Introduction

ICS 332 Operating Systems

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Course Goal

- At this point in your life you:
  - Have used at least one OS
  - Know which OS runs on your computer
  - Know that without the OS, you couldn’t use your computer
- Question: What does the OS do?

Motivation to Study OSes

- You are unlikely to develop or work on an actual OS
- But you are likely to develop software that relies on/works with the OS
- Obvious Motivation:
  - Important to know how to use the OS as a programmer
  - Important to know what the OS can and cannot do
  - Important to know what happens behind the scenes to understand bugs, vulnerabilities, performance, etc.
- Meta Motivation:
  - Knowing OS principles makes you a better software architect and developer
  - OS concepts are massively reusable in your own projects

Spectre/Meltdown

- Disclaimer: There are some generalizations made
- Discovered/disclosed early 2018
- Hardware fixes released late 2018
- Affected most CPUs between 1995 and 2018
- Broke memory isolation
  - An attacker could access sensitive information from kernel memory or other user processes (passwords, keys, etc.)
- Based around out-of-order and speculative execution
- Software patches to disable these performance improvements could mitigate the vulnerability (5-30% performance impact)
- But the proper patch is to fix the hardware
- https://meltdownattack.com/
- https://www.cloudflare.com/learning/security/threats/meltdown-spectre/

Expectations

- We will not be developing an OS in ICS 332
  - It’s difficult
  - Very programming heavy for students in an undergraduate course
  - Time consuming
- This course will be more of an overview of how an OS works along with some small programming assignments
- If you want to dive deeper
  - Take ICS 612 Theory of Operating Systems/other grad courses
  - Apply for an internship that does low level/OS related work
  - Do it on your own

Disclaimer

- I’m not an expert on OSes
- This class focuses on the general principles rather than specific implementations

Challenges of Teaching OSes

- A significant part of the material follows the pattern of “here is how it works and why it’s a good idea”
  - It’s not feasible to have a full hands-on experience for everything in an undergrad course
  - You will have some opportunities for gaining hands on experience
- It’s important to ask questions

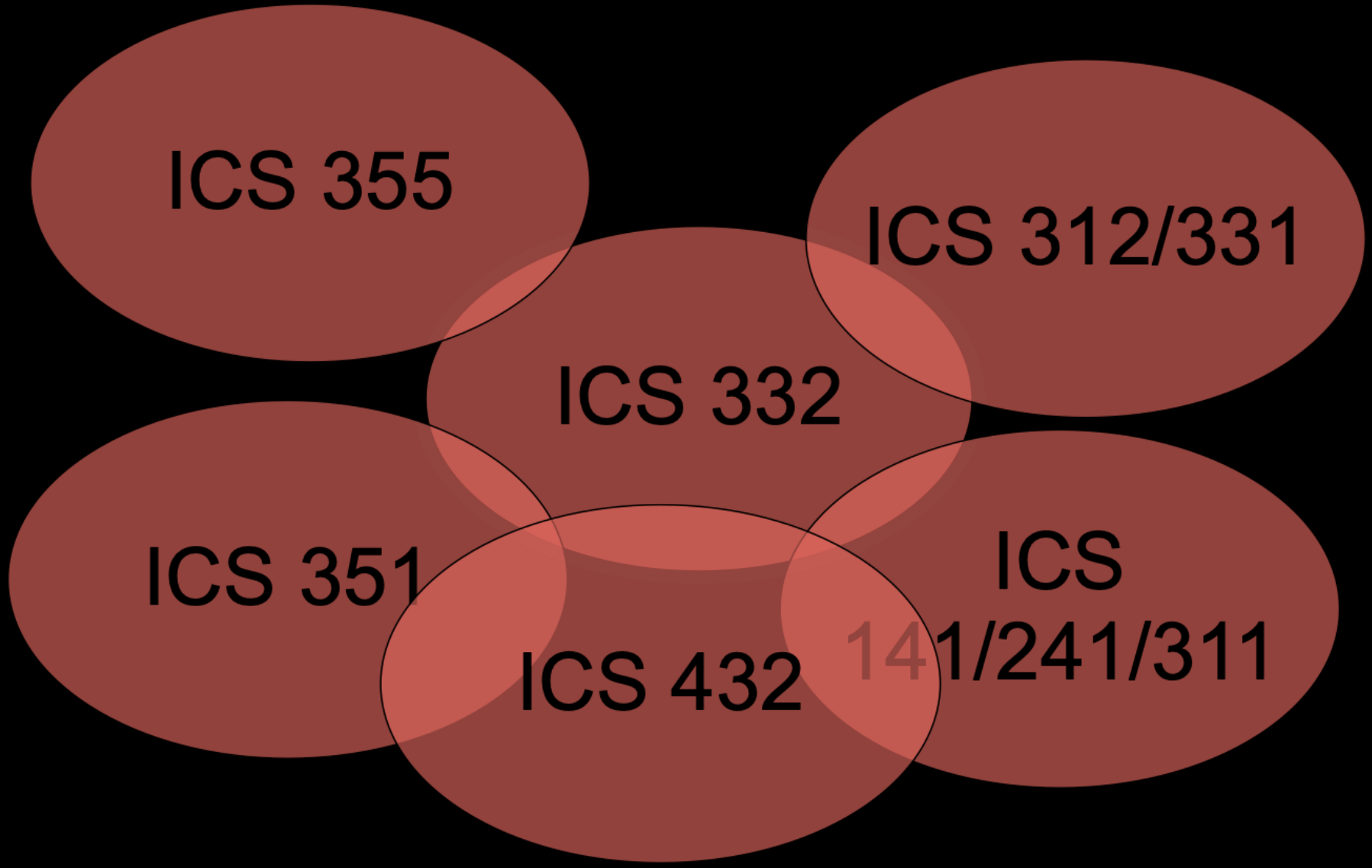
What we will learn

- Roles of an operating system
- Fundamental principles of operating system design and kernel implementation
- Specifics
  - The course content is not specific to a particular OS
  - But we will often reference Unix derivatives (macOS, Linux, etc.) and sometimes Windows
  - Many Oses do things in a similar way (they are trying to solve for the same problem), but they also have key differences
  - We will mention historical OSes whenever relevant
  - We will not study special purpose OSes (real-time, network, etc.)

What we will learn

- The course is broken into three major parts
  1. CPU – Processes, Threads, Scheduling, Synchronization
  2. Memory – Main Memory, Virtual Memory
  3. I/O – Storage, File Systems
- We will have several programming assignments. They are more about using the OS than about implementing the OS

ICS 332 and the ICS Curriculum



Grading

- Two exams (40%)
  - One midterm exam
  - One final exam
- Quizzes (10%)
  - Roughly every week
- Homework assignments (50%)
- Read the statement on academic dishonesty in the syllabus

Quizzes

- Roughly one quiz a week
- Unannounced
- Closed book
- Multiple choice or short answer

Homework Assignments

- All assignments must be turned in electronically using Laulima by 11:55pm HST on the day the assignment is due
  - **Scanned hand-written assignments will not be accepted**
  - Make sure to follow the file format instructions in the assignment description
- Late assignments
  - 10% penalty for up to 24 hours of lateness
  - A grade of 0 for more than 24 hours of lateness
  - If you know you will not be able to complete an assignment before its deadline, email me and the TA

Homework Assignments

- If Laulima is down, email me and the TA your submission immediately
  - Don’t send an email saying “Laulima is down what should I do?”
- After submitting, double-check what you submitted

Homework Assignments

- All assignments are individual (not group) assignments
- Some assignments will be **pencil-and-paper** that require no programming
- Some assignments will be **programming** assignments
  - Write code
- The Instructor/TA will not answer homework related emails on the day the assignment is due

Programming Assignments

- Show of hands: familiarity in C/Java?
- Primarily in C and Java
- You can use your own machine and whatever editor or IDE you want
- But you must test/run your code on a Linux machine
  - Because that's what we'll use to do testing/grading
  - There are some potential issues when cross-developing between Windows and Linux
  - See Homework #0

Programming assignments

- Each programming assignment has specifications and examples
  - Command-line arguments, file names, directory structure, etc.
  - If you find the specifications unclear, let us know right away
- Not following the specifications will most likely lead to deductions
  - We will not go into your code to fix it
- Following specifications and writing robust code will probably be a huge part of your professional lives

The Linux CLI (Shell)

- Knowledge of the Unix/Linux LI (shell) is required
- Show of hands: Which OS do you use daily (Linux, macOS, Windows, other)?
- Show of hands: Who feels somewhat familiar with the Unix/Linux CLI?
- A huge potential side-benefit of taking this course is to become proficient with the CLI

Important of Terminology

- As we learn about Operating Systems, we will encounter a lot of terminology
- Recognizing and using the correct terminology is a part of what we learn in this course
- Knowing the terminology is very important (e.g., in a job interview, in a professional context)
- Terminology will be a part of the quizzes/exams

How to do well in this course

- Come to class
  - It’s more than just the slides
  - I’ll do live demos and answer questions
- Start assignments early
  - You can have more opportunities for help
  - You can ask questions earlier
  - You’ll have more time to think
- Turn in all of the assignments
- Come to office hours

How to do well in this course

- Do not cheat
  - Cheating is bad for many reasons, including hurting the reputation of ICS graduates
  - If you feel like something is too difficult, you should be thinking about how you can ask the Instructor/TA for help instead of cheating
- Study for quizzes
  - Quizzes help you to study for the exams

Course Website

- Located at
  - https://www.chadmorita.com/ics332s25/
- Let’s look at the website

Questions?