Introduction

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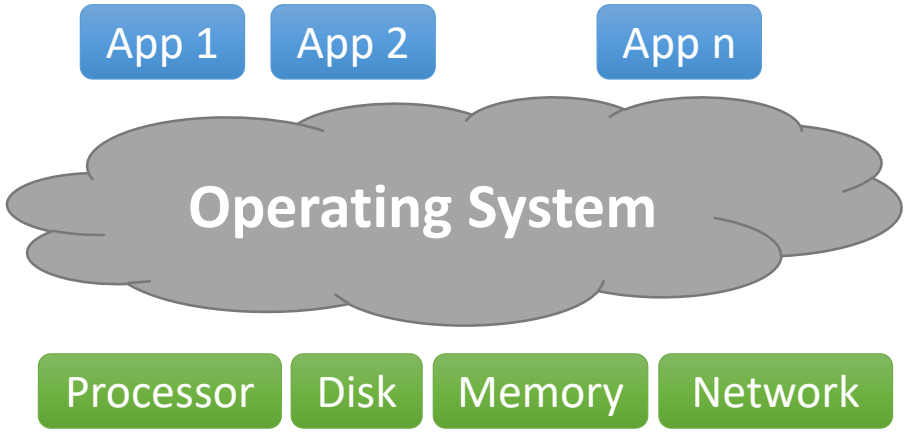
What is an Operating System? (1)

- All of the stuff between you/your application and the hardware
  - Kernel
  - Device Drivers
  - API libraries
  - UI



- Our focus is mostly on the kernel and some advanced API

What is an Operating System? (2)

- What are the main tasks of an OS?
  - Abstract the hardware for convenience and portability
  - Virtualize the hardware to share it among multiple applications
  - Multiplex the virtualized resources over physical resources
  - Provide services to applications and users
    - Process isolation
    - Inter-process communication
    - UI
    - …

Why Operating Systems?

- Primary Goal: Demystify how computers work
  - Lots of abstractions and heuristics between your application and the hardware
  - A good computer scientist should understand what happens inside the system when one types a command
- Secondary: Learn how to write robust programs
  - OSes like Linux have many users and work on a wide range of hardware
  - Deal with subtle issues: concurrency, consistency, etc.

About This Course

- This course is being revised
  - After recent changes in CSE 320 and making it a prerequisite
- Bear with me as we try to finalize the course syllabus
- Some basic OS concepts and API already taught in CSE 320
  - We will review those quickly
  - We will cover more advanced API here
- More importantly, we will talk about internal design and implementation issues of Oses
  - Not covered in CSE 320

Course Format :: Lectures (1)

- Basic OS ideas: abstractions, interfaces and algorithms on core issues
  - Memory
  - CPU
  - Multi-threading and synchronization
  - Storage — Disks (HDDs and SSDs) and File systems
  - Networking
  - Device programming
  - Inter-process communication and isolation issues
- Supplement background on hardware programming

Course Format :: Lectures (2)

- Several more recent topics (time permitting)
  - OS Security
  - Virtual machines
  - Advanced file systems
  - OS in data centers and cloud
  - Embedded OS issues
  - High performance networking
  - etc.

Course Format :: Lectures (3)

- Discuss and supplement reading material
- An important chance to clarify issues
  - Questions are encouraged!
- I expect you to arrive prepared to answer and ask questions about the reading material
- Everything in lectures may appear on the exams, even if not in the book

Course Format :: Labs (1)

- Learn by doing
- 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 to learn on your own/with lab partner
- You will make substantial modifications to xv6, a simple x86 Unix variant
  - Code is written to be easy to understand, but lacks many modern OS features
  - Challenging work, but a very marketable skill

Course Format :: Labs (2)

- We may have one or two advanced user-mode programming labs to use advanced OS API not covered in CSE 320
  - Unlike xv6 labs that will be kernel-mode programming
- One way or the other, there will be **five labs** in total
  - Combination of xv6 and user-mode programming
- The exact combination will be determined as we go

Course Format :: Labs (3)

- Each student will have a Linux virtual machine on a departmental cluster
  - Comes with basic development tool chain that you need for the course (GCC, GDB, Qemu, etc.)
  - You have sudo access and can install new software as you need
- You can also use your own laptops but the tech staff won't support them
- See https://compas.cs.stonybrook.edu/~nhonarmand/courses/fa17/cse306/labs.html for complete details

Lab Late Hours

- Each lab team gets 72 late hours
  - List how many you use in slack.txt
  - Each hour after these are gone costs 2% 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 Teams

- Can work alone or as a pair
- Choose your own partners
- Remains the same for the entire course
  - Changes only with instructor permission

Readings & Books

- **Required Readings**
  - Assigned from the OSTEP book + maybe some papers
  - Should be completed before the lecture
  - Required reading material may appear on the exams, even if not discussed in lecture
- Highly recommended (optional) books
  - K&R for C programming
  - Understanding the Linux Kernel (3rd edition) for Linux internals
  - Advanced Programming in the UNIX Environment (3rd edition), the UNIX bible
- Many other references on the website

Other Course Information

- TA: TBD
- Course website:
  - compas.cs.stonybrook.edu/~nhonarmand/courses/fa17/cse306
  - Syllabus, schedule, homework, etc. posted here
- Course newsgroup
  - Blackboard → Discussions → "General Discussions" Forum
  - Main venue for all class-related discussions
  - Sign up ASAP to avoid missing anything
  - Goal: Everyone can learn from general questions
  - Do not post code or other solutions here

Prerequisites

- CSE 219 (CS III) or CSE 260 (CS B, Honors)
- CSE 320 (Systems Fundamentals II) or ESE 380 (Embedded Microprocessor Design I)
- The background courses are necessary
- In some cases, industry experience is ok
  - In-class quiz, due before you leave
  - If you can't answer 50% of these questions you are not prepared
- C programming
- Basic Unix command-line proficiency

C Programming

- You should have learned C in the prerequisite courses
- If you are not sure, you should read “The C Programming Language” by Kernighan and Ritchie (K&R) cover to cover this week
  - And complete all exercises in the book
- If you can do this in the next week or so, you will be prepared to complete this course on schedule

Other administrative notes

- Read syllabus completely
- Subscribe to the discussion forum on Blackboard
- The exams cover *lectures*, *labs*, *assigned readings* and *blackboard discussions*
- Lab VMs aren't ready yet
- Back up your lab work in a private repo
  - Department provides git repos to let you backup your work
    - Send an email to `rt@cs.stonybrook.edu` to have yours activated
  - Or use BitBucket or Github
- **Do not make your repos publicly available**

Grading

What?	Points
1 Quiz	0
Labs	60
Midterm exam	20
Final exam	20
Total	**100**

- Guaranteed grades: [A, A-, B+, …, D, F] = [85, 80, 75, …, 45, <45]
  - I may use a curve on top of this (but there is no guarantee)
- Midterm grade will be the max(midterm, final)
- Grades solely determined by your performance in the course
  - **Not whether they are needed for graduation, qualifiers, etc.**

Academic Integrity

- We take cheating very seriously. It can end your career.
- Share ideas but not code
  - Acknowledge students that give you good ideas
- In a gray area, it is your job to stay on right side of line
- Never show your code to anyone except course staff
- Never look at anyone else's code (including other universities)
  - Do not debug each other's code
- Fully read the Academic Integrity text on the website

Questions?

Remember:

- Hand in the survey
- VMs and Lab 1 coming out soon
- Reading assigned for next class (Thursday)
  - No class on Tuesday (Labor Day Observance)

Survey Quiz