Hard Disks
Why care about hard disks anyway?

industry is slow moving

major database products still disk-based
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very large datasets, Google, Yahoo! et.al
Hard Disks

cylinder = set of similar tracks for all platters

platter

spindle

arm

(virtual) tracks

(disk) heads
Circular Sectors vs. HD Sectors

- Circular sector: angle
- Hard disk sector: 4K block of data
Zone Bit Recording
HD Sector

unit for read/write-access

fixed size subunit of a track

typically 0.5 to 4 KB

stored with self-correcting error codes

① Detect error
② Recover data

□ → 1-11
HD Sector vs. OS Blocks

- Hard disk sector: 4K block of data
- Operating system block: 8K block of data
Physical CHS Addressing

Cylinder

Head

Sector

1024/16/256
Logical CHS Addressing

logical CHS number

HD controller maps it to physical CHS!

Cylinder
Head
Sector

1024/16/256 -> 512/12/256

Notice that standards such as EIDE and ATA-2 constrain the address space that may be used for (C,H,S), e.g. if 28 Bits may be used for the address, C may use 16 bits, H may use 4 bits, and S may use 8 bits. Obviously, if the drive has less net storage space available, not all of these sectors are actually addressable.
Logical Block Addressing (LBA)

logical block number $0, 7, \ldots, 16$
Logical Block Addressing (LBA)

logical block number

HD controller maps it to physical CHS!

\[\begin{align*}
0 & \rightarrow (0, 0, 1) \\
1 & \rightarrow (0, 0, 2)
\end{align*}\]

and so forth

\[\text{\rightarrow low-level file system!}\]
Sparing