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)

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.
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
  – 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

Lateteness

- 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?