

CSE 350

Advanced Data Structures

Lecture 4: History of Storage 🧠💾

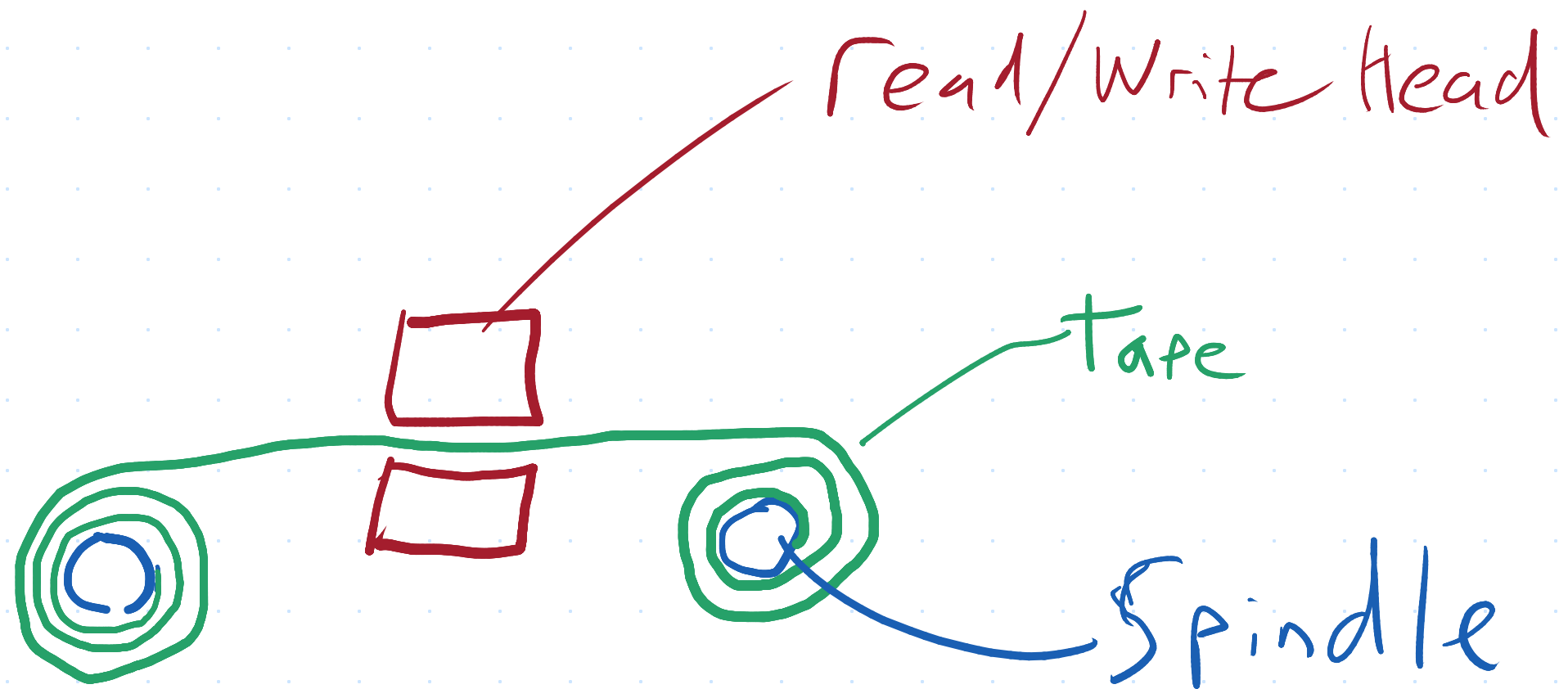
Tape Drives



Image: Wikipedia (Guroadrunner)

IBM TS1170 (2023)

- 50TB
- 400 MB/s
- 1 km of tape (100s of seconds seek)



Tape Libraries



- 20TB to 2.1EB
- Very cheap 2¢/GB
- Even slower
 - seconds to minutes

Hundreds of tapes

Robot

Image: Wikipedia (Austin Mills)

Hard Disk Drives

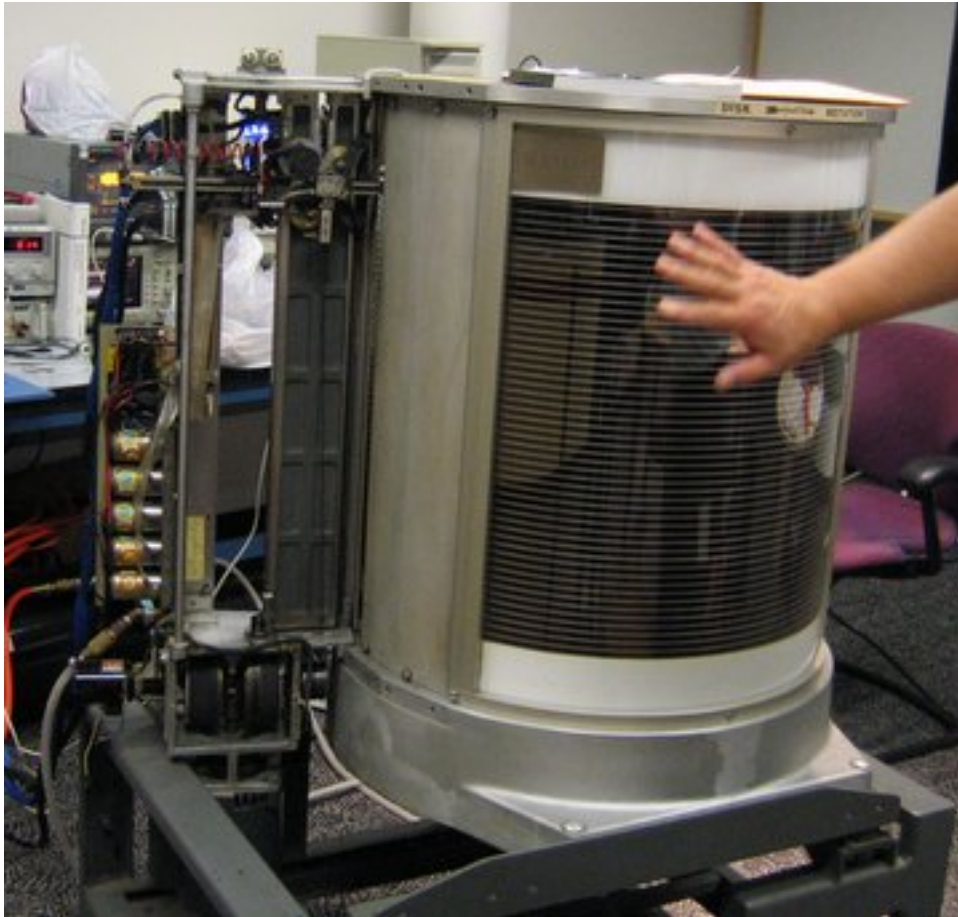


Image: Wikipedia (vnunet.com)

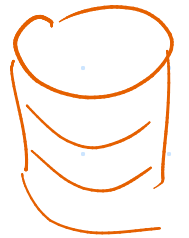


Image: Wikipedia (Anselm Schüler)

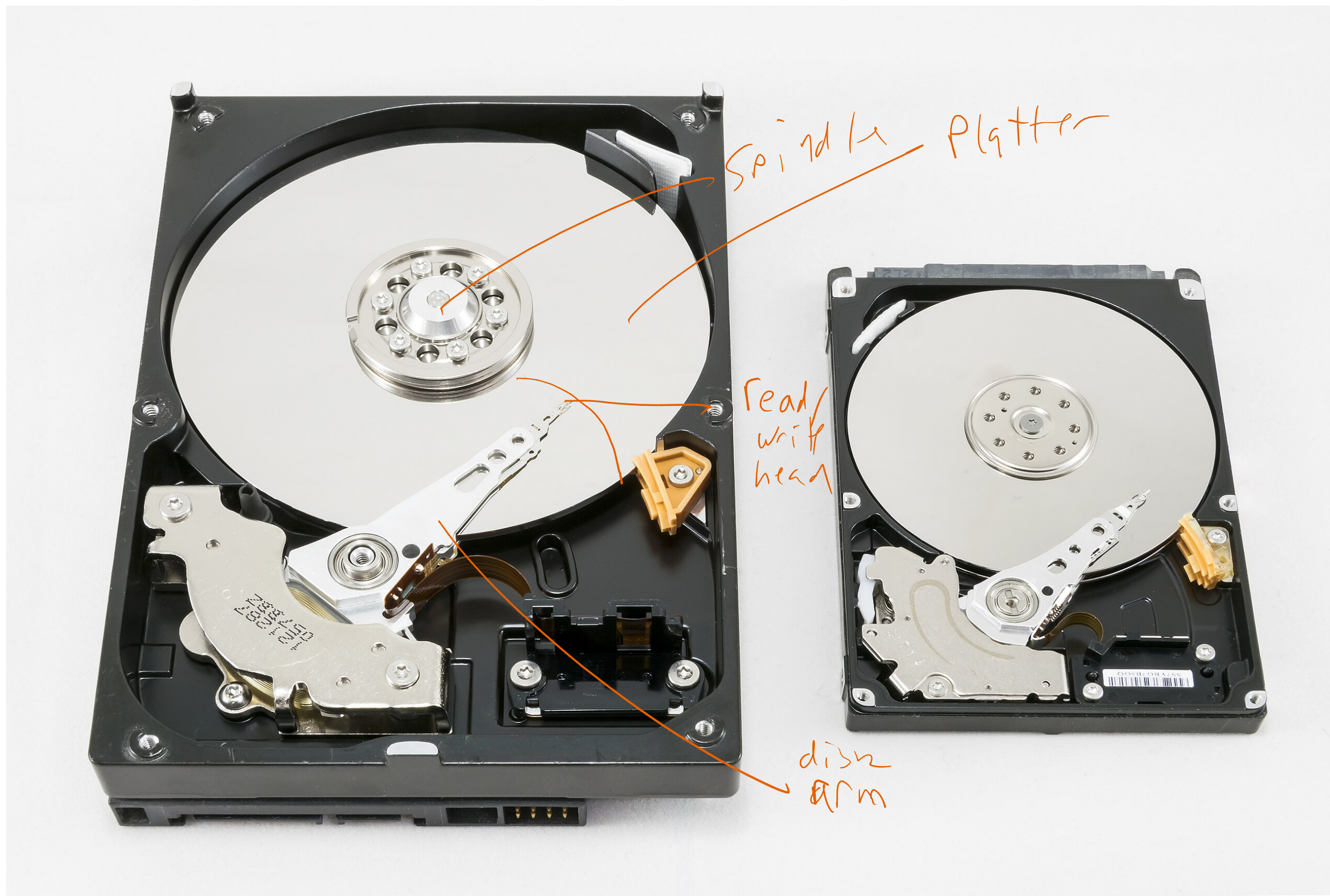
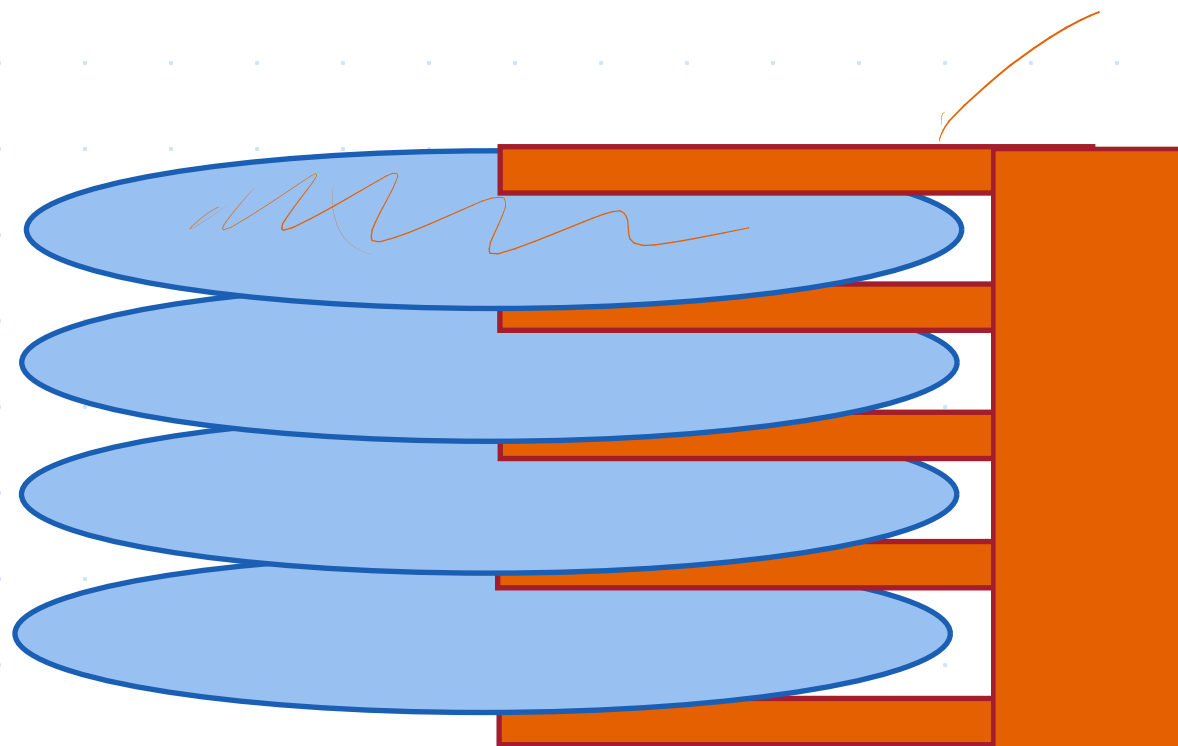
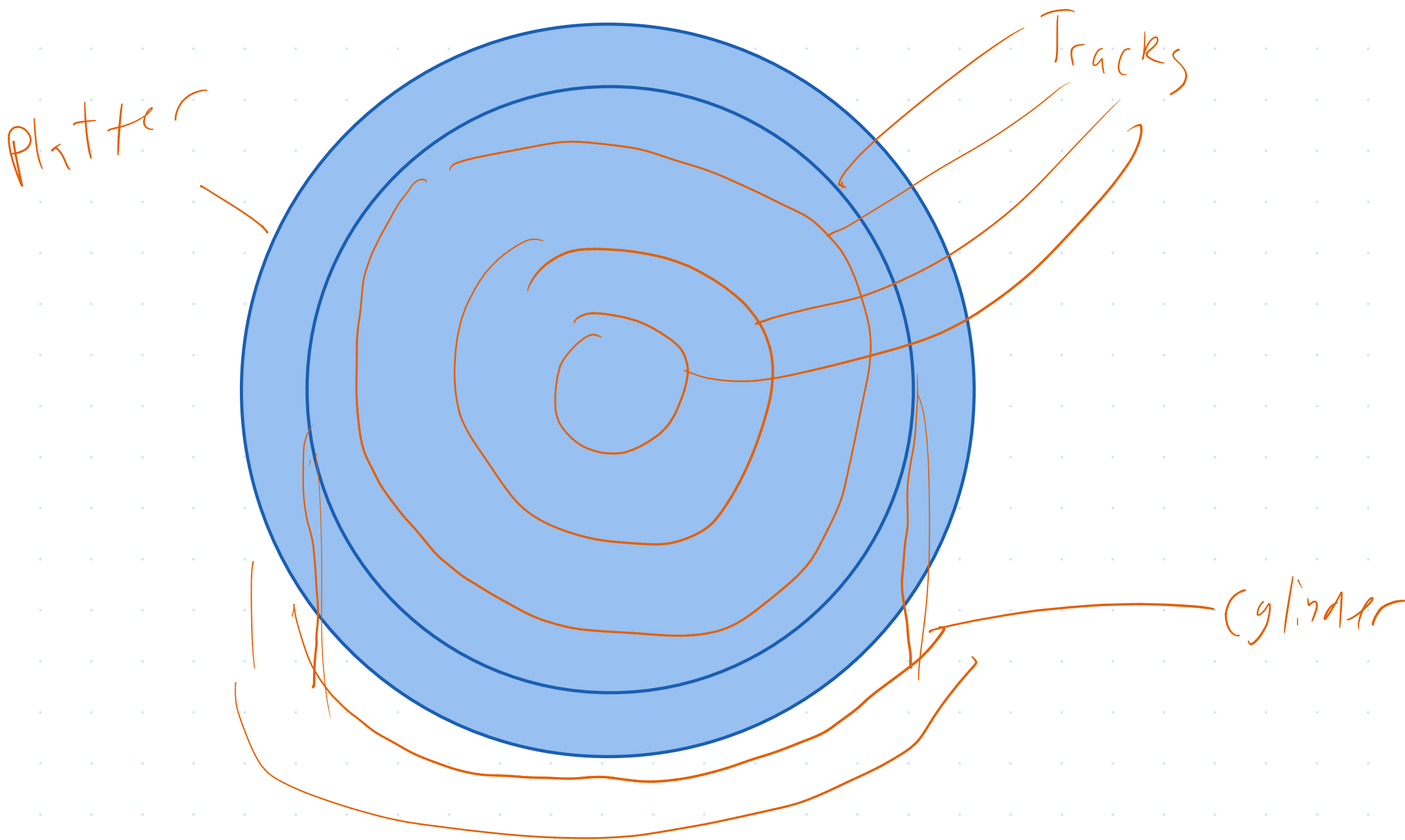
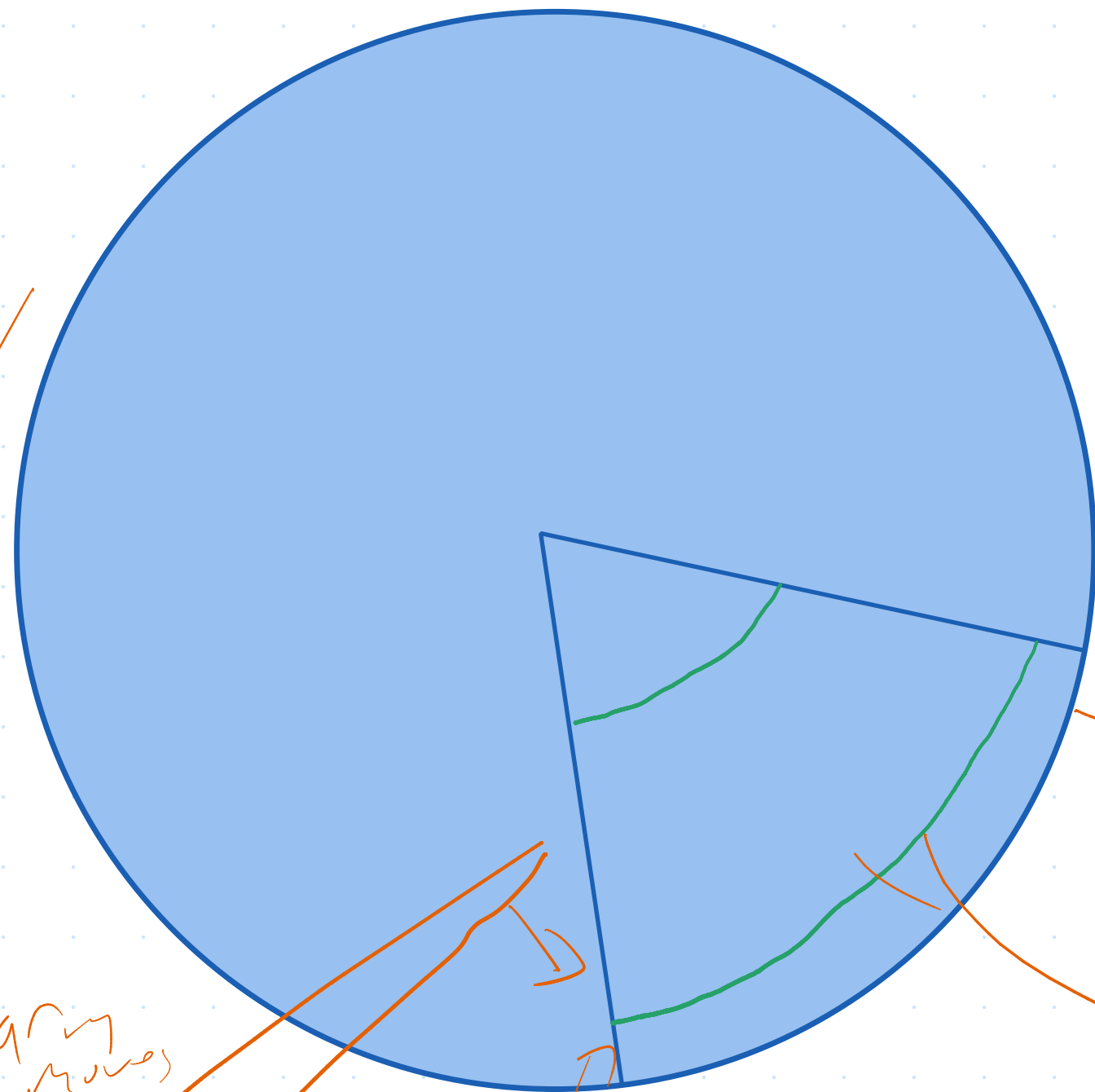


Image: Wikipedia (Jacek Halicki)





7 to RAM
15



Sector

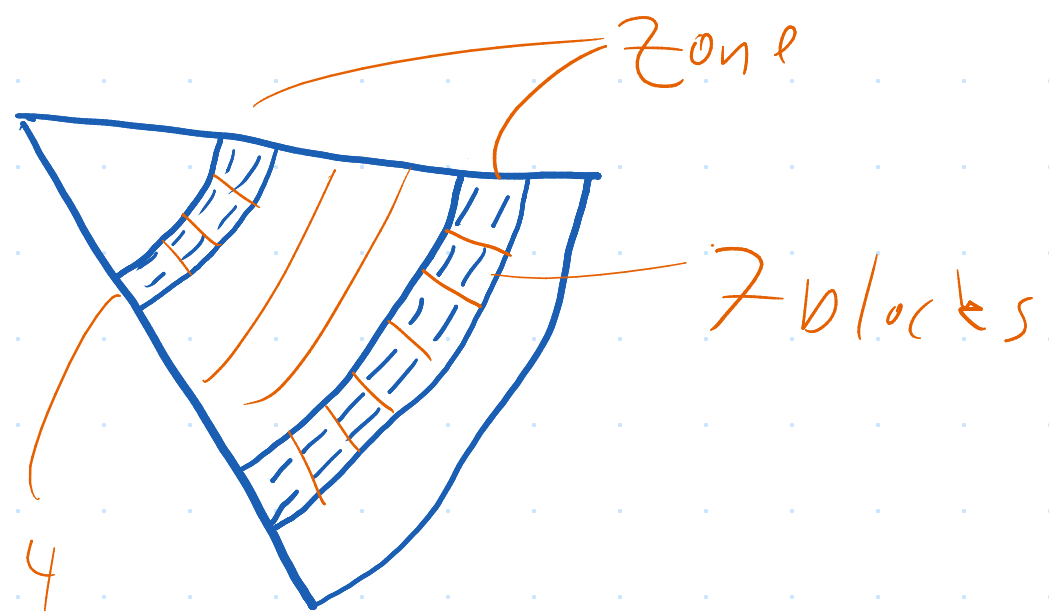
Id'd by - track - platter

One data chunk
"block"

(1) arm moves to track

(2) sector rotates to position

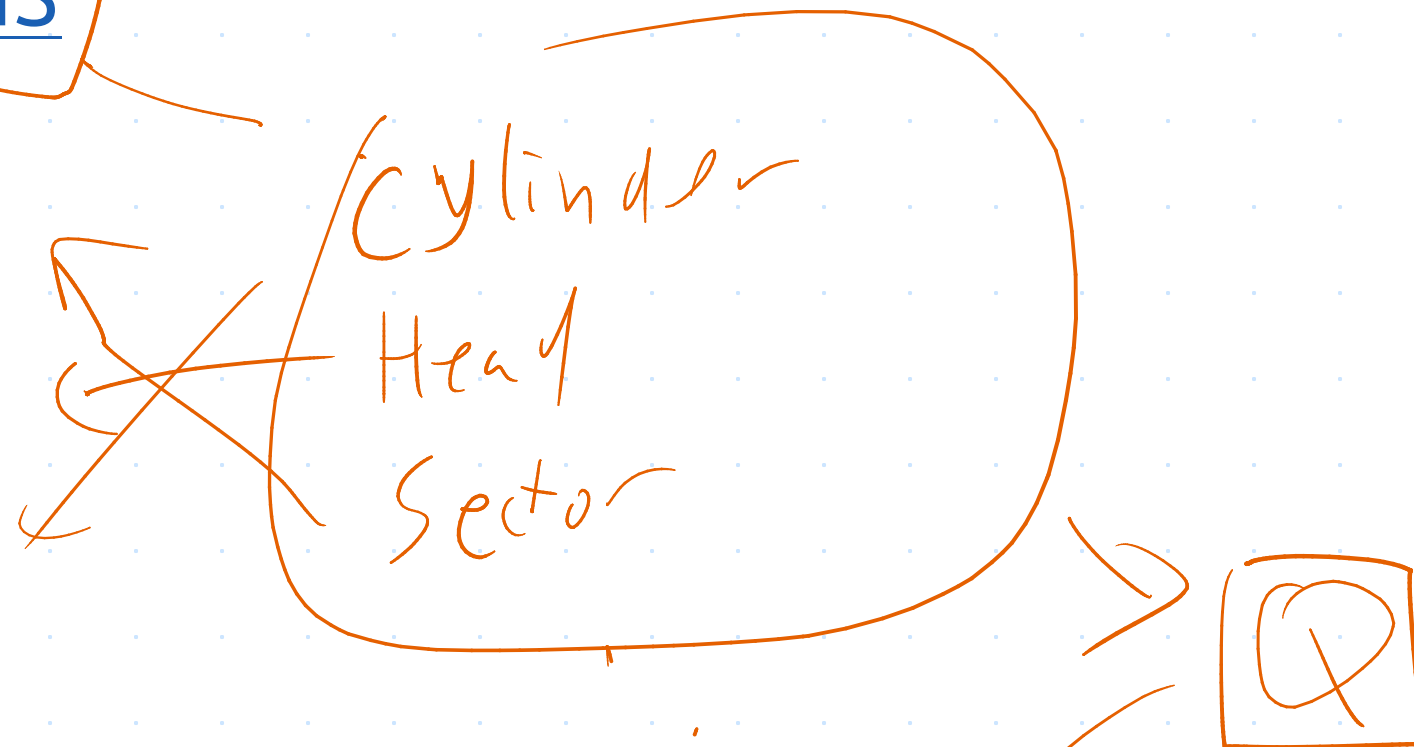
(3) head reads/writes



Addressing

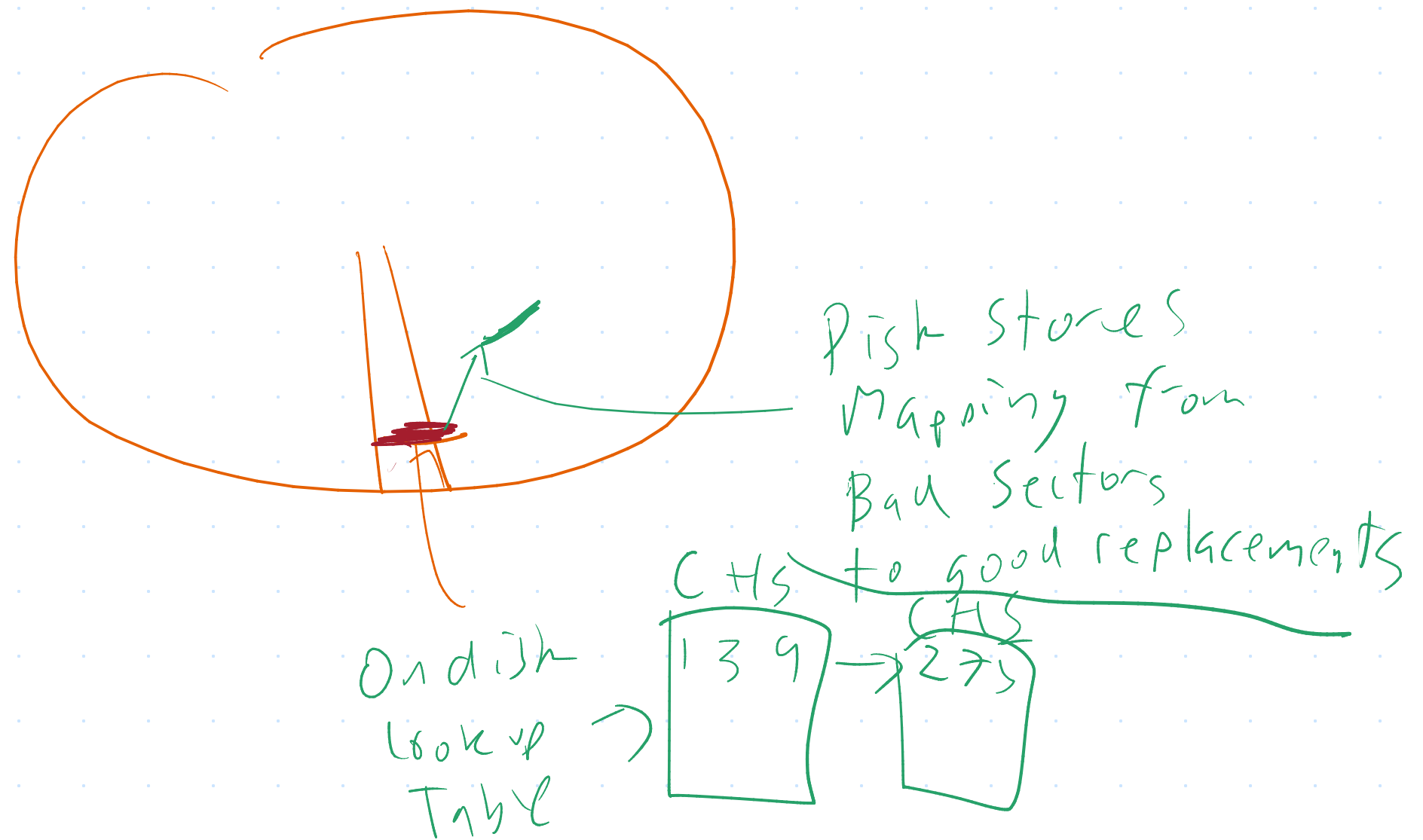
Physical CHS

Sector
Platter
Track

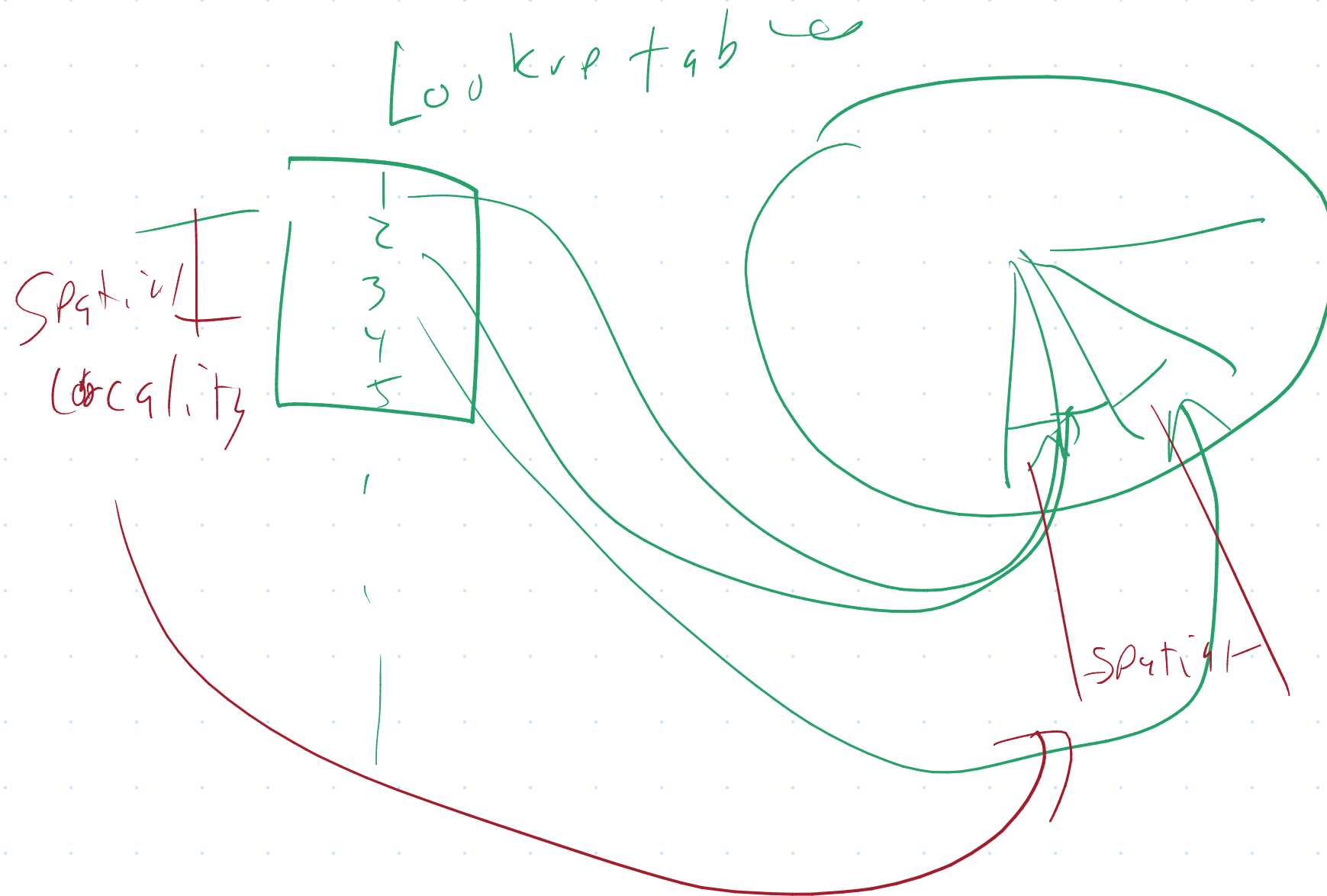


Blockdata

Logical CHS



Logical Block Addressing

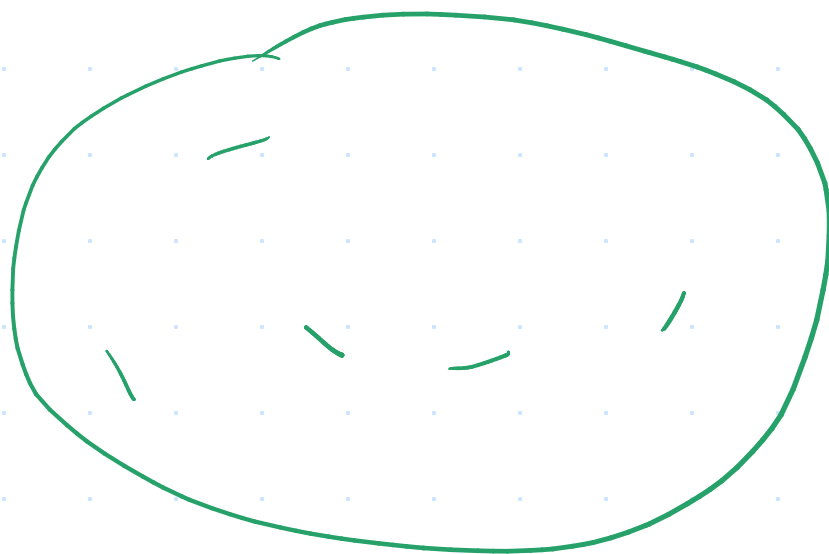


Sector Arc on a platter
One "chunk" of data (HD sector)
on disk

4K

Block Level of granularity for OS read/write
on disk
in mem
4 or 8K

Page
↑ my term



Solid State Drives



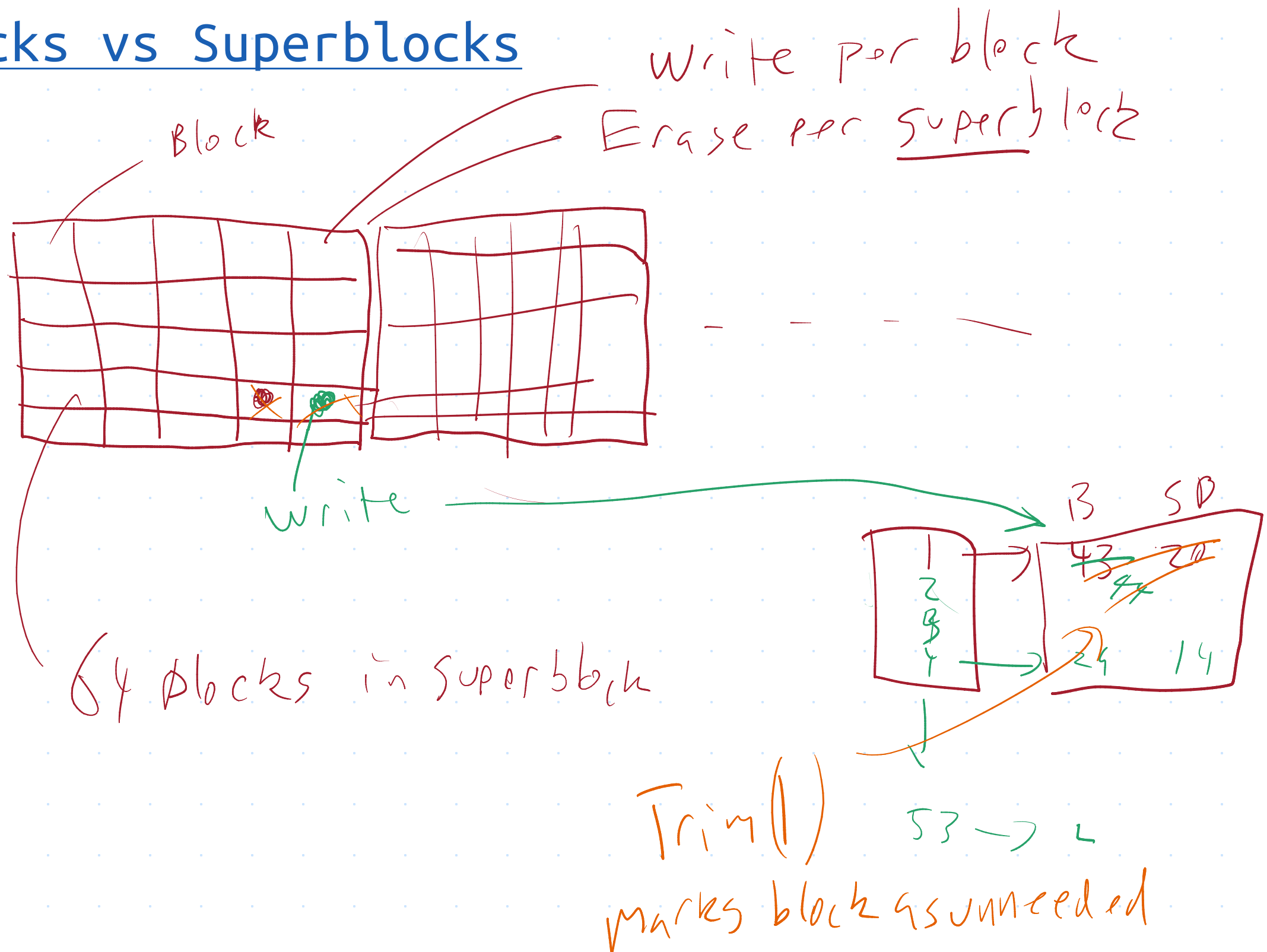
Image: Wikipedia (Jacek Halicki)



Image: Wikipedia (User5515)

- 120GB to 512GB
- 200MB/s to 14GB/s
- ~~0.1s~~ Random Read

Blocks vs Superblocks



write

if free block available

write

update lookup table

modulo some spare capacity

if not

reclaim space

↳ if superblock empty

erase it

we have a free block

↳ move data on one superblock
somewhere else

erase it

} expensive

2 HDD SSD Controller

Logical → Physical Mapping

Caching

Remapping Broken Blocks

Garbage Collection (Trim)

RAID (Next Lecture)

RAID

RAID0

RAID1

RAID 4

RAID 5

RAID 6