CS 347m / CS 219 Lecture 21

* announcements

① Quiz 2 (pen-paper)
29th Oct. Wed
830 am

② Lab Quiz
5th Nov. Wed.
830 am
- implementating/coding
- Lab 1/2/3, practice labs
- SL2

Persistence

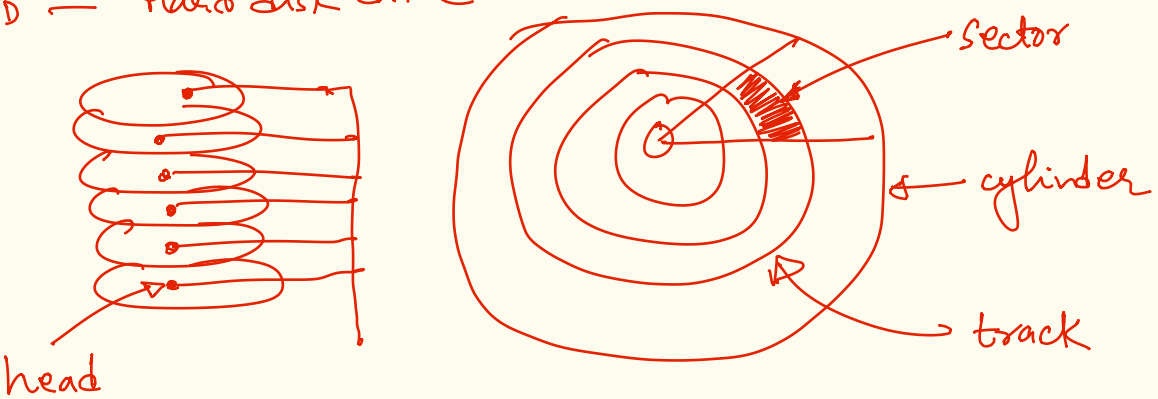
- the file abstraction
  - name, organization (PATH)
  - size, timestamps
  - links
  - access control information
  - linear sequence of bytes.

Q how to design of the file system?

requirements
- the file abstraction implementation
- reliability
- efficiency! — CPU — faster than memory (RAM) access — faster than storage / disk
- deal w/ diverse storage devices.

① what is h/w view?

(a) HDD — Hard disk drive



* 1500 rpm

each access ⟹ c, t, s — cylinder track sector

(*) ~ moving parts (electro-mechanical)

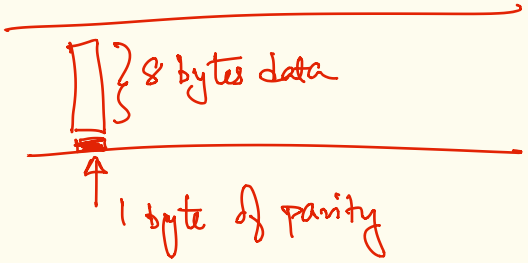
~ magnetization on the cylinder to encode 0s & 1s

(b) Flash drives / USB disk

- NOR/NAND flashes / gates
- semi-conductor based / no-moving parts
- banks & pages of physical storage layout
- access ⇒ bank index & page number
  r/w is at page granularity
- fixed # writes per storage location.

(c) Tape drives

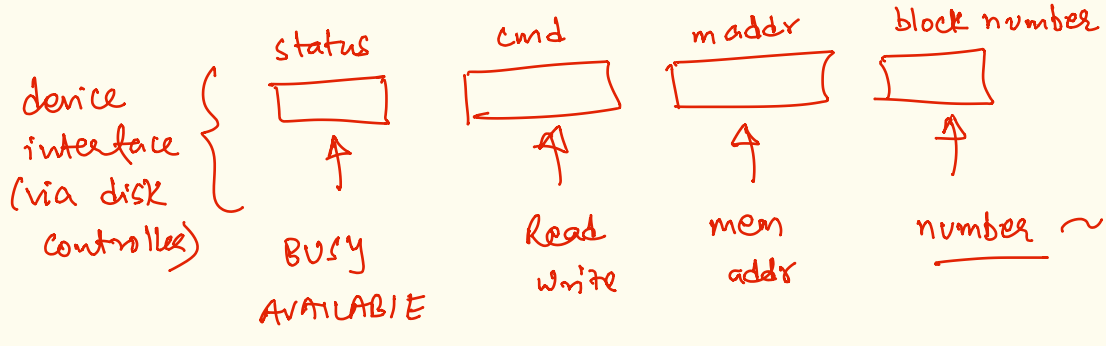
access ⇐ offset!



(#) Disk / Storage controller — h/w element.

- provides a higher / uniform abstraction
  e.g: block
- a storage device / disk is a ordered set of blocks
- each block is a fixed size.

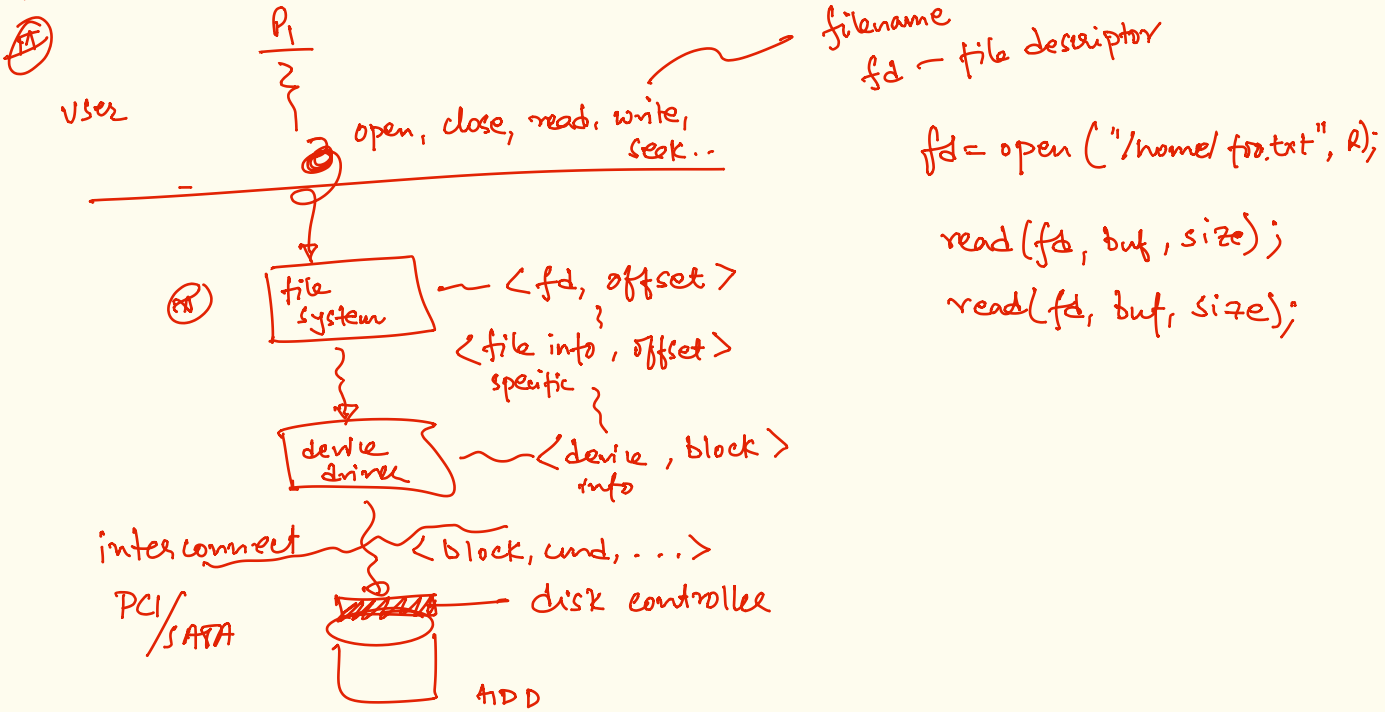
canonical device interface



device driver!

```
while (STATUS == BUSY);
cmd ← R;
maddr ← &buffer;
block ← 23;
STATUS ← BUSY;
```

} cmds for disk controller to work on




```
fd = open ("/home/foo.txt", R);
read (fd, buf, size);
read (fd, buf, size);
```

file system design

size, name, location, timestamps... permissions..
blocks on disk
23, 44, 27, 86

} metadata of the file abstraction

inode ← index node
metadata object for each file.

Q where is the inode stored?

(1) has to be a persistent storage medium
on disk!

(2) disk metadata ~ status of disk usage
on disk

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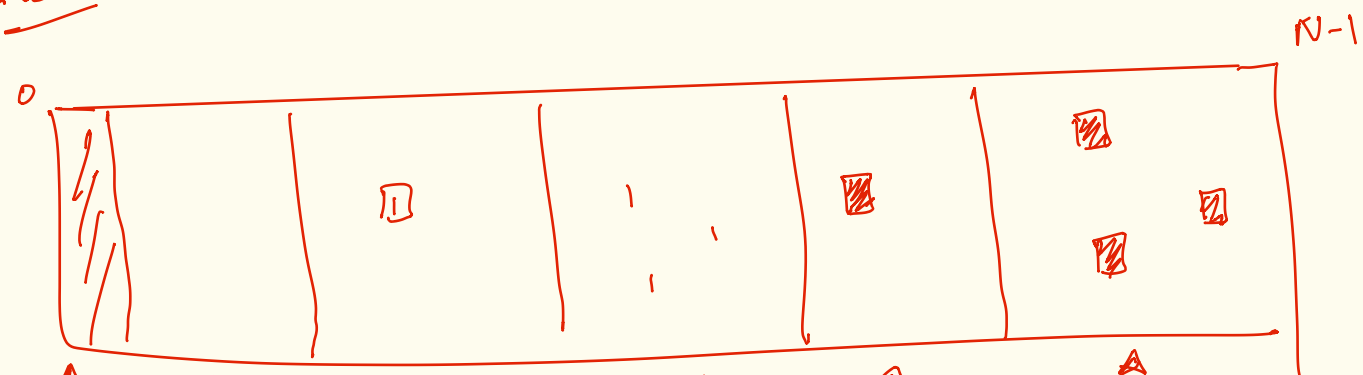
disk (linear order of blocks)



boot block — boot program ptr. to the kernel file

super block — FS-specific info
#inodes
start of inode bitmap
replicas of super block

inode bitmap — bitmap of all inodes (0/1)
(indexed inode number)

data bitmap — status of data blocks
0 - free
1 - not free

inodes — metadata of each file
(indexed inode number)

data blocks — data
content of files