Announcements

- **Reading Chapter 13**
- **Midterm #2 is on Thursday**
  - Covers through last Th lecture
  - Can repeat info from first midterm
Project #3

- See updated buildfat for improved error messages
Disk Scheduling

- First come, first served
  - ordering may lead to lots of disk head movement
  - i.e. 1, 190, 3, 170, 4, 160 etc.
  - total number of tracks traversed: 863

- Shortest seek time first: select request with the minimum seek time from current head position
  - move head to closest track
  - i.e. 1,3,4,160,190
  - total number of tracks traversed: 189
  - potential problem with distant tracks not getting service for an indefinite period
Disk Scheduling

- **Scan scheduling** - read-write head starts at one end of the disk, moves to the other, servicing requests as it reaches each track
  - Consider example: 1, 190, 3, 170, 4, 160
  - If head starts at track 64 and moves towards 0, the ordering would be 4, 3, 1, 160, 170, 190
  - Total distance 265

- **C-Scan (circular scan)**
  - Disk head sweeps in only one direction
  - When the disk head reaches one end, it returns to the other
  - Consider example: 1, 190, 3, 170, 4, 160
  - If head starts at track 64 and moves towards 0, the ordering would be 4, 3, 1, 190, 170, 160
  - Total distance 282
Disk Cache

- Buffer in main memory for disk sectors
- Cache contains copy of some of the sectors on a disk. When I/O request is made for a sector, a check is made to find out if sector is in the disk cache
- Replacement strategy:
  - Least recently used: block that has been in the cache longest with no reference gets replaced
  - Least frequently used: block that experiences fewest references gets replaced
Virtual Memory and File Cache

- Both need to contend for memory
- Possible solutions:
  - Fixed size allocation of buffer cache (i.e. 20% of memory)
  - Unified buffer cache and virtual memory system
    - All pages (memory and file buffer) compete for all of memory
    - Allows large processes or lots of file access as needed
Memory Mapped Files

- Can treat files like memory
  - Allows fast random access to files
  - Uses file cache to make operations fast
- Interface
  - Use mmap call to map file into memory (similar to open)
  - Use normal memory operations to access file (instead of read/write)
  - Use munmap to “close” file
Bad Blocks

- Some blocks on a disk may not work
  - could be bad from the start (when disk is installed)
  - could go bad during use

- Two options to manage bad blocks
  - disk drive maps the blocks to “replacement” blocks
    - special blocks that are held in reserve for this purpose
  - OS keeps track of where the bad blocks are located and avoids them

- Replacement blocks
  - can be located in tracks at one location, or around the disk
  - provide correct behavior, but change disk performance

- Even if the disk re-maps bad blocks
  - OS could lose data stored on disk
  - needs to be able to recover filesystem from partial update
Booting the OS

- **How does the OS get loaded and started?**
- **Process is called booting**
  - want to use the OS to load itself
  - but what loads the OS?
- **ROM monitor**
  - knows how to read from a fixed location on disk and jump into it
- **Bootstrap program**
  - knows how to load a program from the filesystem and jump into it
- **Alternative:**
  - put more info into ROM about booting
    - MAC OS has most of the info in ROM
    - hard to change OS without changing ROMs
Booting the OS (cont.)

- put info into ROM about booting
  - MAC OS has most of the info in ROM
  - hard to change OS without changing ROMs

- Network Booting
  - ROM knows how to request a boot packet from the network
    - once the packet is received, execute it
  - useful for systems without local disks
  - used by OS developers to ease edit/compile/boot cycles