```
1   CS5600, Handout Week12.a
2
3   //   Code snippets borrowed from WeensyOS boot loader
4   //   They illustrate how kernel "talks" to a disk through programmed I/O:
5   //   the bootloader reads in the kernel from the disk.
6   //
7   //   See the functions boot_waitdisk() and boot_readsect(). Compare to
8   //   Figures 36.5 and 36.6 in OSTEP.
9
10
11  //   WeensyOS boot loader loads the kernel at address 0x40000 from
12  //   the first IDE hard disk.
13  //
14  //   A BOOT LOADER is a tiny program that loads an operating system into
15  //   memory. It has to be tiny because it can contain no more than 510 bytes
16  //   of instructions: it is stored in the disk's first 512-byte sector.
17
18
19      #define SECTORSIZE      512
20
21      // boot_readsect(dst, src_sect)
22      //    Read disk sector number `src_sect` into address `dst`.
23      static void boot_readsect(uintptr_t dst, uint32_t src_sect) {
24          // programmed I/O for "read sector"
25          boot_waitdisk();
26          outb(0x1F2, 1);             // send `count = 1` as an ATA argument
27          outb(0x1F3, src_sect);      // send `src_sect`, the sector number
28          outb(0x1F4, src_sect >> 8);
29          outb(0x1F5, src_sect >> 16);
30          outb(0x1F6, (src_sect >> 24) | 0xE0);
31          outb(0x1F7, 0x20);          // send the command: 0x20 = read sectors
32
33          // then move the data into memory
34          boot_waitdisk();
35          insl(0x1F0, (void*) dst, SECTORSIZE/4); // read 128 words from the disk
36      }
37
38
39      // boot_waitdisk
40      //    Wait for the disk to be ready.
41      static void boot_waitdisk(void) {
42          // Wait until the ATA status register says ready (0x40 is on)
43          // & not busy (0x80 is off)
44          while ((inb(0x1F7) & 0xC0) != 0x40) {
45              /* do nothing */
46          }
47      }
```

B

1 sector

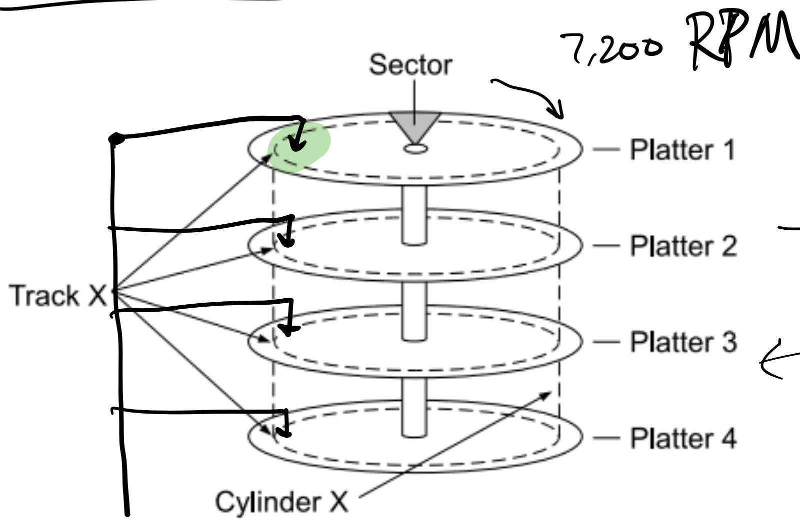
#sector

VA

persistant
storage

HDD

Hard disk drive organization



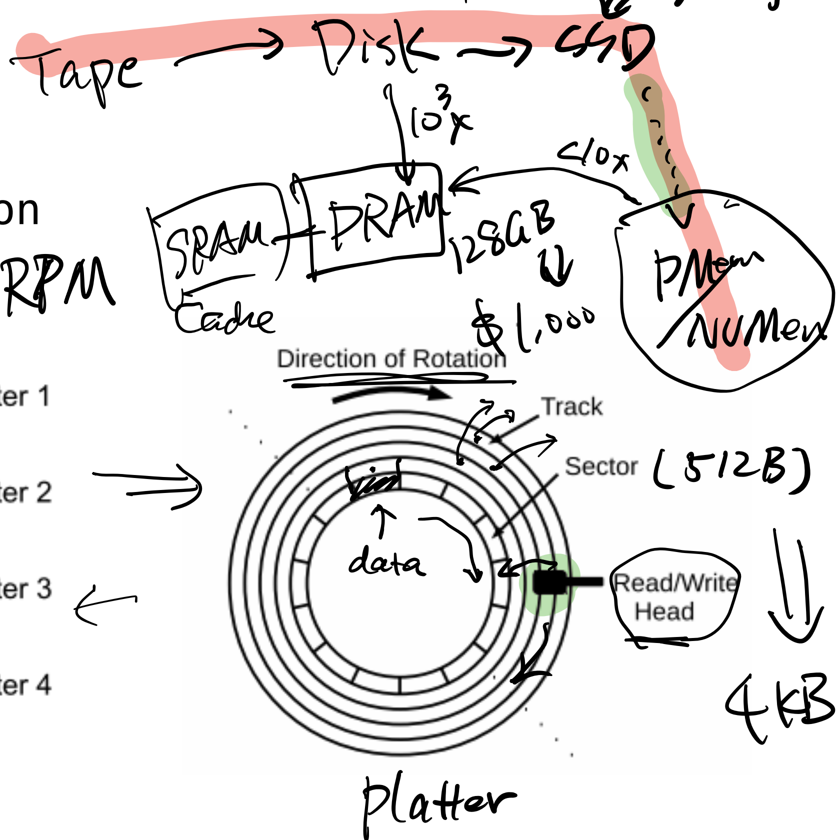


Fig 5.11, 5.12 from
http://www.ccs.neu.edu/~pjd/x600-book-v0903.pdf

Q: read is faster than write. WHY?

A Flash-based SSD (logical diagram)

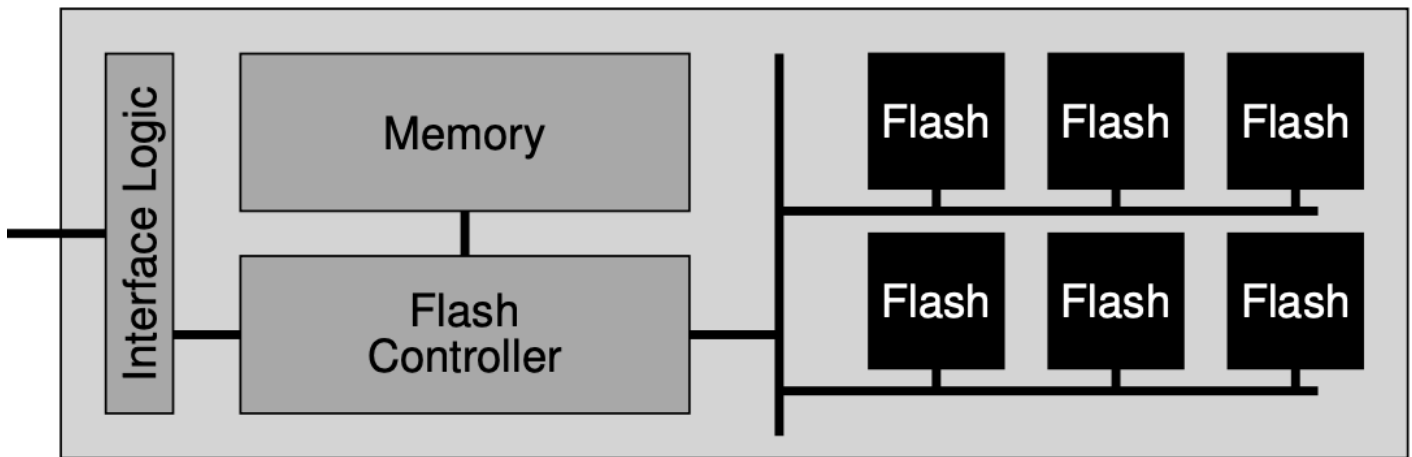


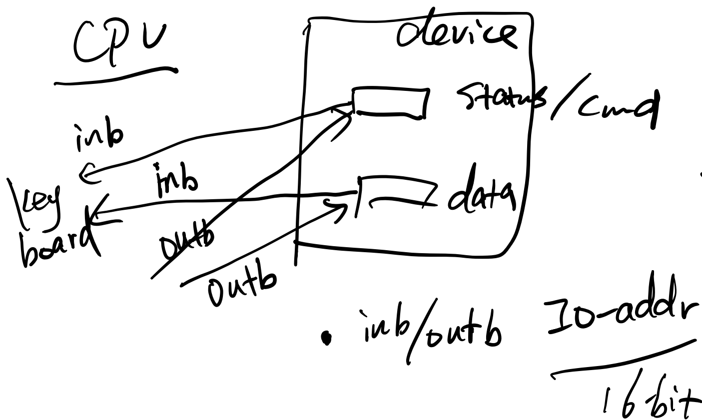
Fig 44.3 from
https://pages.cs.wisc.edu/~remzi/OSTEP/file-ssd.pdf

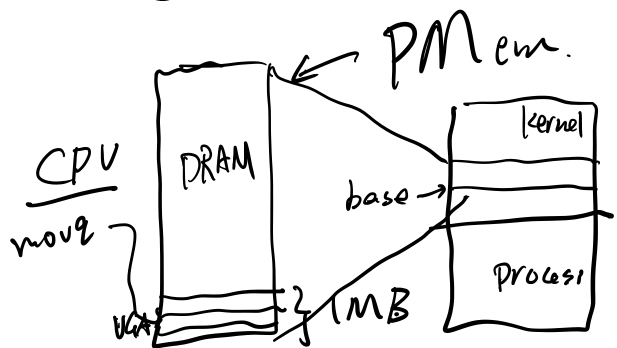
1. I/O, continued
2. device drivers
3. sync vs. async I/O
4. User-level threading
5. Disk
6. SSD

Lab3

① Port-mapped I/O

② MMI/O.





• inb/outb IO-addr
16bit

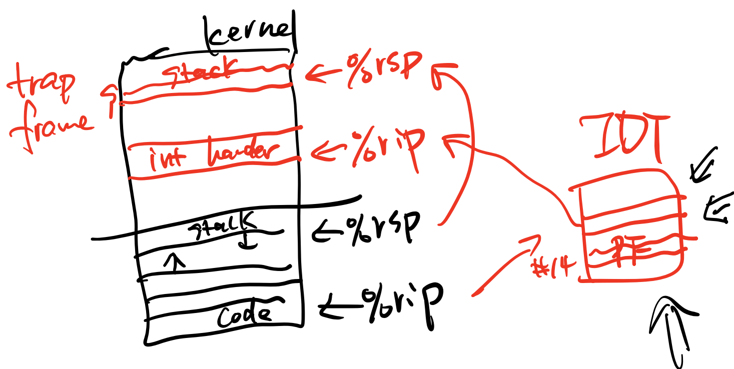
Kernel:
movq 'a', VGA_PA1

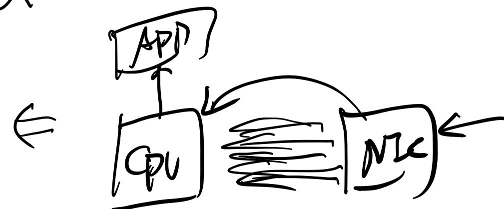
* polling vs. interrupt

Q: movq 'a', base+VGA_PA1

How interrupt?

Q: NIC. PICe

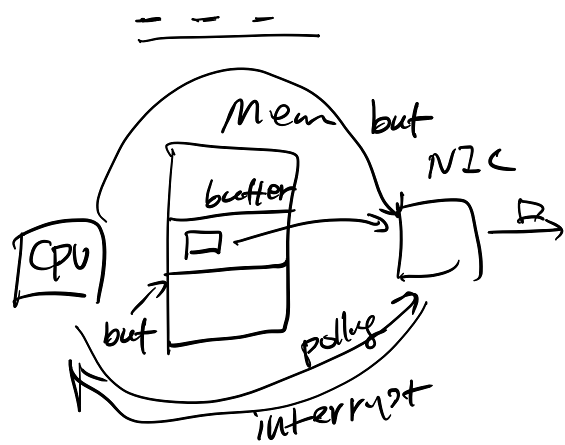




"receive livelock"

* Programmed I/O vs. DMA.

↳ PMIO + MMIO



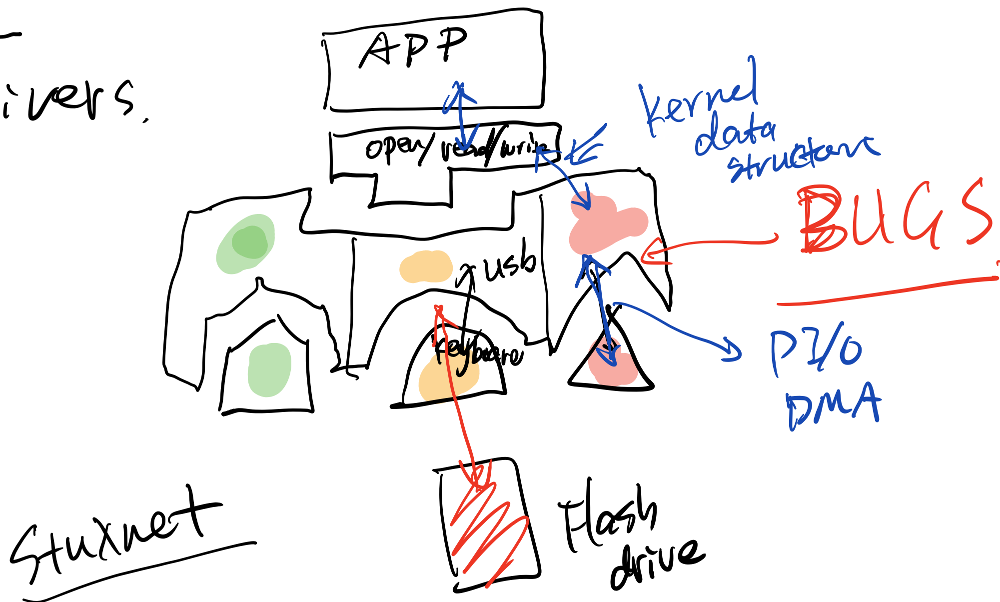
•

{polling, interrupt}

{PIO, DMA}

DMAC controller

• drivers.



• sync I/O vs. async I/O

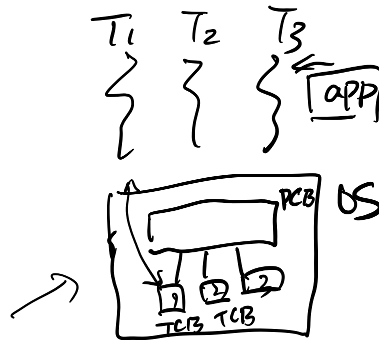
⇒ BLOCK or signal

↑ abstraction of interrupt

async-read()

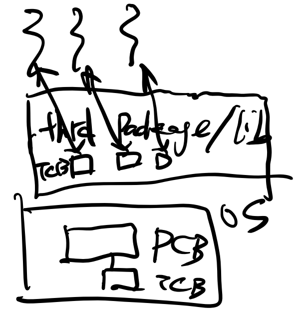
- IO thread. → disk (block)
- your thread → return.

POSIX



⇒

user-level threading



N-to-M.

N >> M.

- Disk