Drivers

cs169 - Spring 2017
Weenix Layout

User Land!

Virtual Memory

System Calls

open, read, write, lseek, mount, getcwd
fork, exec, wait
yield
mmap, brk

VFS

S5FS
TTY
Disk Driver
Terminal Driver

Other Drivers

Process Management
Scheduler

TLB
Page Tables
Page Frames
Drivers - Details

- You already have threads, mutexes, and queues (condition variables)
- Now you need to let programs interact with the outside world
  - Read/write to disk, type on screen, etc.
- Drivers let you do this by mediating between the OS and the hardware
Drivers - Getting Started

- Set ‘DRIVERS = 1’ in Config.mk
- ‘make clean && make’
- Now you are doing drivers
- All code is in ‘kernel/drivers’
- You need to implement 18 functions
Drivers - Overview

- Block Devices
  - Disk Driver
  - ATA Device
- Character Devices
  - TTY Driver
    - Line Discipline
    - TTY
- Memory Devices
  - /dev/zero, /dev/null, etc.
Drivers - Block Devices

- These can either be real (hardware) devices or virtual (memory) devices
- You need to implement 1 block device
  - An ATA Device (hard drive)
    - Reads in terms of disk blocks
- Driver needs to:
  - Translate reads into terms of pages
  - Use queues and interrupts to allow other code to run during IO
Drivers - Block Devices

- Block devices all have 2 operations
  - read
    - reads a given number of blocks, starting at a given offset, into a buffer. Returns the number of bytes read.
  - write
    - Writes a given number of blocks into the device, starting at a particular offset, from a buffer. Returns the number of bytes written.
Drivers - ATA Devices

- Controlled using DMA registers
  - Need to provide information like sectors, blocks, etc.
  - DMA sends a hardware interrupt when an operation finishes
- Read and write are both implemented in `ata_do_operation` since they are very similar
- These are very finicky
  - Follow the instructions in the code comments closely!
  - You will likely destroy the disk several times
- Use `./weenix -n` to start weenix with a new disk
- Use `./fsmaker disk0.img -i` to look at the disk
  - Use `block` command to see contents of blocks
Drivers - Character Devices

● These are things like ‘/dev/null’, ‘/dev/zero’, ‘/dev/tty’ etc.
  ○ These will not be actual files until VFS
● We provide a keyboard and terminal driver
  ○ They will read keyboard input and can write strings to the screen
● Similar to block devices except used in terms of characters
● Generally read one line at a time
Drivers - TTY

- The VT subsystem (keyboard and terminal drivers) will call your code to handle input
- You will write a line discipline to do this
  - Simple circular buffer to provide line-oriented read(2)
    - Do not declare the buffer with the static keyword, as this can cause problems much later on
  - Handles deletion of characters
Drivers - Line Discipline

- Keyboard interrupts call TTY which calls line discipline
- When a newline is passed, the buffer is “cooked” up to a certain point
  - Anything up to that point cannot be changed
- The actual tty methods mostly just pass along data to the line discipline
Drivers - KShell

- Once you have ttys working you will be able to use the ‘kshell’
- This is a ‘sh’ like environment where you can run code from the command line
- You will need to modify init to get it running
  - Look at ‘kernel/test/kshell.c’ to figure out how, and see the Weenix documentation for example code
Drivers - Other Stuff

- Be sure to continue testing your code
- You might want to add your procs tests to the kshell
- Ask your mentor TAs if you have problems
- Start Early