CSE 421/521: Operating Systems

Karthik Dantu
kdantu@buffalo.edu

Who Am I?

- Karthik Dantu
  - Davis 331
  - Web: http://www.cse.buffalo.edu/~kdantu/
  - Office Hours: Wednesday 3:00-5:00pm

- Research Areas
  - Multi-Robot Systems
  - Mobile Computing
  - Perception/Sensor Systems

The Real Help

Sharath Chandrasekhara

Farshad Ghanei

Chang Min Park

Course Objectives

- Learning internals of an Operating System
  - OS Structures/Threads/Scheduling/Process Synchronization
  - Main and virtual memory management
  - File systems
  - Distributed Systems
- Implement key-components of an OS
  - Threads/Scheduling
  - System Calls
  - Virtual Memory

Course Logistics - Sources

- Webpage: https://www.cse.buffalo.edu/~kdantu/cse421/
- Textbook: None
- Recommended Books:
  Operating Systems: Principles and Practice – Tom Anderson and Mike Dahlin

  Operating Systems Concepts – Silberschatz et al
- Recitations:

Course Logistics - Content

- Material
  - Lecture Slides
  - Online resources
  - Discussion forum (piazza)
  - Office hours (make the most of this)
- Load
  - Attend all classes
  - Start early on assignments
  - Most time likely spent on assignments
  - Exams multiple choice

Course Logistics - Grading

- Programming Assignments – 45%
  - PA1 (Threads/scheduling) – 15%
  - PA2 (System calls) – 15%
  - PA3 (Virtual Memory) – 15%
  - Late submission policy (0-24 hrs – 10%;24-48hrs – 25%; 48-72 hrs – 50%; >72hrs – 100%)
- Midterms – 40%
  - Midterm 1 – 20%
  - Midterm 2 – 20%
- Surprise quizzes in class – 10%
- Class participation – 5%
- *No Finals*

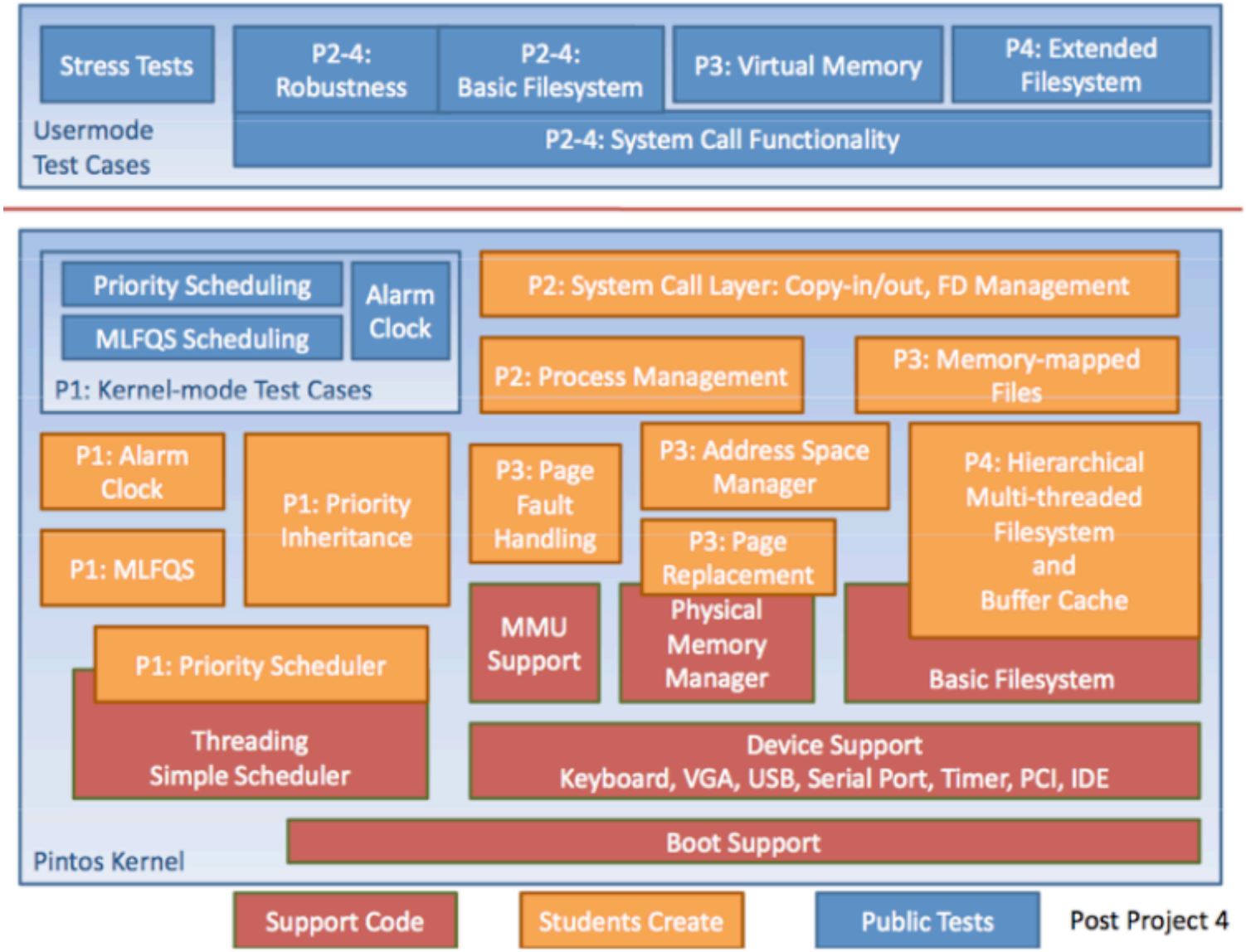
Course Logistics – Program Assignments

- Three students per team
- Teams formed by next week
- Pre-reqs
  - git
  - Linux user experience
  - C programming
  - Editor on linux (vi/emacs/others)
- Practice: PA0
  - Not graded
  - Lets you calibrate your preparation for class

Group Projects

- Group Projects: The Good
  - Simulates real-world
  - Online and offline coordination experience
  - Design/Documentation
- Group Projects: The Bad
  - Everyone does not do the exact same amount of work
  - Clear task allocation − trial by fire
  - Lack of trush => Failed project
- Group Projects: Caveats
  - We will NOT micro-manage teams
  - Submissions − everyone's responsibility
  - Use git to clearly identify individual contributions

PintOS


Stress Tests
P2-4: Robustness
P2-4: Basic Filesystem
P3: Virtual Memory
P4: Extended Filesystem
Usermode Test Cases
P2-4: System Call Functionality
Priority Scheduling
MLFQS Scheduling
Alarm Clock
P1: Kernel-mode Test Cases
P2: System Call Layer: Copy-in/out, FD Management
P2: Process Management
P3: Memory-mapped Files
P1: Alarm Clock
P1: MLFQS
P1: Priority Inheritance
P3: Page Fault Handling
P3: Address Space Manager
P3: Page Replacement
P4: Hierarchical Multi-threaded Filesystem and Buffer Cache
MMU Support
Physical Memory Manager
Basic Filesystem
P1: Priority Scheduler
Threading Simple Scheduler
Device Support Keyboard, VGA, USB, Serial Port, Timer, PCI, IDE
Boot Support
Pintos Kernel
Support Code
Students Create
Public Tests
Post Project 4

Group Projects - Plagiarism

- Just don't do it – we will know!
- UB CSE Academic Integrity Policy
- Penalty
  - First offense – 0 on the assignment to the group
  - Second offense – F class grade to the group
- moss
  - System that automatically detects code similarity
  - Looks at structure
  - Far more sophisticated than is worth your time

Plagiarism - Gradations

- Copying code from other groups or online resources
- Looking at another team's code
  - Your code is likely influenced by this
  - Similarities creep in even if you did not directly copy code
  - moss will catch that
- Discussing program structure
  - Potential for your code structure to be influenced by others
  - Similarity will be caught by moss
- Discussing design
  - Potential data structures and logic

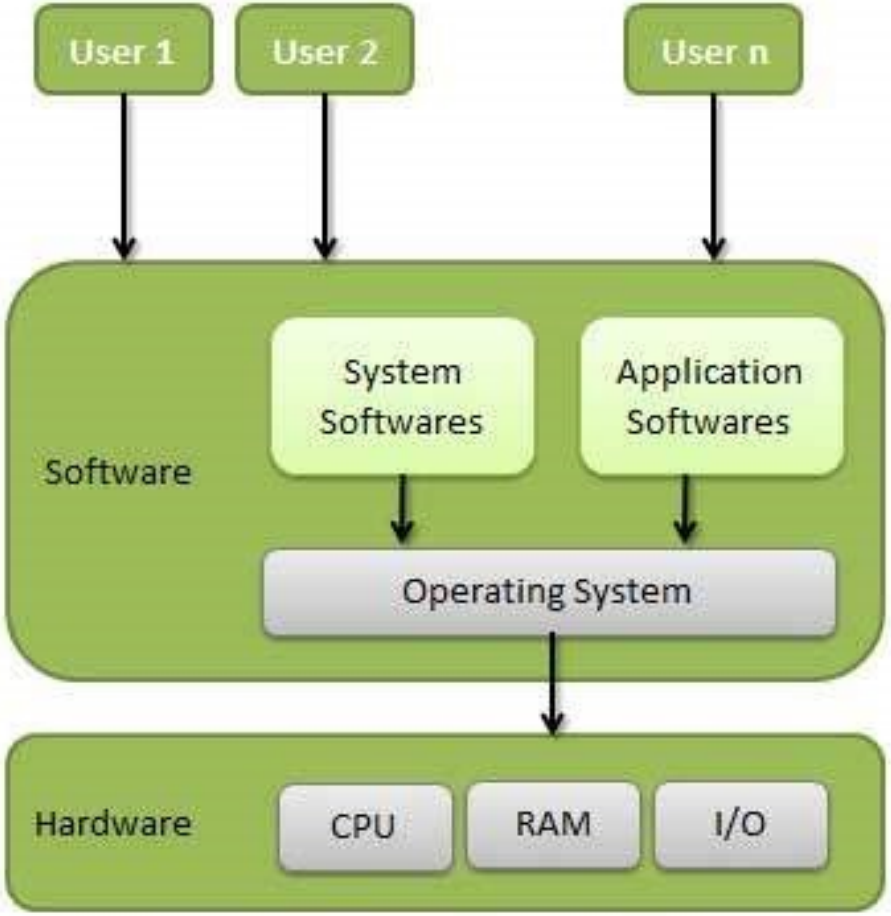
github Integration

- TBD – look on piazza

Assignment 0

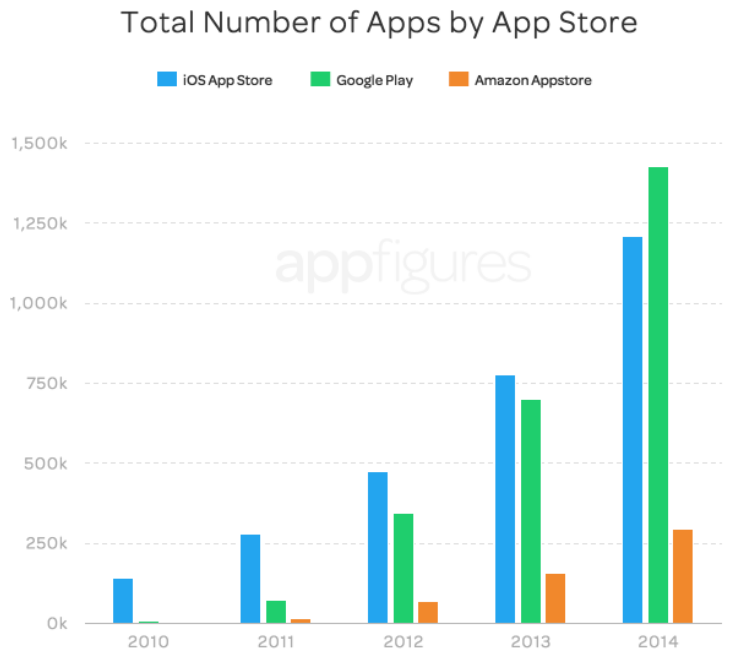
What is an OS?

- Special layer of software to provide access to hardware resources
  - Provide hardware abstraction
  - Protected access to shared resources
  - Authentication/Security
  - Storage
  - Communication
- Features distinguish OSes



What does an OS do?

- Hardware abstraction to apps
  - Filesystems
  - Processes/threads
  - Virtual Memory
  - Naming
- Manage resources
  - CPU: scheduling
  - VM: memory
  - Filesystem: Storage



Action Items

- Join Piazza
- Look through assignment#0
- Set up development environment: VirtualBox + Ubuntu 16.04
- Implement assignment and test in the environment
- Form groups