

# Operating System Design and Implementation

*Course Overview*

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# Outline

- Course overview
- References and text books
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- Rating
- Suggestions for studies

# Course overview

- Instructor:張立平、曹孝櫟
- TA team<sup>+</sup>:
  - 陳勇旗 [yungchi@cs.nctu.edu.tw](mailto:yungchi@cs.nctu.edu.tw)
  - 吳崧銘 [tbchesingg@gmail.com](mailto:tbchesingg@gmail.com)
- Course: 2CD4G-EC115
- Lab: 3IJK-EC324
- Upper limit number of students registered this class: 75
- Course web site: <http://e3.nctu.edu.tw>

# Course overview

- Dept. distinguished course (特色課程)
- Solid operating system, system software design and implementation knowledge
- Practical system software programming and kernel development skills
- Large scale software development and maintenance experiences

# Course overview

- Why Operating System course AGAIN?
  - A professional engineer is defined as a person who can systematically and scientifically solve any practical problems based on the sciences they have learned
  - You learn how to realize what you learn in the area of computer systems

# References and text books

- OS/2 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"

# References and text books

- One text book is not enough
  - Usually you need to refer at least three text books on the same topic and then you realize you have to understand another three topics
- Even you have all text books are not enough
  - Usually you have to “try, try and see”
- Even you understand the codes (or can write the codes) are not enough
  - Usually you have to study the books again and think carefully and deeply
- Repeat the above iterations several times to understand one single concept
  - Slow?, no, because slow is fast



# Schedule

Week	Date	Subject	Prof.	Lab	TA
1	2月24日	Course overview	Prof. Tsao (W1)		
	2月26日	Getting started with kernel and kernel debugging			
2	3月3日	Hardware knowlege for OSDI	Prof. Tsao (W2)		
	3月4日	Hardware knowlege for OSDI/Bootng process			
	3月5日	Bootng process			
3	3月10日	TA time	Prof. Tsao (W3)	Lab 1. makefile/patch/kernel debugger	Prof. Tsao TA
	3月12日	no class			
4	3月17日	OSDI overview	Prof. Tsao (W4)	Lab 2. kernel bootng	Prof. Tsao TA
	3月29日	OSDI overview, ATOM, spin_lock, mutex (kernel sync)			
5	3月24日	IO subsystem/Device Driver	Prof. Tsao (W5)	Lab 3. simple process management	Prof. Tsao TA
	3月26日	IO subsystem/tophalf-bottomhalf design			
6	3月31日	Process management basics	Prof. Tsao (W6)	Lab 4. simple device driver	Prof. Tsao TA
	4月2日	no class			
7	4月7日	Memory management basics	Prof. Tsao (W7)	Lab 5. simple protocol analyer	Prof. Tsao TA
	4月9日	No class (Spring Break)			
8	4月14日	Network device drivers	Prof. Tsao (W8)	Lab 6. Linux, system call and dev. driver	Prof. Tsao TA
	4月16日	TCP/UDP-layer protocol stack			
9	4月21日	Socket layer protocol stack	Prof. Tsao (W9)		
	4月23日	Mid term exam (1 hour)			

# Schedule (Cont.)

10	4月28日	Process management topics	Prof. Chang (W1)	Lab 7. task strcuture/signal to process	Prof. Chang TA
	4月30日	Process management topics			
11	5月5日	Process management topics	Prof. Chang (W2)	Lab 8. moving tasks between cores	Prof. Chang TA
	5月7日	Process management topics			
12	5月12日	Memory management topics	Prof. Chang (W3)	Lab 9. memory (page frame)	Prof. Chang TA
	5月14日	Memory management topics			
13	5月19日	Memory management topics	Prof. Chang (W4)		
	5月21日	Memory management topics			
14	5月26日	Block device driver	Prof. Chang (W5)	Lab 10. block device driver	Prof. Chang TA
	5月28日	Block device driver			
15	6月2日	Block device driver	Prof. Chang (W6)		
	6月4日	I/O scheduler			
16	6月9日	I/O scheduler	Prof. Chang (W7)	Lab 11. disk scheduler	Prof. Chang TA
	6月11日	I/O scheduler			
17	6月16日	File system	Prof. Chang (W8)	Lab 12. file system driver	Prof. Chang TA
	6月18日	File system			
18	6月23日	File system	Prof. Chang (W9)		
	6月25日	Term exam (1 hour)			

# Rating

- 12 Labs, each for 7%
- Mid term exam 8%
- Final exam 8%

# SOP for lab exercises

- TA will announce lab packages in advance
- Download lab packages from SVN
  - Package contains all necessary files (such as sources, notes, references, tools, etc.)
- Study and/or work on the lab before lab classes (Optional)
- Roll call at 6:30PM, please arrive EC 324 before 6:30PM on Wed
  - 10% penalty applied to delay within 30 mins (before 19:00PM), 20% penalty applied to delay more than 30 mins
- Leader TA presents his/her lab notes at lab class
- Work on lab exercise
- Ask questions if you have problems (**Don't treat TAs as your Doraemon**)

# SOP for lab exercises (Cont.)

- Leader TA provides hints after 2 hours (Optional)
- Upload the package (depending on the upload requirements) to SVN after finish the homework
- TAs evaluate students' homework (current or previous) during the class
  - TAs check the SVN log time to determine the rating rule
  - TAs download the student package on local machine and ask questions
- TAs score the student
  - 1 week maximal, 20% penalty applied
- TAs may arrange other slots to evaluate students' homework if necessary

# Suggestions for studies

- You are not permitted to know the answers before you can understand the questions (problems)
  - Understand the questions (problems) not the answers (solutions), but sometimes to know the answers help you to understand the questions
- OSDI is kind of “the Force”
  - Three-hour lecture plus three-hour hands-on practices per week is definitely not enough even you are Linus Torvalds
  - Encourage you to study (dig into details) what you learn during the lecture and hands-on practices
- This course must be a very painful course if you are not interested in programming, particularly in system programming
  - will be a painful but enjoyable course for students who love system programming
- Study codes, read references, hands on experiments, think about it, do the above procedures iteratively
- The more questions you ask and answered by yourself, the more you learn
  - The more questions you ask and answered by profs. and/or TAs, the more you lose

*Do You Feel Excited?*  
*Enjoy Kernel Hacking*