CSE 506
Graduate OS

Introduction

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Why Grad OS?

- Primary Goal: Demystify how computers work

An example progression

- Undergrad OS:
  - High-level understanding of paging
  - Theoretical issues like fragmentation
- Grad OS (506): Build a pager
  - Solid understanding of how paging SW + HW work
- Advanced Grad OS (624): Read novel research papers
  - Do creative things with paging: virtualization, security, etc

506: Learn by doing

- You will write major chunks of your own OS
  - Memory management, context switching, scheduler, file system, IPC, network driver, shell, etc.
- Linux scheduler:
  - Difficult to understand just by reading source
  - Small modifications require first understanding the code
  - Impossible to replace/reimplement
  - No substitute for building it yourself!

A logical view of hardware

- CPU(s)
- RAM
- PCI-X Bus
- North Bridge (Fast devices: e.g., GPU)
- BIOS
- SATA
- PCI Bus
- South Bridge (“Slow” Devices: e.g., Disk, USB, Most network)

Fewer Bridges

- Newer system organizations are moving more devices to the North bridge, and consolidating more things on the CPU itself.
A logical view of the OS

Binary Formats  Memory Allocators  Threads  System Calls
RCU  File System  Networking  Sync
Memory Management  Device Drivers  CPU Scheduler
Interrupts  Disk  Net  Consistency

JOS

- Developed at MIT, used at several top schools
- The “J” is for Josh Cates, not Java
- In C and Assembly, boots on real PC hardware
- You get the skeleton code, fill in interesting pieces
- Build the right intuitions about real OSes
- but with much simpler code

Labs, cont.

- This course is **coding intensive**
  - You should know C, or be prepared to remediate quickly
  - You will learn basic, inline x86 assembly
  - You must learn on your own/with lab partner
  - The lab is difficult, but worthwhile
  - You will want to commemorate, with a T-shirt, tattoo, etc.

JOS Labs

Last Lab

- Includes open ended project
  - Can add significant feature to JOS
  - Or do a research task on another system
  - Plan ahead – proposals due 10/23
  - Note all deadlines on course website

Challenge Problems

- Each lab includes challenge problems, which you may complete for bonus points (generally 5—10 points out of 100)
  - Unwise to turn in a lab late to do challenge problems
  - Can complete challenge problems at any point in the semester—even on old labs
  - Indicate any challenge problems completed in challenge.txt file
CSE 522

- This course can also count as your MS project course (CSE 522)
- Requirements: Same as 506, except:
  - You must do the labs alone
  - You must complete 1 challenge problem in each lab
  - To enroll: you must first be in 506
  - Ask me and I will have you moved to 522

No Textbook

- You're welcome
- Several recommended texts
  - Several free on SBU safari online site
  - Others on reserve at library
  - Required readings will mainly be papers you can print out

Lectures

- Compare and contrast JOS with real-world OSes
- Mostly Linux, some Windows
- Supplement background on hardware programming
- Common educational gap between OS and architecture

SBU Capture

- Experiment: TLT will be recording the projection and audio (no video of me, sadly)
- Recordings will be automatically posted to BlackBoard
- Intended to help you study
- This is best effort
- No guarantee all lectures will be recorded
- This is no substitute for lecture attendance
- Can't ask questions
- If attendance suffers, I will stop recording lectures

Prerequisites

- Undergrad OS
  - In some cases, industry experience is ok
  - Worth brushing up if it has been a while
  - In-class quiz, due before you leave
    - If you can't answer 50% of these questions, consider undergrad OS
- C programming
- Basic Unix command-line proficiency
- See me if you have already done the JOS lab, or similar

Space in the class

- Wait list is currently full
- Grad students often over-enroll
  - Space likely to open up in first week
  - If you want in, keep showing up for a few lectures
  - Worst case: Prof. Zadok teaching 506 in spring
  - Likely to be offered every semester going forward
Course email list

+ Sign up at http://lists.cs.stonybrook.edu/mailman/listinfo/cse506
+ This is the primary announcement medium
+ And for discussions about course work
  + Do not post code here or other solutions
  + Goal: Everyone can learn from general questions
  + Material discussed on the mailing list can be an exam question

Other administrative notes

+ Read syllabus completely
+ Subscribe to the class mailing list
+ 2 exams cover: lectures, labs, mailing list
+ Every student will get a VM for lab work
  + You may use your own computer, staff can’t support it
  + All staff email goes to cs506ta@cs.stonybrook.edu
  + Except private issues for instructor only

VM Assignments

+ Your VM is cse506-USER, where USER is your netid
+ Each VM is hosted on the server esx1sc--esx4sc
  + You should receive an email with your server and initial password
  + The account is cse506
+ Once it is powered on, it will listen for ssh on port 130
+ Change the password immediately

Lab Partners

+ Can work alone, but better with help
  + Some excellent students earned A’s working alone
  + Many good students earned B’s working alone
  + No need to be a hero
  + Choose your own partners
  + Lab mailing list good for finding them
  + Same for entire course
  + Changes only with instructor permission

To Do

+ Email me your partner selection
+ We will then create the git repository you will use to turn in your assignments
+ In the meantime, clone the read-only, http repository to get started
+ Please do this well in advance of the deadline

Academic Integrity

+ I take cheating very seriously. It can end your career.
+ In a gray area, it is your job to stay on right side of line
+ Never show your code to anyone except your partner and course staff
+ Never look at anyone else’s code (incl. other universities)
+ Do not discuss code; do not debug each other’s code
+ Acknowledge students that give you good ideas
Lateness

Each group gets 72 late hours
- List how many you use in slack.txt
- Each day after these are gone costs a full letter grade on the assignment
- It is your responsibility to use these to manage:
  - Holidays, weddings, research deadlines, conference travel, Buffy marathons, release of the next Zelda game, etc.
  - 3 Exceptions: illness (need doctor’s note), death in immediate family, accommodation for disability

Lab 1 assigned

- Due Friday, 9/7 at 11:59 pm, eastern.
- Instructions on website
- Quick demo

Getting help

- TA's (TBD) will keep office hours
- Instructor keeps office hours
  - Note that “by appointment” means more time available on demand

Questions?