Course Overview

Warning

- You are now taking the most challenging course in the CSE curriculum
- Lectures will be difficult and projects will be tough

Overview

- What this course is about
- Who teaches this course
- Why you have to take this course
- What you will learn in this course
- What you will earn in this course
- How to succeed in this course

What this course is about

- Learn what a modern operating system is, does, and consists of
- Design principles of internal components
  - Process management
  - Memory management
  - Storage management
  - Synchronization tools

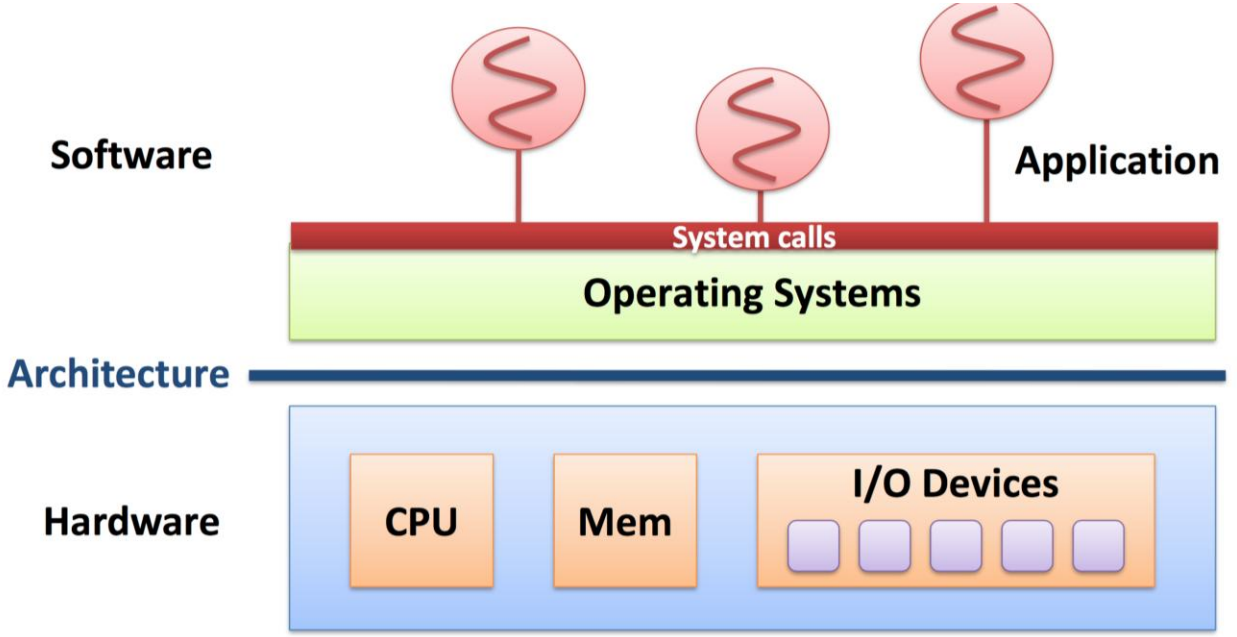
Then What is an OS?

- There are many breeds of operating systems

- This looks like an OS

Operating System is …

- No official definitions
- It provides an interface between user and computer
  (easy to catch, right?)
- It also provides an interface between hardware and applications (what does this mean????)



Operating System is …

- An operating system is software that converts hardware into a useful form for applications
- We will revisit this notion in the next class in detail
- We will study the internal design of modern operating systems during this semester
  - Focus on design principles and design philosophy

Administrative Information

- Course Code
  - SWE3004-41
- Class Hour
  - 화요일 12:00 – 13:15
  - 목요일 13:30 – 14:45
- Lecture Room
  - 26310

Lecturer

- Euiseong Seo
  - Professor, Dept. of Computer Science and Engineering
  - E-Mail: euiseong (at) skku.edu
  - Office: #85564
  - Phone: (031) 299-4953
  - Office hour: Wednesday (all day)

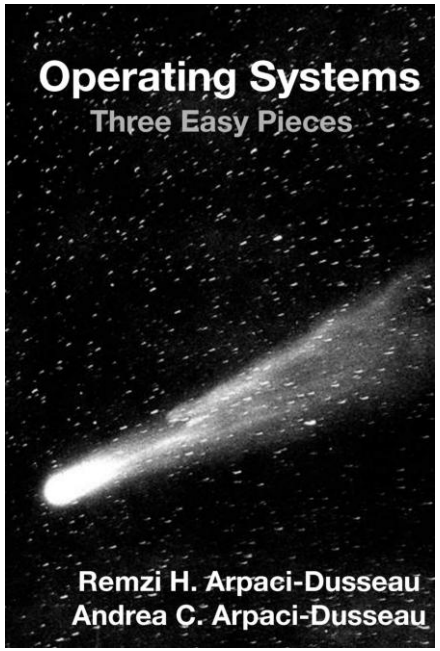
- Computer Systems Lab. (http://csl.skku.edu)
  - Research area
    - Operating systems
    - Cloud computing
    - Embedded systems
    - High-performance AI and big-data processing systems
  - Undergraduate internship is available, apply now!
    - Only when you are a talented and enthusiastic hacker

Teaching Assistants

- 박관종
  - E-Mail: dbfltkfkd01 at gmail.com
- 신윤성
  - E-Mail: sopia0821@g.skku.edu
- They live in #85533
- E-mail is the preferred way to contact
- Make an appointment before you visit

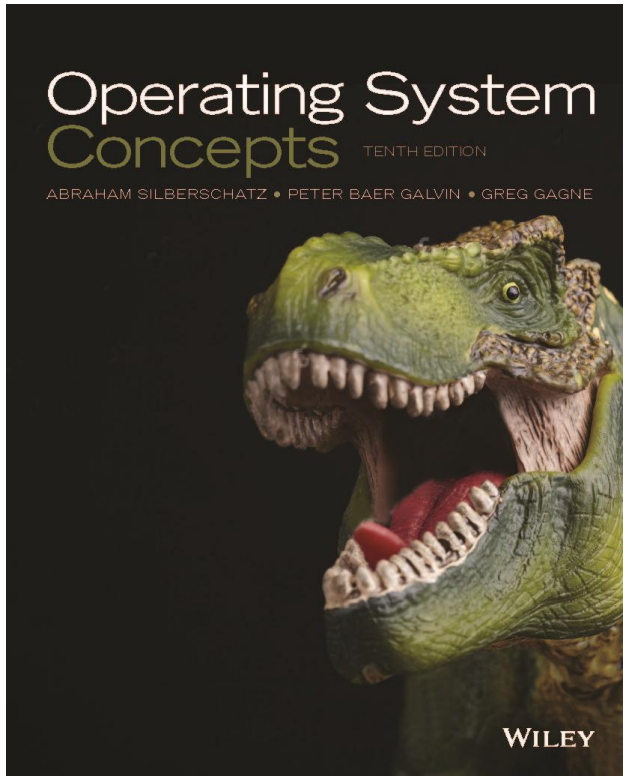
Textbook

- Operating Systems: Three Easy Pieces (The Comet Book)
  - A Free (Open-Source) Downloadable Textbook
  - Written by two prominent professors, Prof. Remzi Arpaci-Dusseu and Prof. Andrea Arpaci-Dusseau at Univ. Wisconsin-Madison
  - It is under continual changes
  - You can download this from its web page http://ostep.org/
  - You can also buy a hard copy at the book store



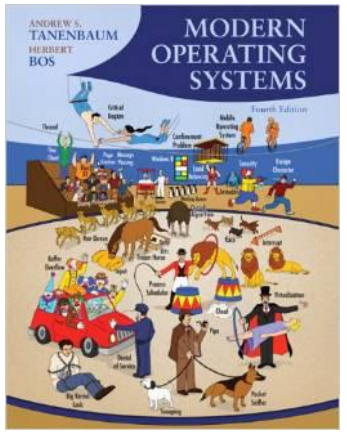
Textbook

- Operating System Concepts (aka The Dinosaur Book)
  - 10th Edition
  - Written by A. Silberschatz, P. B. Galvin and G. Gagne
  - Published by Wiley
  - 2018



References (1)

- Operating Systems: Internals and Design Principles (8th ed.)
  - William Stallings
  - Prentice Hall, 2014
- Modern Operating Systems (4th ed)
  - Andrew S. Tanenbaum,
  - Prentice Hall, 2014



References (2)

- For Linux:
  - **Understanding the Linux Kernel** (3rd ed.)
  - D. Bovet and M. Cesati,
  - O'Reilly & Associates, 2015
- For Windows:
  - **Windows Internals** (6th ed.)
  - Mark E. Russinovich, David A. Solomon, and Alex Ionescu,
  - Microsoft Press, 2012
- For Solaris:
  - **Solaris Internals**
  - Richard McDougall and Jim Mauro
  - Sun Microsystems, 2001

Course Web Page

- Check i-campus regularly
- Class material, project information and other useful things will be posted

Course Components

- Class participation
  - Attendance will not contribute to your grade
  - Our law requires a student to attend at least ¾ of class hours to earn the credits
- Exams
  - Mid and final
  - 60% of total score
- Programming assignment
  - Programming xv6, an educational operating system
  - Total 6 assignments
  - 40% of total score
  - A wonderful group of TAs will guide you

Ethical Code

- No academic misconduct will be tolerated
  - Zero-tolerance policy
  - One who is found guilty will be kicked out of my class immediately

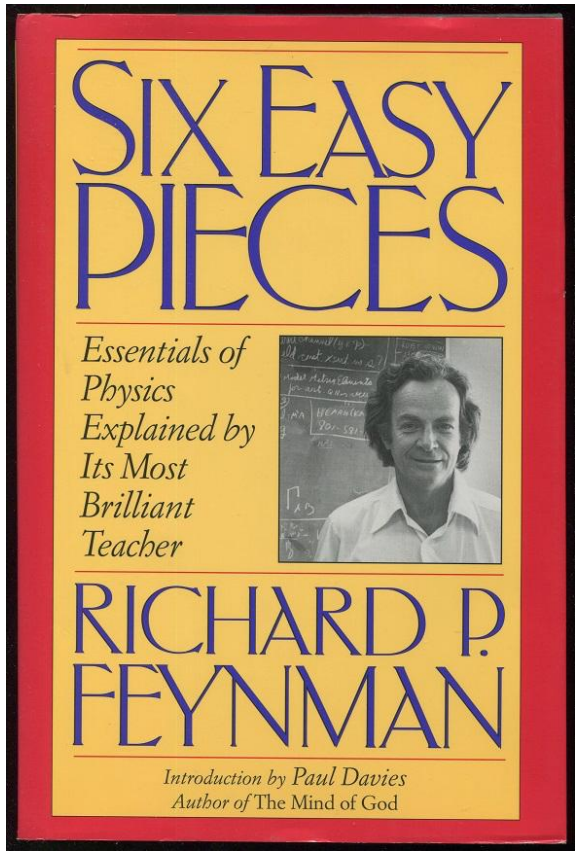
Lecture Topics

- OS Structure
- Processes and threads
- CPU Scheduling
- Synchronization
- Deadlocks
- Memory management
- Virtual memory
- I/O systems
- Storage
- Filesystems

Why Three Pieces?

"… *as Operating Systems are about half as hard as Physics.*"

A Dialogue on the Book
Chap. I



Lecture Topics

- Virtualization
  - Processes
  - CPU scheduling
  - Virtual memory
- Concurrency
  - Threads
  - Synchronization
- Persistence
  - Storage
  - File systems

Why You Have to Take This Course

- To graduate
- To understand computer systems better
- To obtain useful design methodologies and principles for implementation of complex software
- Just for Fun!
- To design a new hardware in OS-compatible ways
- To make a better OS or systems
  - Functionality
  - Performance / Cost
  - Reliability
  - Energy efficiency

Prerequisites

- Mandatory courses
  - Introduction to Computer Systems (or System Programming)
    - » SSE2030, CSE2003, or SWE2001
  - System Software Experiment 2 (or System (Unix) Programming)
    - » SSE2033, SWE2007, ICE2015, or CSE3044
  - Computer Architecture
    - » ICE3003, SWE3005, or EEE3050

- Required skills
  - Fluent C programming skills
  - Intel x86 architecture & assembly programming
  - Basic knowledge of Unix/Linux systems
  - Reading a large, complex program

xv6 Project

- A teaching OS developed by MIT
  - Port of the Sixth Edition Unix (v6) in ANSI C
  - Runs on multi-core x86 systems

- Why moving on to xv6 (from Pintos)
  - Code inherited from a real, historical OS!
  - Includes working user-level programs and libraries
  - Easier to install on modern Linux systems
  - Easier to extend
  - Easier to understand modern OSes such as Linux

Project Plan (1)

- Initially, the source tree of xv6 has skeleton codes
  - Do nothing but testing the functionality
- You are supposed to fill in the empty code to provide following features
- We are preparing 5 projects
- Not a simple coding programming assignment

Project Plan (2)

- Lab sessions
  - A separate class with the TA
  - Once when each project term begins
  - Explanation of project assignment
  - Q&A
  - Hints & helps
  - Oral tests
  - Code review
  - …

Project Plan (3)

- Project topics
  - Project 0: booting (2nd week, 1 week)
  - Project 1: system call (3rd week, 2 weeks)
  - Project 2: CPU scheduling (5th week, 2 weeks)
  - Project 3: virtual memory (7th week, 3 weeks)
  - Project 4: page replacement (10th week, 3 weeks)
  - Project 5: file systems (13th week, 2 weeks)

  - Subject to change

Keys to Success

- Read textbook exhaustively
- Think, think and think
- Begin your project assignments as early as possible