4190.568: Advanced Operating Systems

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Systems Software & Architecture Lab.

Seoul National University

Spring 2019

Course Information

- Schedule
  - 14:00 – 15:15 (Tuesday & Thursday)
  - Lecture room: Engineering Bldg. #301-101
  - 3 credits
  - Official language: Korean

- TA: Jae-Hoon Shim (x7296)

- Course homepage: http://csl.snu.ac.kr/courses/4190.568/2019-1/

About Me

- Jin-Soo Kim (김진수)
  - Professor @ CSE Dept.
  - Systems Software & Architecture Laboratory
  - Operating systems, storage systems, parallel and distributed computing, embedded systems, …

- E-mail: jinsoo.kim@snu.ac.kr
- Tel: 02-880-7302
- Office: Engineering Bldg. #301-520 (office hours: Tuesday & Thursday)

- The best way to contact me is by email

Prerequisites

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  - M1522.000800 Undergraduate Systems Programming or equivalent – Must!
  - 4190.307 Undergraduate Operating Systems or equivalent – Must!
  - 4190.308 Undergraduate Computer Architecture or equivalent – Must!
  - 4190.411 Undergraduate Computer Networks or equivalent

- We will NOT cover undergraduate operating systems materials

Course Plan

- Lectures (+ invited talks)
  - Advanced topics on operating systems
- Reading assignments
  - You should read them BEFORE the class
- Paper presentation
- Term project
- Quizzes and Final exam (no Midterm ☺)

Topics Planned

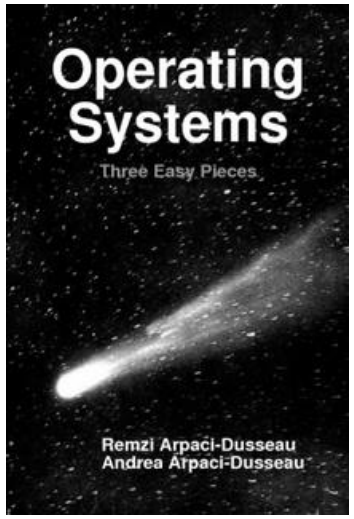
- Introduction to computer systems research
- CPU scheduling and concurrency
- Virtual memory
- SSD (Solid State Drive)
- File systems
- Virtual machines
- OS structure and design
- Distributed file systems
- Key-value stores
- Datacenter issues

Class Materials

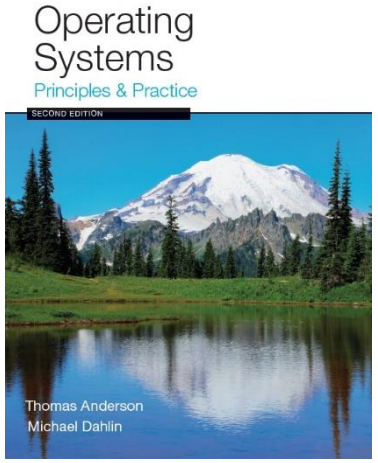
- Quality research papers from major conferences will be used:
  - SOSP (ACM Symposium on Operating Systems Principles)
  - OSDI (USENIX Symposium on Operating Systems Design and Implementation)
  - ASPLOS (ACM Conference on Architectural Support for Programming Languages and Operating Systems)
  - USENIX ATC (USENIX Annual Technical Conference)
  - FAST (USENIX Conference on File and Storage Technologies)
  - NSDI (USENIX Symposium on Networked Systems Design and Implementation)
  - EuroSys (ACM European Systems Conference)
  - …

References

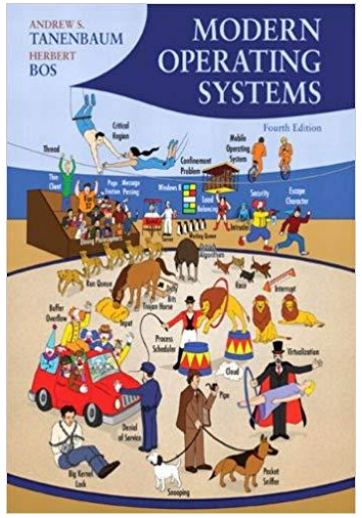
- Operating Systems: Three Easy Pieces
  - By Remzi & Andrea Arpaci-Dusseau
  - Freely available at http://ostep.org



- Operating Systems: Principles and Practice
  - By Tom Anderson & Michael Dahlin
  - 2nd Edition, Recursive Books, 2014



- Modern Operating Systems
  - By Andrew Tanenbaum & Herbert Bos
  - 4th Edition, Pearson Education, 2015



Reading Assignments

- Critical reading of technical papers is a must skill to have for your research
- You should complete and submit a paper critique form BEFORE each class
- This is an individual assignment
- Papers you have to review will be listed in the course home page
- You are asked to read and evaluate 15+ papers
- The link to the paper critique form will be posted at the course home page

Paper Presentation

- Paper presentation should be done in teams of two students
- Each team will bid for a paper they want to present
- Again, the list of papers will be available in the course home page soon

- 30 min. presentation (max 30 slides) + 15 min. discussion
- Use a simplified example whenever possible
- Highlight the main ideas of the paper
- Briefly review subsequent work (use http://scholar.google.com)

Projects: Basic Policies

- The same team for paper presentation will work on a term project
- Projects should be completed within this semester with some tangible results
  - New ideas without any evaluation will not be considered for grading, no matter how novel they are.
- You should have access to the required hardware and software to conduct the necessary experiments
- Project topics need to be related to OS, and must be explicitly okay'd by the instructor
- You are encouraged to propose your own project

Projects: Proposal

- Due: April 18th (in class, tentative)
- Format: 1 page, free writing
- Project proposal should include the followings:
  - The motivation and the goal of your work
  - The problem you would like to solve (define clearly)
  - Your ideas to solve the problem
  - Research plan for the project

- Project proposals will be reviewed by the instructor

Projects: Mini Conference & Term Paper

- We will have a mini conference at the end of this semester
- Each project team should give a formal presentation
- On June 14th (tentative)

- You are expected to write up a term paper
- Due: June 21st (tentative)
- In ACM/IEEE conference proceedings format
- Up to 6-page long in English

Projects: Evaluation

- Your term paper will be evaluated using the following criteria:

1. Brightness: on your motivation and idea
2. Comprehensiveness: on the survey of existing work
3. Soundness: on your methodology
4. Impressiveness: on your results
5. Your time and efforts spent on this project

Projects: Possible Topics

- Characterize some aspects of operating system behaviors
  - How does OS need to be changed to accommodate emerging devices/applications/services?
- Implement and evaluate the lottery scheduler in Linux
- Build a lightweight hash-based key-value store running on the block dev.
- Accelerate data-intensive applications using SPDK (http://spdk.io)
- Develop a new, real, simple but extensible OS for undergraduate OS projects using Biscuit (https://github.com/mit-pdos/biscuit, OSDI'18)
- Reproduce the results from other papers and investigate a way to improve it
- Extend Linux for something cool

Take-Home Exam

- Due: March 7th, 1:00AM
- The purpose of this exam is to let you review undergraduate OS materials
- Questions will be posted in the course home page tonight
- You may be asked about your answers during class
- If you are unable to answer the questions properly, please reconsider taking this course seriously

How to Take a Take-Home Exam

- A take-home exam is a variation on the open-book exam
- A take-home exam aims to allow you to opportunity to produce a well-written and well-thought out response.
- Remember, you are not expected to write a book or similar sort of answer. Answer the question concisely.
- This is an exam, not a homework.
  DO NO SHARE YOUR ANSWER SHEET WITH OTHERS.

Grading Policy

- Take-Home exam: 10%
- Quizzes and Exams: 40%
- Paper critiques and class participation: 20%
- Term project: 30%

- *Subject to change*