Welcome to CSE 506

Introduction & Review

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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)
  - South Bridge ("Slow" Devices: e.g., Disk, USB, Most network)
- **BIOS**
- **SATA**
- **PCI Bus**
Fewer Bridges

• Newer system organizations are moving more devices to the North bridge, and consolidating more things on the CPU itself.
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

• 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
JOS 64

• You will actually implement a 64-bit variant of JOS
• Developed at Stony Brook!
  – Primarily by Amit Arya and Abhinand Palicherla
  – Contributions also by: Vivek Kulkarni, Varun Agarwal, Chia-Che Tsai, Tao Zhang...
    • Some of these final projects or just contributions from a previous 506 course
    • See your name here next year if you add a particularly useful feature!
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 or OS X, FreeBSD, etc.

• Supplement background on hardware programming
  – Common educational gap between OS and architecture
My Lecture Style

• I like participation and questions
• I can explain any concept in many ways, and explain missing background on the fly
  – ...but I can’t read your mind---I need to know if you don’t understand something!
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
  – Especially helpful for people without strong English

• 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
PhD vs. MS Sections

• This course was supposed to be split into 2 sections
  – I teach MS section
  – Prof. Honarmand teaches PhD section

• Benefits: More seats, more tailored material
  – But 85+% similar

• The two sections are temporarily merged
  – All students will take lectures from me until further notice
  – We expect to re-divide the sections later
Section 2: PhD

• Two parts:
  – Part 1: same material as MS section (up to Security)
  – Part 2: Introduction to some advanced OS topics
    • Emphasizing paper reading (it’s a PhD section after all)

• 5 Lab assignments (same as first 5 in MS section)
  – 37% of grade

• Midterm and Final exams (same days as MS section)
  – 40% of grade (midterm: 20%, final: 20%)

• Paper reading and analysis
  – 18% of grade

• Presentation or Project
  – 15% of grade

• Yes, they sum up to 110%
Section 2: PhD (cont’d)

• There will be papers for reading and discussion
  – Occasionally in Part 1, mostly in Part 2
  – Should discuss papers on newsgroup (mandatory participation)

• In Part 2, we’ll discuss advanced topics
  – Such as alternative OS architectures and security

• For the last 15%: Students can
  – present a set of assigned papers in Part 2
  - or -
  – do a research project

• Same groups as your lab assignments
Space in the class

• Wait list is currently full for MS section
• 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. Ferdman teaching 506 in spring
  – Likely to be offered every semester going forward
Course email list

• We will use Piazza this year, we will enroll classes
  – Both MS and PhD will share a discussion forum
• 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
• 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
• Also, checkpoint your VM before you change things
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 (soon)

• Due Monday, 9/8 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?