



National Yang Ming Chiao Tung University  
Computer Architecture & System Lab

# **IOC5226 Operating System Capstone**

## **Syllabus**

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# Course overview

- Instructor: **Tsung Tai Yeh**
- TA team+: EC619
- Lecture Time: R78
- Classroom: EC022
- Office Hour: 2 – 3 pm Tuesday
- My office: EC516
- Course web site:
  - <https://reurl.cc/W85a69>

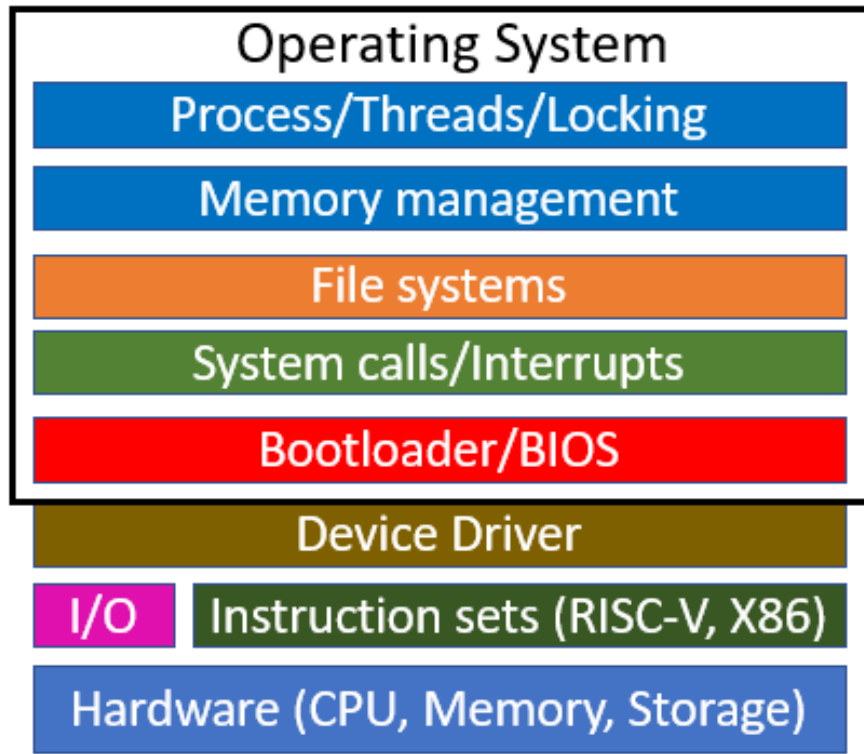


Course website QR Code



# 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 exercise
- Lecture materials have shown on the class website
- 3:30 – 5:20 pm in EC022



# Lab Assignments

- Each student will obtain a RISC-V Orange 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: 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

## Course Outline

Week	Date	Lecture Topics	Lecture Slide	TA Slides	Lab/Project	Materials	Misc
1	2/26	OS Introduction	<a href="#">[Syllabus]</a>				<a href="#">[note]</a>
2	3/5	Linker				<a href="#">[GOT/PLT]</a>	<a href="#">[note]</a>
3	3/12	Bootloader	<a href="#">[slide]</a>		Lab 0/1 due		<a href="#">[note]</a>
4	3/19	Interrupt and exceptions	<a href="#">[slide]</a>				
5	3/27	Process	<a href="#">[slide]</a>		Lab 2 due		
6	4/3	Spring Break					
7	4/10	System Calls	<a href="#">[slide]</a>		Lab 3 due		
8	4/16	Memory Allocation	<a href="#">[slide]</a>				
9	4/23	Virtual Memory	<a href="#">[slide]</a>		Lab 4 due		
10	4/30	Paging	<a href="#">[slide]</a>				
11	5/7	Concurrency	<a href="#">[slide]</a>		Lab 5 due		
12	5/14	Locking	<a href="#">[slide]</a>				
13	5/21	Spin-Lock	<a href="#">[slide]</a>				
14	5/28	File System	<a href="#">[slide]</a>		Lab 6 due		
15	6/5	Journal File System	<a href="#">[slide]</a>				
16	6/11	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"



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# Course Administration



# Outline

- Course Enrollment
- Labs Submission Policy
- Labs Grading Criteria
- Orange Pi Board 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
- **50** 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 50 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.



# Orange Pi Rental Rules

- A student will obtain
  - one Orange Pi
  - 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



# Orange Pi 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/8tEfYjmP4b>



Google Form

<https://reurl.cc/dqE05g>