National Yang Ming Chiao Tung University
Computer Architecture & System Lab

IOC5226 Operating System Capstone

Syllabus

Tsung Tai Yeh
Department of Computer Science
National Yang Ming Chiao Tung University

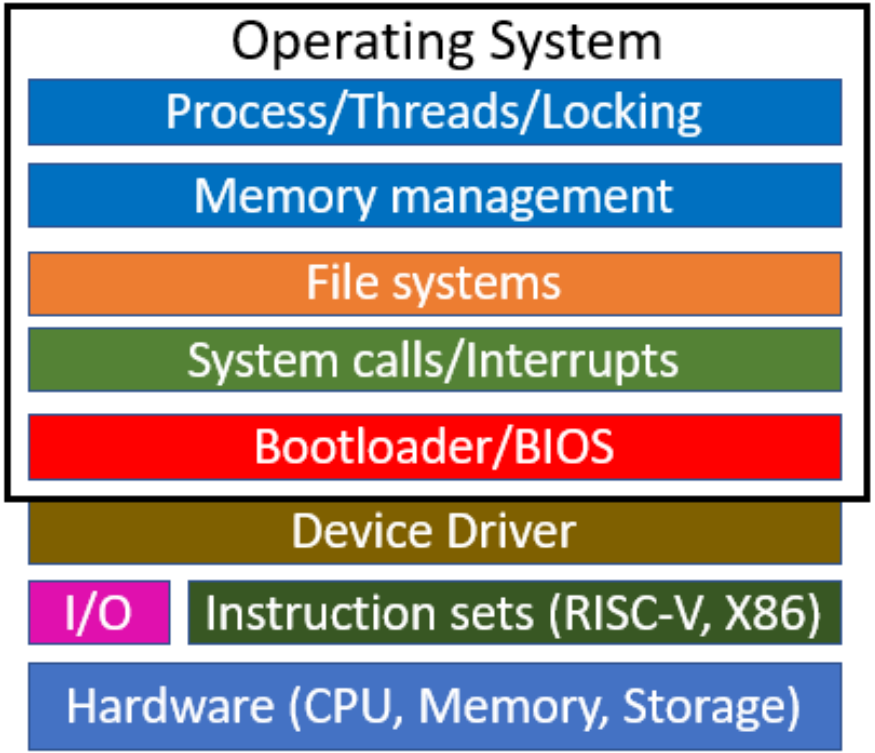
Course overview

- Instructor: **Tsung Tai Yeh**
- TA team+: EC619
- Lecture Time: T78
- Classroom: EC022
- Office Hour: 2 – 3 pm Tuesday
- My office: EC516
- Course web site:
  - https://reurl.cc/lNbg2j

Course website QR Code

Course overview

- **Operating system design**
  - Hardware + Software
  - Full stack implementation
- **Building a small OS**
- **Lecture + laboratory**
  - Class lecture
  - 7 labs
    - (booting to file systems)



Intended Lecture Outcomes (ILOs)

- What is difference of OSDI class against OS course ?
  - OS concepts + Implementation
  - **Describing** details of the interaction between the computer hardware and OS
  - **Designing** multiple abstractions (system calls, processes, memory management, file systems)
  - **Implementing** bare-metal OS (labs)
  - **Understanding** the OS research on different topics

Lecture

- **Class lecture**
  - Lectures cover each OS topics
  - 1 hour lecture – summarize course materials of each topic
  - 1 hour TA tutorial for the lab assignment
  - Lecture materials have shown on the class website
  - 3:30 – 5:20 pm in EC022

Lab Assignments

- Each student will obtain a Raspberry Pi dev. board
- Lab 0 for practices/Lab 1-Lab 7
  - One lab every two weeks
  - Lab 1 – 2 takes 10% each, 3 – 7 takes 15% each
  - In-class quiz: 5%
- **Lab Demo**
  - Every student has to demonstrate biweekly your lab work in EC 222
  - TA will check your lab work and ask you questions during your demonstration

Schedule

Week	Date	Lecture Topics	Lecture Slide	TA Slides	Lab/Project	Materials	Misc
1	2/18	OS Introduction [slide] [slide]	[Syllabus]				[note]
2	2/25	Assembler,Linker,Loader [slide]				[GOT/PLT]	[note]
3	3/4	Boot Loader	[slide]		Lab 0/1 due		
4	3/11	Process	[slide]				
5	3/18	Interrup and exceptions	[slide]		Lab 2 due		
6	3/25	System Calls	[slide]				
7	4/1	Virtual Memory	[slide]		Lab 3 due		
8	4/8	Paging	[slide]				
9	4/15	Memory Allocation	[slide]		Lab 4 due		
10	4/22	Concurrency	[slide]				
11	4/29	Locking	[slide]		Lab 5 due		
12	5/6	Spin-Lock	[slide]				
13	5/13	File System	[slide]				
14	5/20	Journal File System	[slide]		Lab 6 due		
15	5/27	Virtualization					
16	6/3	Lab Demo			Lab 7 due		

References and text books

- OSDI references
  - Andrew S Tanenbaum, and Albert S Woodhull, "Operating Systems Design and Implementation (3rd Edition)"
  - Marshall Kirk McKusick, Keith Bostic, Michael J. Karels, and John S. Quarterman, "The Design and Implementation of the 4.4 BSD Operating System"
- Linux Kernel
  - Robert Love, "Linux Kernel Development (3rd Edition)"
  - Michael Beck, Harald Bohme, Mirko Dziadzka, Ulrich Kunitz, Robert Magnus, and Dirk Verworner, "Linux Kernel Internals (2nd Edition)"
  - Daniel P. Bovet, and Marco Cesati, "Understanding the Linux Kernel, Third Edition"

References and text books

- Network subsystem
  - Klaus Wehrle, Frank Pahlke, Hartmut Ritter, Daniel Muller, and Marc Bechler, "Linux Networking Architecture"
  - Christian Benvenuti, "Understanding Linux Network Internals"
- Device Drivers
  - Sreekrishnan Venkateswaran, "Essential Linux Device Drivers"
  - Jonathan Corbet, Alessandro Rubini, and Greg Kroah-Hartman, “Linux Device Drivers, 3rd Edition“

Course Administration

Outline

- Course Enrollment
- Labs Submission Policy
- Labs Grading Criteria
- Rpi 3B+ Rental Rules
- Discord and GitHub Classroom Invitation

Course Enrollment Policy

- Enrollment will be based on a **Quiz** held during the first class
- The quiz covers fundamental knowledge of Operating System
- **Higher scores** have **higher priority** for enrollment
- **15** students for enrollment expected

Enrollment Quiz

- Students who have already been in the course are still required to take the quiz for self-assessment, **not-graded.**
- If you struggle with most of the quiz questions, you should **reconsider taking this course**.
- The quiz topics are assumed **prerequisite knowledge** and will not be re-taught.
- If you need to learn these fundamentals from scratch while completing lab assignments, the course may be very challenging.

Enrollment Process

- After completing the quiz, submit your answer sheet to the front
- We will review and rank the scores
- The top 15 students with the highest scores will be announced
- For these students, please bring your application form to the front

Labs Policy

- Commit your work to your own repository in **GitHub Classroom**
- Late submissions will result in a **10% penalty per week**
- During the demo session, we will check the **timestamp of your last commit** to determine your final score

Labs Policy - Plagiarism

- **PLAGIARISM is not allowed**, including copying from previous years
- We may run the plagiarism checker **at any time**
- Copying is meaningless—if you don’t understand your own work, you will fail to answer questions during the demo

Labs Grading Criteria

- **100%: Excellent**

  Your solution functions correctly on the Raspberry Pi, and you can articulate your code well and address TA inquiries proficiently.

- **90%: Good with room for improvement**

  While your solution performs well in QEMU, it encounters issues on the Raspberry Pi.

Labs Grading Criteria (cont’d)

- **70%: Requires additional effort**

  You haven't completed all the task requirements.

- **50%: Unclear**

  You seem unsure about your approach or what you've implemented.

Rpi 3B+ Rental Rules

- A student will obtain
  - one Raspberry Pi 3B+
  - one UART cable
  - one SD card
  - one Card Reader
- Please take these four utilities from the TAs at EC619
- Please return these four utilities after finishing Lab 7 or drop the course.
- You won’t get your final score until the Raspberry Pi is returned

Rpi 3B+ Rental Rules (cont'd)

- Please note that the Raspberry Pi 3B+ is susceptible to damage due to power issues.
- Before connecting power, please review the pin layout
- Avoid using power transformers/power supplies

Discord

- Make sure to join the course's Discord server to receive important announcements and participate in discussions.
- For course-related questions, please ask directly in the Discord server—**TAs will not respond to private messages.**
- You may privately message the TAs on Discord or email us **only** for grade-related or other privacy-sensitive issues.
- If you actively and correctly answer other people's questions on the Discord server, you can earn a **bonus** for your grade.

Discord and GitHub Classroom

- Fill out the Google Form to provide your Student ID, Discord ID, and GitHub ID
- Use the invitation link to join the Discord Server
- Students who are not enrolled in the course or fail to complete the form will be removed from the server

Discord and GitHub Classroom Links

Discord Invitation

https://discord.gg/6mFJ5BPsQu

Google Form

https://forms.gle/pRCCPwmVyJABUrqZ8