System Administration

Week 02, Segment 4
Physical Disk Structure

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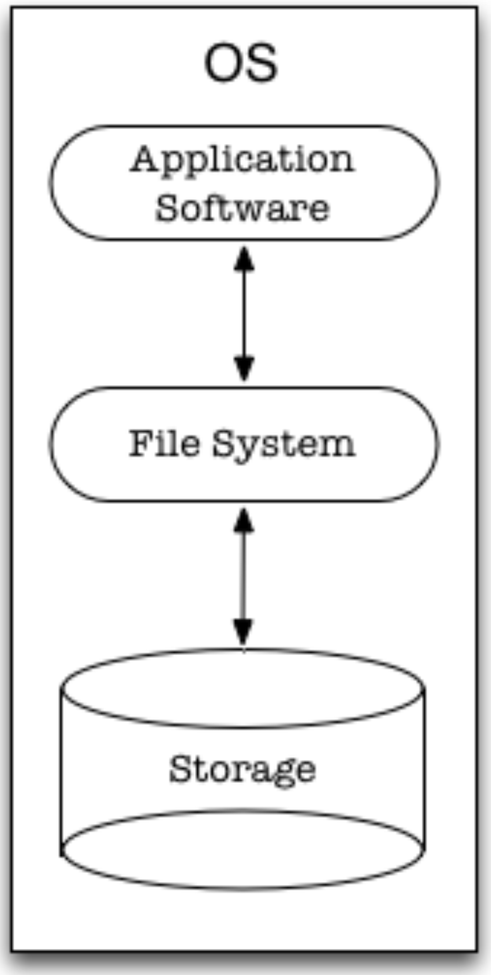
https://stevens.netmeister.org/615/

Direct Attached Storage (DAS)




ASM P/N 13N6704
FRU P/N 13N6705
4200RPM
Travelstar
www.hgst.com
MODEL:IC25N040ATMR04-0
5V 1.0A DC
40GB
4200RPM
ATA/IDE
MADE IN THAILAND BY Hitachi Global Storage Technologies(Thailand).Ltd.
WARRANTY VOID IF ANY LABEL/ SCREW IS REMOVED OR BROKEN
06DEC03
IBM P/N:92P6592 (HITACHI P/N:13G1812)
MLC:H69555
(16383CYL. 16HEADS. 63SEC/T)
78.140.160 LBA'S
11S92P6592Z1Z8PZJRVZMH
Don't shock/ push cover
DO NOT COVER THIS HOLE
< JUMPER >
DEVICE0
DEVICE1
CABLE SEL.

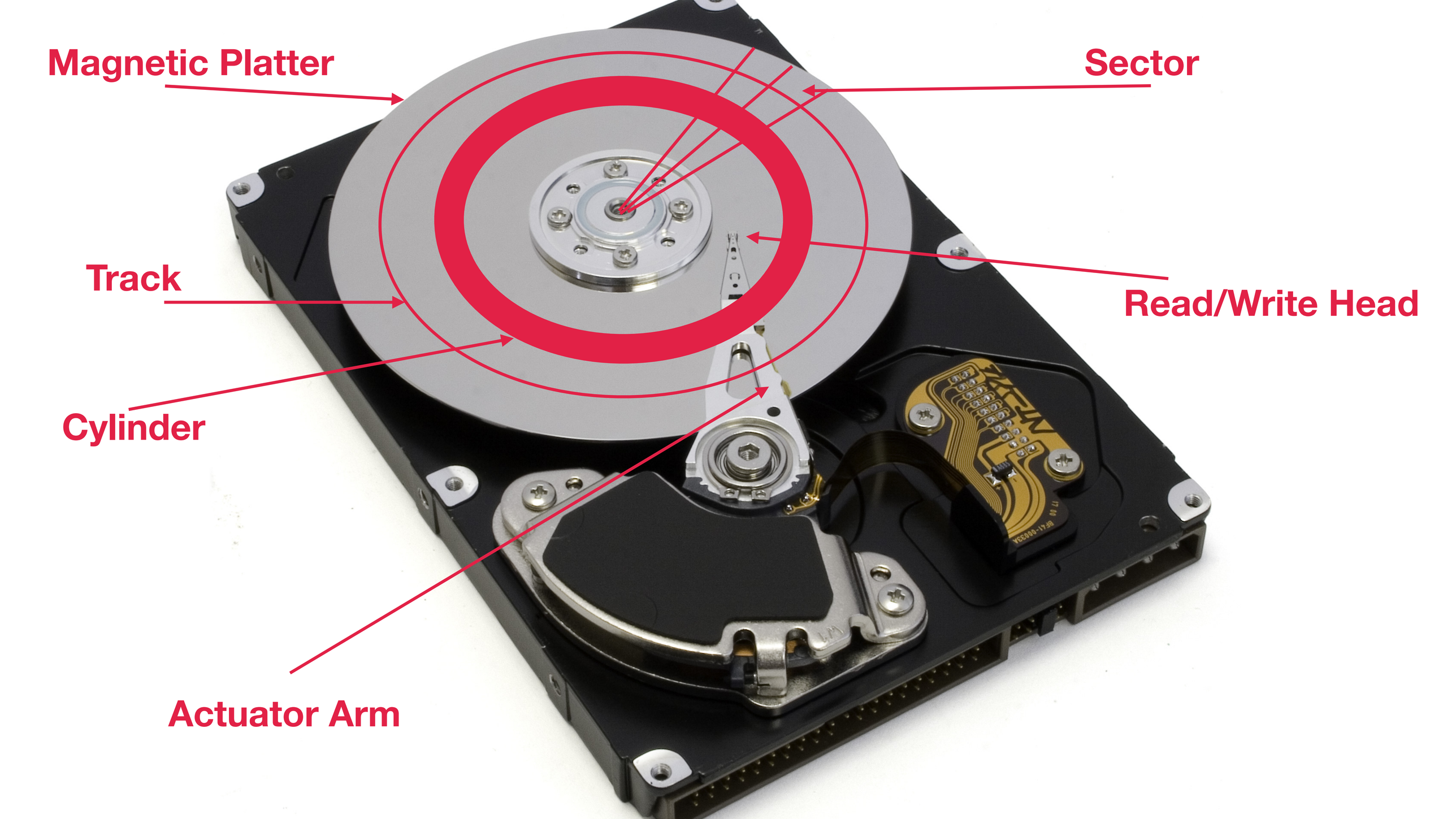

Magnetic Platter
Sector
Track
Read/Write Head
Cylinder
Actuator Arm

Photo Credit: Eric Gaba, Wikimedia Commons user Sting

https://en.wikipedia.org/wiki/File:Seagate_ST33232A_hard_disk_inner_view.jpg

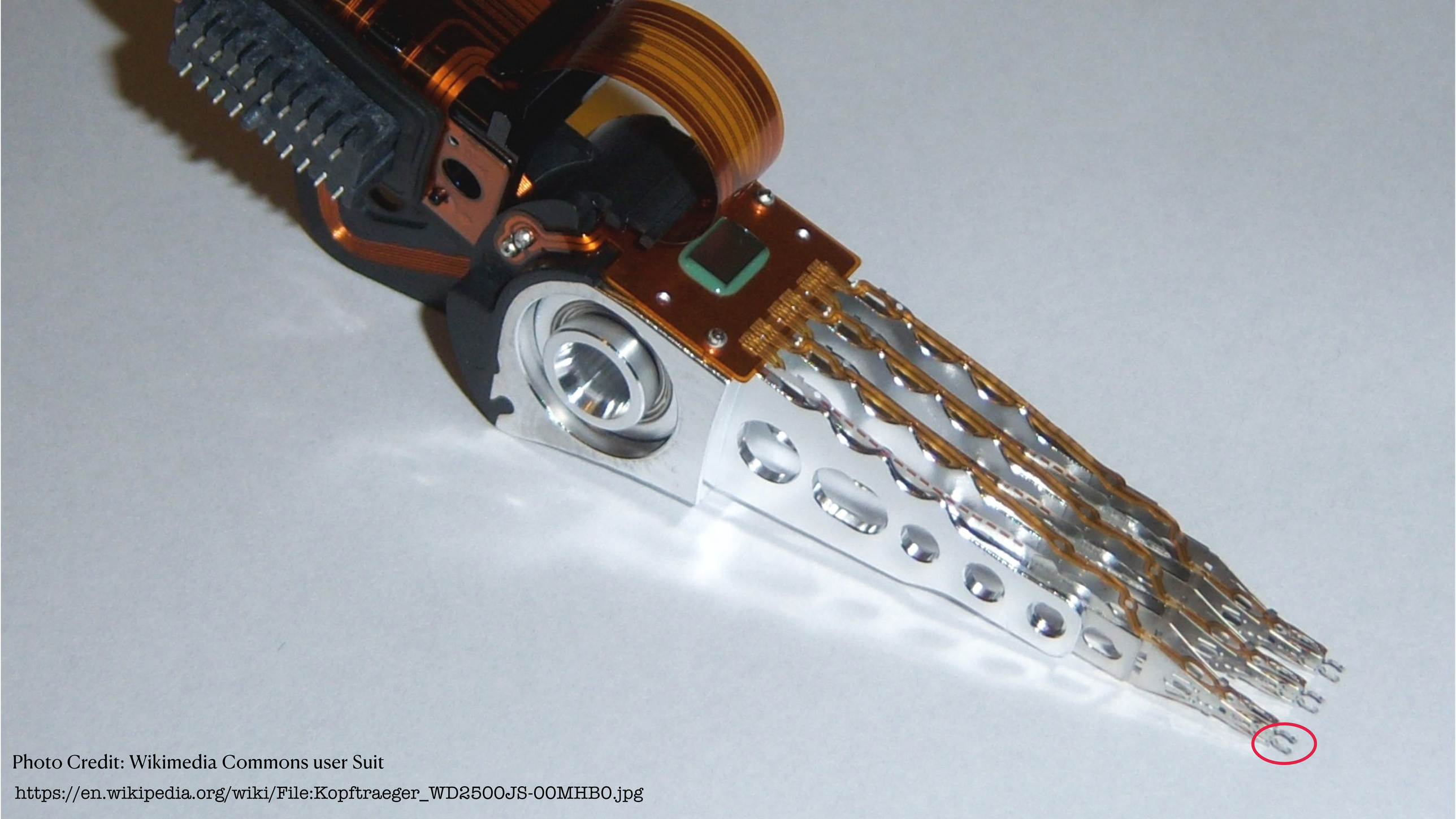
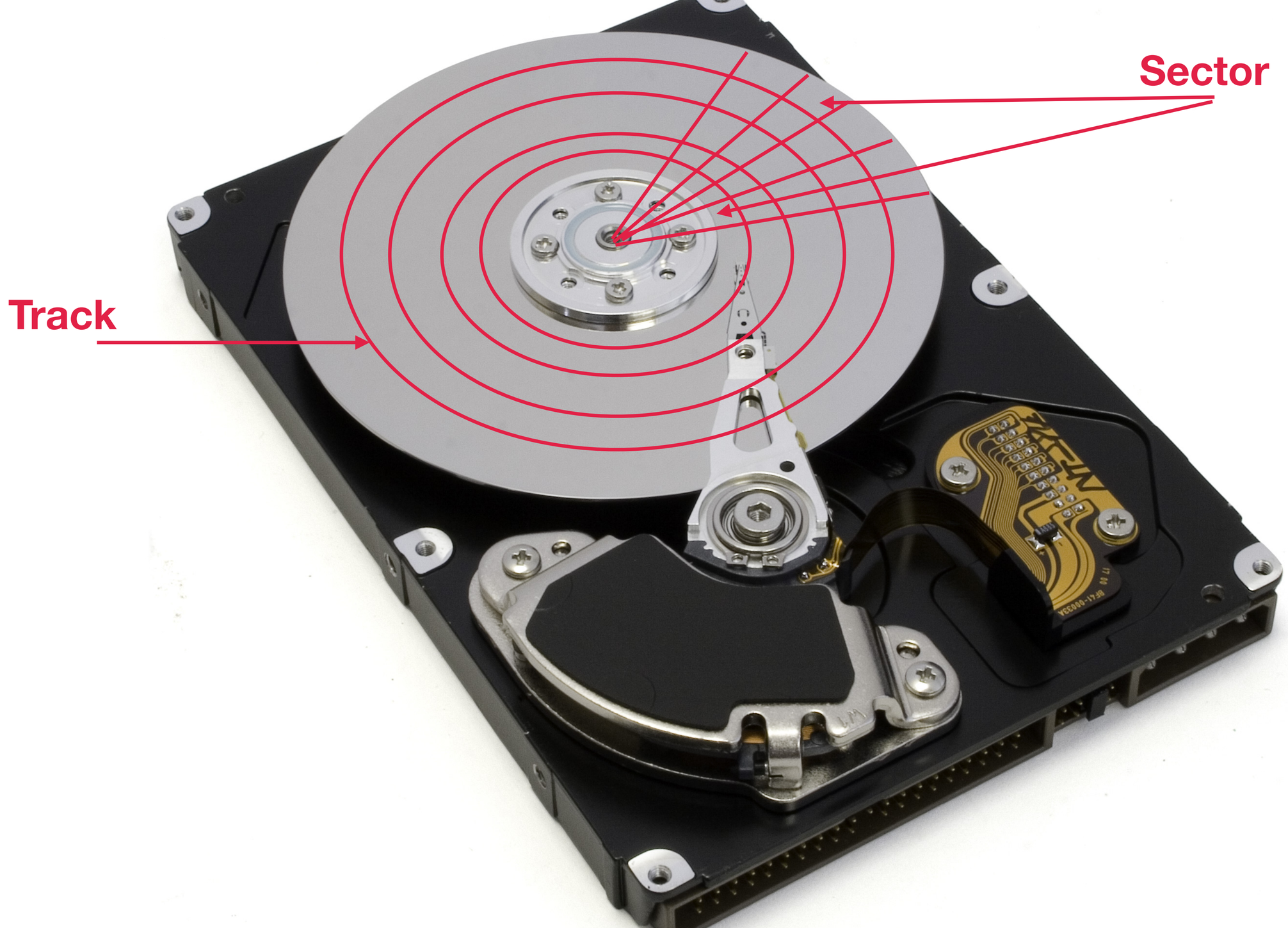


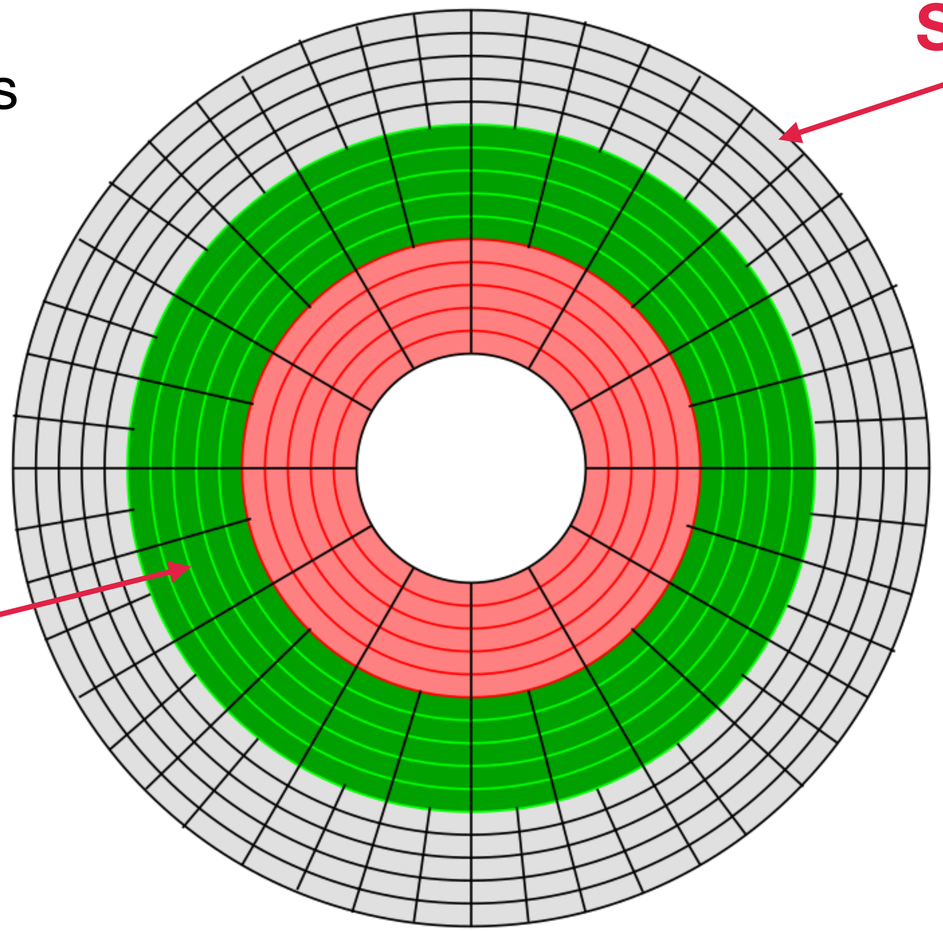
Photo Credit: Wikimedia Commons user Suit

https://en.wikipedia.org/wiki/File:Kopftraeger_WD2500JS-00MHB0.jpg


Sector
Track

Zone Bit Recording

- Increased data transfer speed on outer sectors
- Increased capacity



Hard Drive Performance

- transfer rate
- seek time
- rotational latency
- a few other negligible factors (external data rate, command overhead, access time, etc.)

Hard Drive Capacity

- Cylinder-head-sector (CHS)
- ATA Specification

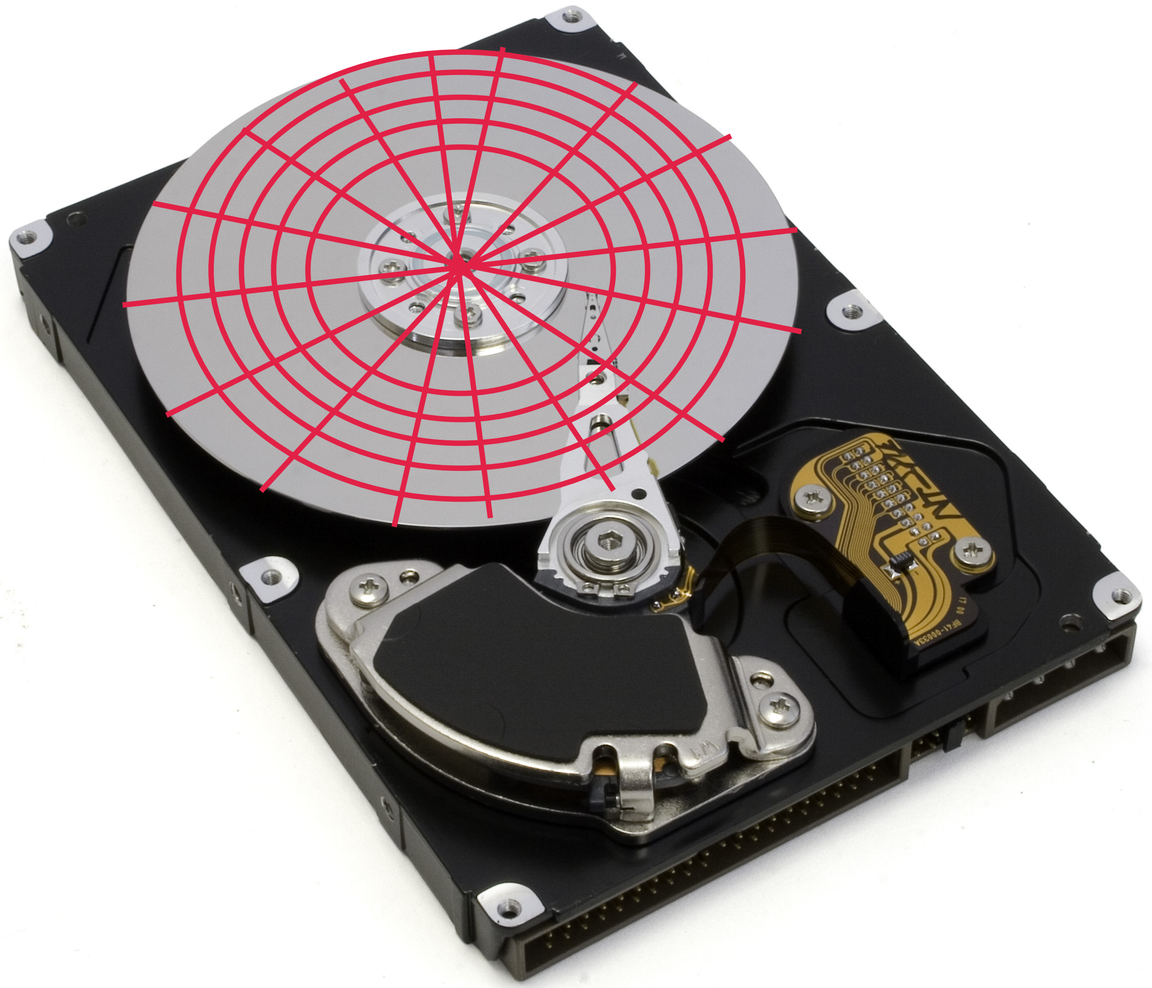
65536 cylinders x

16 heads x

255 sectors/track x

512 bytes/sector

=> ~ 137 GB



Hard Drive Capacity

- Cylinder-head-sector (CHS)
- ATA Specification (65536 C, 16 H, 255 S)
- BIOS limit:

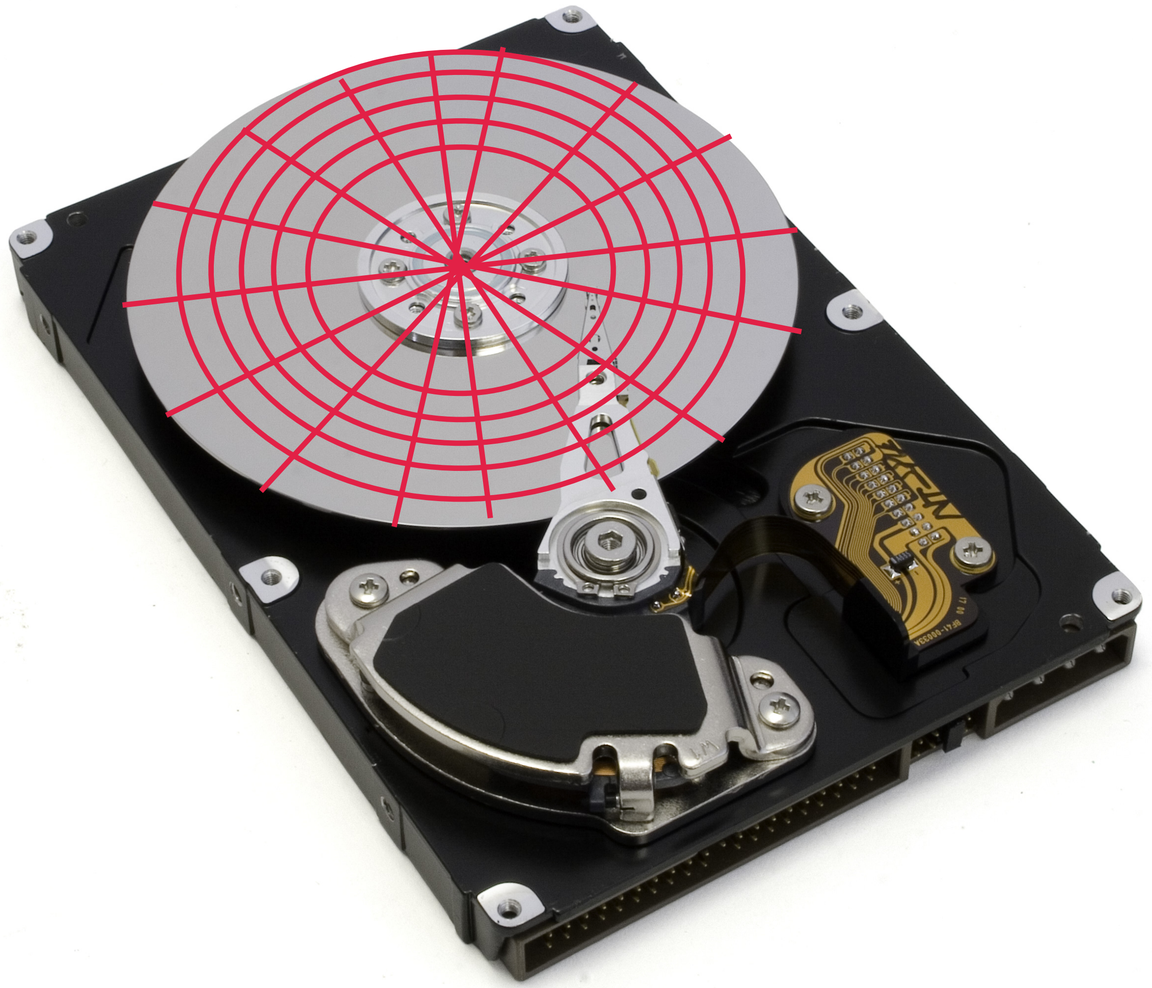
1024 cylinders x

256 heads x

63 sectors/track x

512 bytes/sector

=> ~ 8.5 GB



Hard Drive Capacity

- Cylinder-head-sector (CHS)
- ATA Specification (65536 C, 16 H, 255 S)
- BIOS limit: (1024 C, 256 H, 63 S)
- Combined:

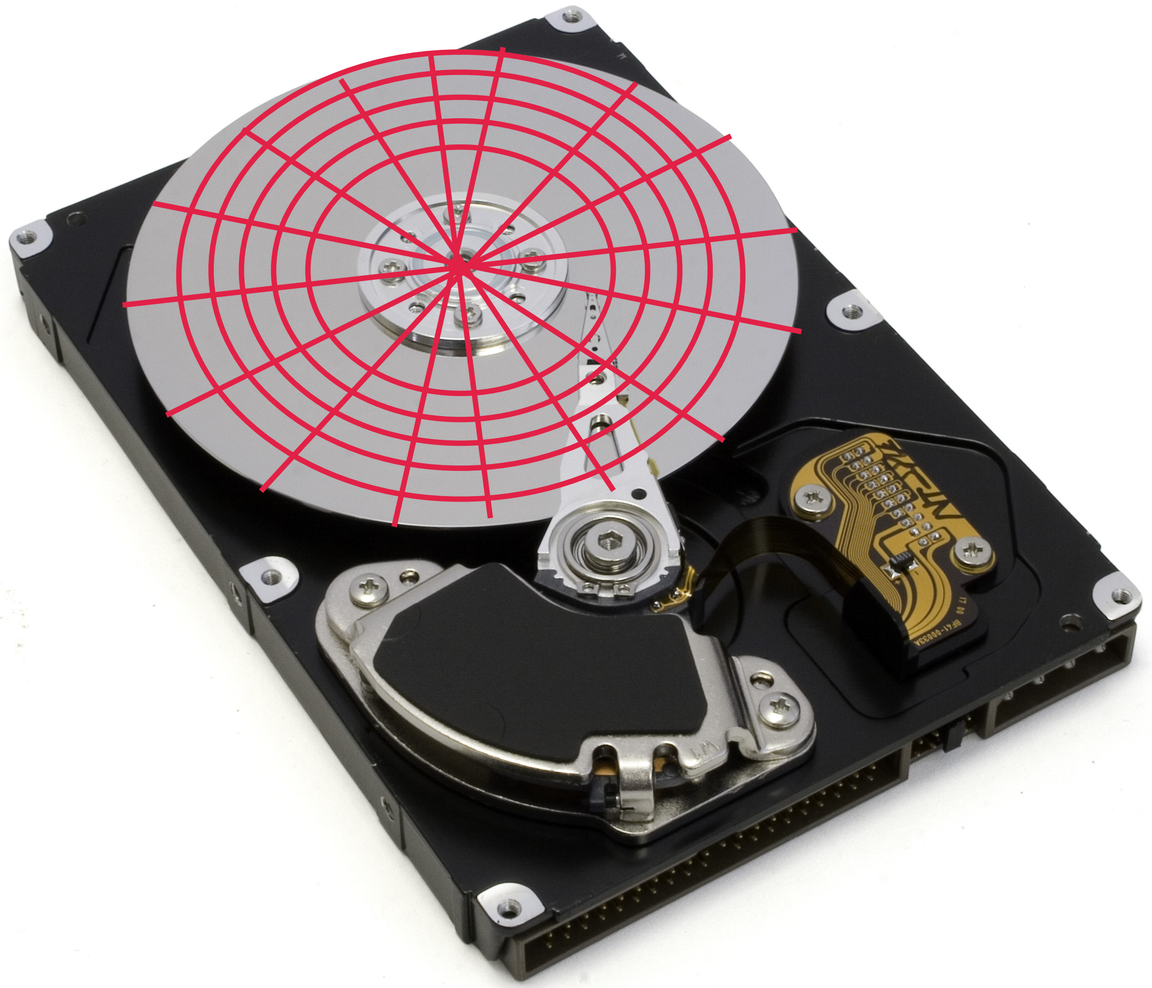
1024 cylinders

16 heads x

63 sectors/track x

512 bytes/sector

=> ~528 MB



Hard Drive Capacity

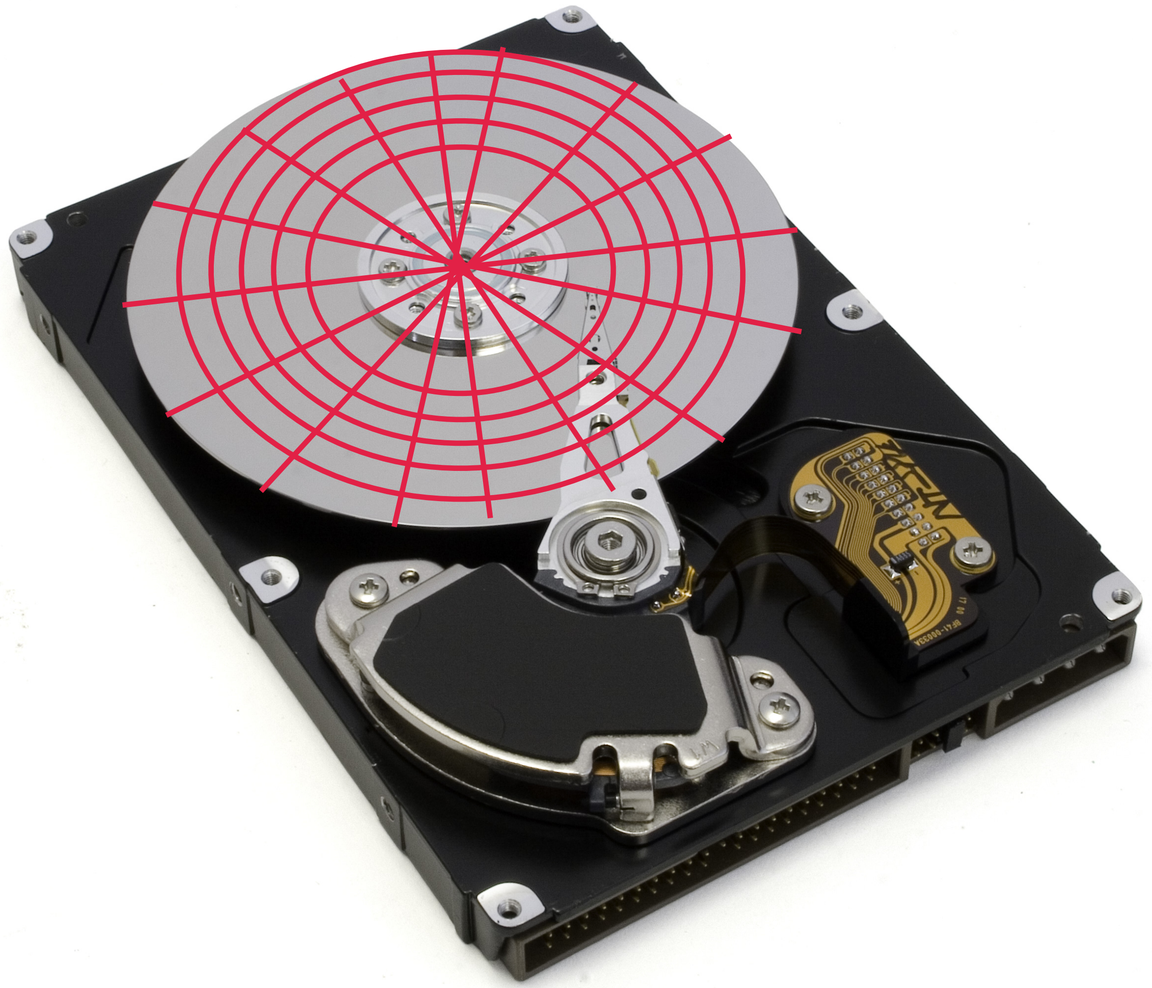
- Logical Block Addressing (LBA)

28-bit LBA in ATA-1: 2^28 * 512 = ~137 GB

48-bit LBA in ATA-6: 2^48 * 512 = ~144 PB

MBR uses 32-bit sector numbers, so limits to 2^32 * 512 = ~2.1TB

GPT uses 64-bit sector numbers => ~9.4 ZB



Summary

The physical disk structure dictates the smallest storage unit as a 512-byte block.

Physical arrangements contributed to initial limits on disk space.

Choice of data types nowadays limit theoretical disk space.

Rotational latency and *seek time* affect disk performance.

The alignment of cylinder groups and the arrangements of the read-write heads together with those factors direct the physical arrangements of *partitions*.

Links

File Systems and Storage Models:

https://www.netmeister.org/book/04-file-systems.pdf

Hard Drive Teardown:

https://en.wikipedia.org/wiki/File:Harddrive-engineerguy.ogv

History of BIOS and IDE limits:

https://www.win.tue.nl/~aeb/linux/Large-Disk-4.html

Hard Disk Drive:

https://en.wikipedia.org/wiki/Hard_disk_drive