CS-GY 6233 Introduction to Operating Systems

Fall 2020

New York University Tandon School of Engineering
Department of Computer Science & Engineering

Instructor

Professor Kamen Yotov

Lecture Time & Location

Wednesday 6:00PM - 8:30PM, Pfizer Auditorium

Course Description

This is a graduate-level course that covers an introduction to operating systems. It is geared at graduate students who have not had a good undergraduate course that covers the principles of operating systems. This material is critical for understanding anything about what is really going on in your desktop, your laptop, your phone and/or in your data center.

While it covers material that often finds its place in undergraduate curricula, we will be supplementing that material with some more recent results from the systems literature, and we will be doing a lot of hands on homework to see what a real operating system looks like.

In addition, there is the opportunity to customize the material based on overall student background entering the course. Finally, we will also focus on some very recent commercial trends in the Operating Systems space, with particular focus on virtualization and how it is transforming the way we think about computing and the way that every Fortune-1000 company manages its information technology infrastructure.

Outcomes

- The Course illustrates modern operating systems design and implementation;
- Students will be able to study low-level internals of operating systems and:
    - Understand x86 Hardware and Assembly Language and how it is used to implement the core concepts of Operating Systems;
    - Understand Process Management and be able to design, implement, and evaluate various scheduling algorithms for multiprocessing and multithreaded systems;
    - Understand Memory Management and be able to design, implement, and evaluate different segmented and virtual memory solutions;
    - Understand I/O subsystem to compare and contrast different solutions (PIO, Interrupts, DMA)
    - Understand the foundations of Security and how it is implemented in the kernel of modern operating systems;
- Students will also be exposed to modern Virtualization and Containerization methods and will be able to compare and contrast their application in scalable infrastructure;

Grading

50% Homework (Programming Projects)
20% Midterm
30% Final

Readings

Textbooks

Modern Operating Systems, by Andrew S. Tanenbaum. (Available at NYU Bookstore.)

xv6: A simple, Unix-like teaching operating system, by Russ Cox, Frans Kaashoek, and Robert Morris.
(https://pdos.csail.mit.edu/6.828/2018/xv6/book-rev10.pdf)
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Useful references

Linux Command Line Cheat Sheet
GDB cheat sheet

Course Requirements

- Attendance will not be taken, but it is highly recommended.
- Assignments must be received by midnight on the day they are due.
- Late homework will not be accepted.

Cooperation Policy

You may work with at most one other person on every assignment. If you work with a partner, you must list the name of your partner when you turn in your assignment. Only one person needs to submit the assignment; if you both submit and your answers differ, there is no guarantee that both will be graded.

Academic Honesty

Aside from the narrow exception for collaboration on homework, all work submitted in this course must be your own. Cheating and plagiarism will not be tolerated. If you have any questions about a specific case, please ask me.

Academic Integrity for Students at NYU

Moses Center Statement of Disability

If you are student with a disability who is requesting accommodations, please contact New York University's Moses Center for Students with Disabilities at 212-998-4980 or mosescsd@nyu.edu. You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at www.nyu.edu/csd. The Moses Center is located at 726 Broadway on the 2nd floor.

Course Schedule

In the following, MOS stands for "*Modern Operating Systems*" and xv6 stands for "*xv6: A simple, Unix-like teaching operating system*".

- **Unit 1 (MOS 1; xv6 0-1)**
  - (Quick) Computer History
  - What is an Operating System
  - Hardware Overview
  - Operating Systems Concepts
- **Unit 2 (MOS 1; xv6 0-1)**
  - C Refresher
- **Unit 3 (MOS 1; xv6 0-1, Appendix B)**
  - PC Architecture
  - Assembly
  - XV6 Boot Process
- **Unit 4 (MOS 2; xv6 3)**
  - System Calls
  - Processes
- **Unit 5 (MOS 2, 3.1-3.2; xv6 5)**
  - Scheduling
  - Threads
  - Memory Management
- **Unit 6 (MOS 3.3-3.5; xv6 2)**
  - Virtual Memory
- **Midterm**
- **Unit 7 (MOS 5; xv6 3)**
  - I/O
- **Unit 8 (MOS 2.3, 2.5, 6; xv6 4)**
  - Concurrency
- **Unit 9 (MOS 2.3, 2.5, 6; xv6 4)**
  - Deadlock
- **Unit 10 (MOS 4.1-4.4; xv6 6)**
  - File Systems
- **Unit 11 (MOS 7, 8.3)**
  - Virtualization
- **Unit 12 (MOS 9)**
  - Security
- **Final**