Lecture 0
Course Introduction

Prof. Yinqian Zhang

Fall 2025

General Course Info

- Course Name: Operating Systems (H)
    - Term: Fall 2025 (Sep. 8, 2025 to Dec. 28, 2025)
- Time: Friday 10:20-12:10
- Location: Room 302, Lecture Hall 3
- Lecturer: Prof. Yinqian ZHANG
- Email: yinqianz@acm.org

General Course Info (Con't)

- Labs
  - Time: Friday 14:00-15:50
  - Location: Room 505, Lecture Hall 3
  - Instructor: Prof. Yinqian ZHANG
- Student TAs
  - Yuke Peng (12531327@mail.sustech.edu.cn)
  - Dahui Li (12532590@mail.sustech.edu.cn)

Self Introduction

Open Office Hour:
Friday 16:00-18:00
615 South CoE Building
Make an appointment before you come !!!!!!!

- A **professor**
  - of Computer Science and Engineering at SUSTech
  - Previously at Ohio State University in USA
- A **security** researcher
  - Study the security of computer architectures, operating systems, and software applications
    - Find vulnerabilities in CPUs and software
    - Build systems to defend against various attacks
  - **My current research interest**: Build secure systems for confidential computing and AI

Why Are You Here?

- Reason 1: OS is a mandatory course
    - **Yes, you have to pass!**
- Reason 2: Rumor has it: the course is a breeze to pass
    - **No,** it is **notoriously challenging**, which involves complex concepts like process scheduling, memory management, and synchronization. **It requires programming in Rust**.
- Reason 3: **Operating system is one of the most important courses for CS majors**
    - **Yes**, it helps you (1) understand how computer systems work, (2) understand abstraction and interfaces, (3) develop system-level thinking, (4) prepare for advanced topics, (5) enhance career opportunities

Content of This Course

- We will study the theory of operating systems
  - Virtualization, concurrency, persistence
  - Management of CPU, memory, I/O and storage

- We will learn the implementation of operating systems
  - Learn Rust, a memory-safe programming language
  - Build an operating system kernel by yourself
  - Run your OS on (emulated) RISC-V CPU (via QEMU)

Goals of This Course

- Be competent with process concepts and CPU scheduling.
- Be competent with memory hierarchy and memory management.
- Be familiar with process control blocks, system calls, context switching, interrupts, and exception control flows.
- Be familiar with process synchronization, inter-process communication, and threads.
- Be familiar with multi-threaded programming.
- Be familiar with file systems, disk scheduling algorithms and I/O.
- **Gain Hands-on experience.**

Prerequisites

- **Rust Programming**
  - All course projects will use Rust (or assembly)
  - **Self-learning is expected!**
- Data structure and algorithm analysis
  - It helps you understand OS concepts, e.g., LRU
- **Computer Organization**
  - How do computers work?
  - Hardware and software coordination
  - **Self-learning is expected!**

Reference Books

- **Operating Systems: Three Easy Pieces,** Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau
  - Virtualization (Process, scheduling, memory address space, swapping)
  - Concurrency (Threads, locks, semaphores)
  - Persistence (I/O, storage, file systems)
  - **Online available: https://pages.cs.wisc.edu/~remzi/OSTEP/**

- **Slides**
  - Download from BB before each class
  - **Take notes in class**

Course Structure

- Lectures
  - Workshop format – slides presentation, round-table discussion
  - Get the main ideas and concepts (English and Chinese)
- Lab
  - Tutorials on kernel code and lab assignments
  - Do the lab exercises / projects
- Lectures and labs are integrated
  - Content are mostly sync-ed (hopefully)
  - All assignments (even written ones) submitted through labs

Gradings

- Lecture participation: 20%
  - Attendance + presentation + discussion
- Lab report/participation: 10%
  - In-class assignments
- Assignments: 25%
  - Coding
- Final exam: 25%
- Projects: 20%
  - A group project of 2-3 students
    - Ask if you'd like to work on your own.

Labs and Projects

- Asterinas is a secure, fast, and general-purpose OS kernel that provides Linux-compatible ABI.
  - Asterinas is written in Rust
  - Asterinas has a new kernel architecture --- framekernel
  - A joint work by SUSTech and Ant Group
- Asterinas provides OSDK (Operating System Development Kit), which is designed to simplify the development of Rust operating systems.
  - Labs: You will learn to build new OS using OSDK
  - Projects: contribute to Asterinas
- https://github.com/asterinas/asterinas

Grading Policy

How about ChatGPT/Deepseek/Kimi/Doubao?

- Late submission policy:
  - No late submission allowed
- Guidelines on collaboration
  - Write up all assignments **ON YOUR OWN**
  - Discussion is allowed, but form your own ideas, words, code
- Zero tolerance on plagiarism
  - Software will be used to detect plagiarism cases!
  - Serious cases will be reported to university
  - Sign academic misconduct agreement with CSE Department

Academic Misconduct

- If an undergraduate assignment is found to be plagiarized, the first time the score of the assignment will be 0.
- The second time the score of the course will be 0.
- If a student does not sign the Assignment Declaration Form or cheats in the course, including regular assignments, midterms, final exams, etc., in addition to the grade penalty, the student will not be allowed to enroll in the two CS majors through 1+3, and cannot receive any recommendation for postgraduate admission exam exemption and all other academic awards.

Wechat Group

Keys to Success

- Class participation
  - **Come to class, do presentation, and discuss**
  - Take notes, ask questions!
  - Lectures will not follow textbooks (but read textbooks will help you understand better)
  - Download slides (before class, and check for updates after)
- Visit BB
  - Announcement
  - Lecture slides (before classes, may update afterwards)
  - Tutorial / lab exercises
  - Solutions
- Prepare to code
  - You will build your own OS kernel!!!
  - Seek help in time!!!

Thank you!