
D
free
free
free
free
free
free
free
free
Block Y
free
free
free
free
free
free
free
free
free
free
free
free
free
free
free
free
1. Four pages (A-D) are written to a block (X). Individual pages can be written at any time if they are currently free (erased).
Block X
A
B
C
D
E
F
G
H
A′
B′
C′
D′
Block Y
free
free
free
free
free
free
free
free
free
free
free
free
free
free
free
free
2. Four new pages (E-H) and four replacement pages (A′-D′) are written to the block (X). The original A-D pages are now invalid (stale) data, but cannot be overwritten until the whole block is erased.
Block X
free
free
free
free
free
free
free
free
free
free
free
free
free
free
free
free
Block Y
free
free
free
free
free
E
F
G
H
A′
B′
C′
D′
3. In order to write to the pages with stale data (A-D) all good pages (E-H & A′-D′) are read and written to a new block (Y) then the old block (X) is erased. This last step is garbage collection.

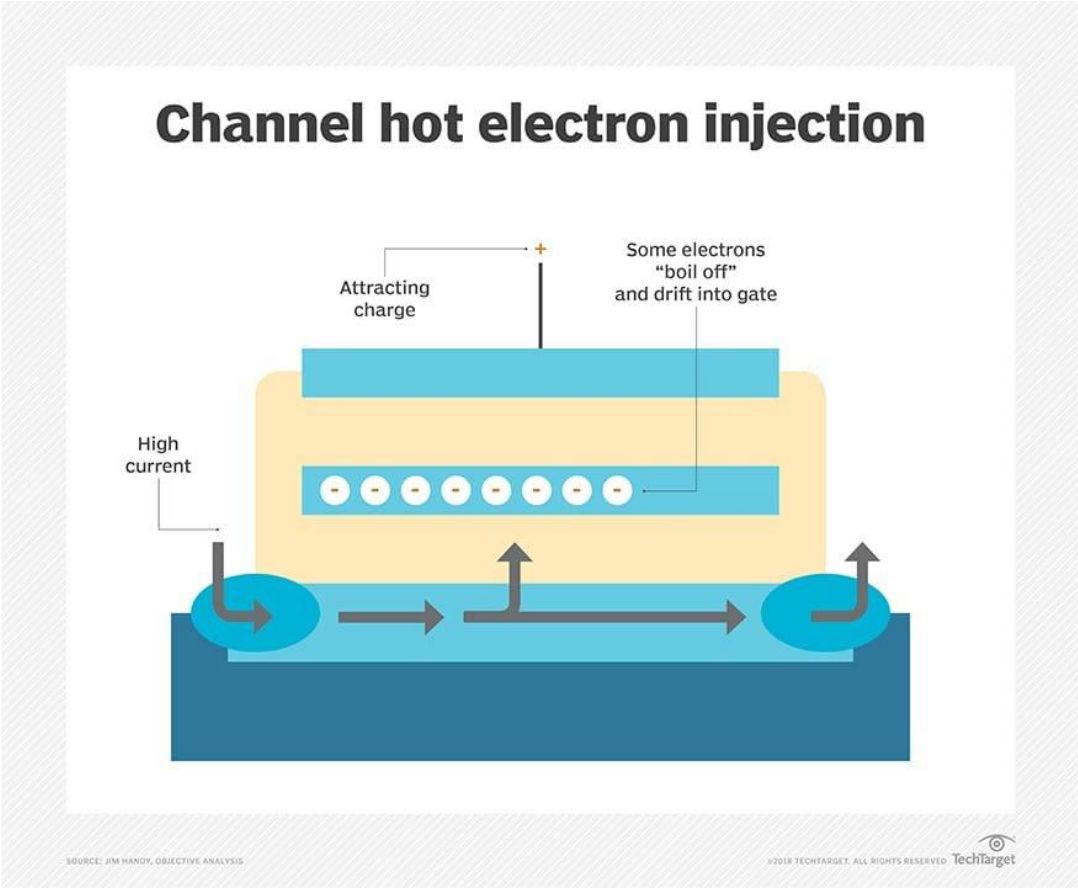


NAND cells are preferred over NOR cells because they can be wired in series, which uses less space.



SSD storage mechanism: the floating gate



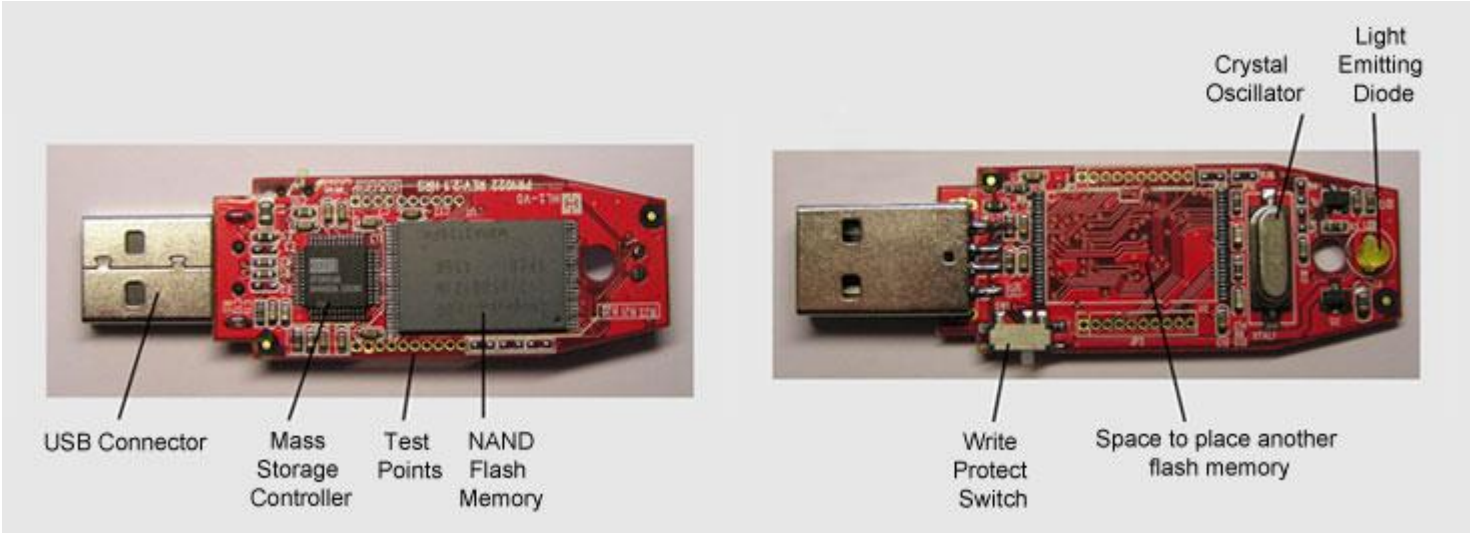


https://www.techtarget.com/searchstorage/definition/floating-gate

SSD vs. HDD

Usually 10,000 or 15,000 rpm SAS drives

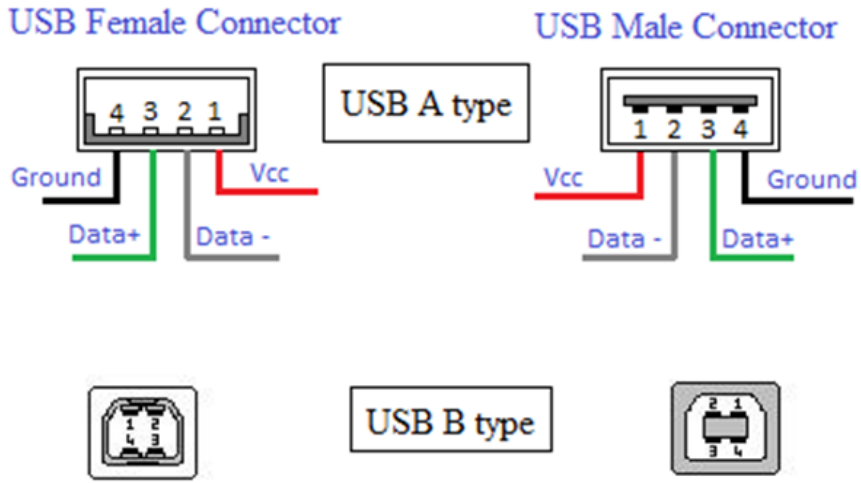
SSD		HDD
0.1 ms	**Access Times** SSDs exhibit virtually no access time	**5.5-8.0 ms**
SSDs deliver at least **6000 io/s**	**Random I/O Performance** SSDs are at least 15 times faster than HDDs	HDDs reach up to **400 io/s**
SSDs have a failure rate of less than **0.5%**	**Reliability** This makes SSDs 4-10 times more reliable	HDDs failure rate fluctuates between **2-5%**
SSDs consume between **2 and 5 watts**	**Energy Savings** This means that on a large server, approximately 100 watts are saved	HDDs consume between **6 and 15 watts**
SSDs have an average I/O wait of **1%**	**CPU Power** You will have an extra 6% of CPU power for other operations	HDDs average I/O wait is about **7%**
The average service time for an I/O request while running a backup remain below **20 ms**	**Input/Output Request Times** SSDs allow for much faster data access	The I/O request time with HDDs during backup rises up to **400-500 ms**
SSD backups take about **6 hours**	**Backup Rates** SSDs allow for 3-5 times faster backup for your data	HDD backups take up to **20-24 hours**



USB 1.0 – 12Mbps

USB 2.0 – 480Mbps

USB3.0 – 4.8Gbps



Variations of USB Connector

USB connectors Type

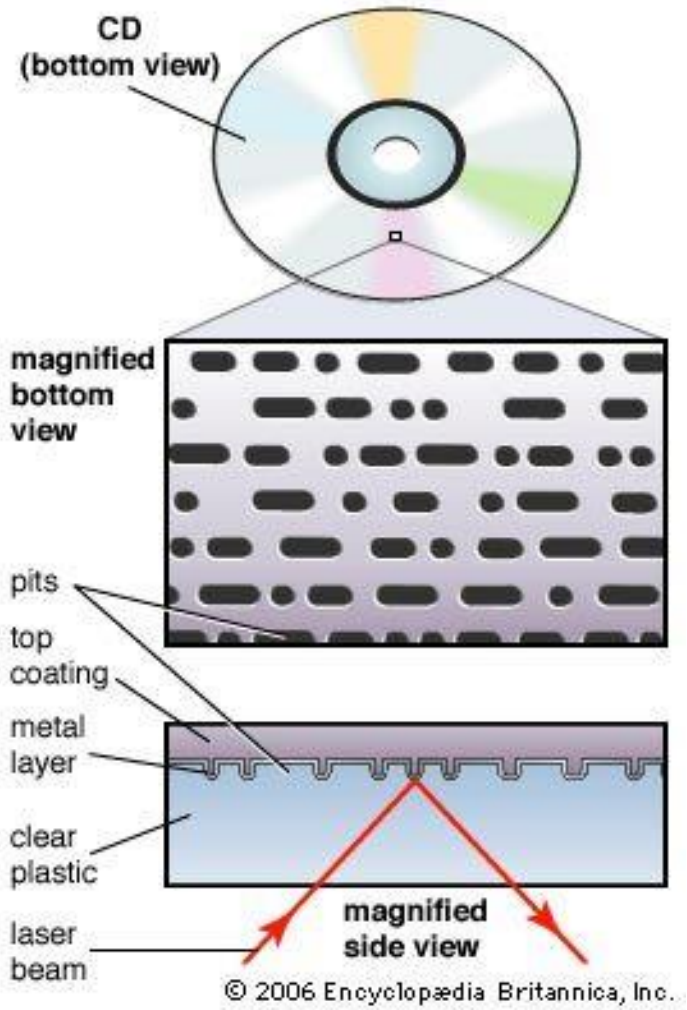
USB Connector Types

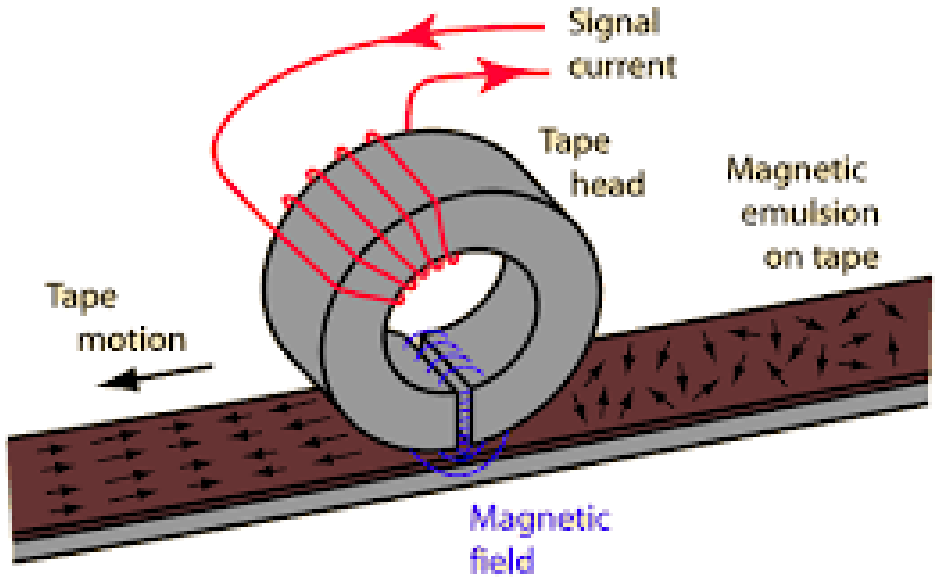
https://www.techdim.com/usb-2-vs-usb-3/

Version of USB

USB 1.x	Data transfer rate of 12 Mbps, supports up to 127 peripheral devices
USB 2.0	Is Known as a hi-speed USB, supports USB 1 devices and cables, was first introduced in 2000
USB 3.0	Is Known as SuperSpeed USB, an improved version of USB-2, first introduced in 2008
USB 3.1	Known as SuperSpeed+, is the latest version of USB having the fastest data transfer rate, was first introduced in 2014
USB Type-C	USB C connector is a reversible plug which is a double-sided connector having 24 pins, was introduced around the time of USB 3.1

Alternative Storage Options





Alternative Storage Options