CS3214: Computer Systems
Fall 2024

Lecture 1: OS Introduction

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Resources

- Course website: https://courses.cs.vt.edu/cs3214/fall2024
- Syllabus: https://courses.cs.vt.edu/cs3214/fall2024/documents/CS3214-Syllabus-Fall24.pdf
- Course Forum: https://cs3214.cs.vt.edu
  - Use your @vt.edu email to sign up (ASAP)
- Discord
- Email: cs3214-staff@cs.vt.edu
- Staff: https://courses.cs.vt.edu/cs3214/fall2022/staff
  - Office hours (in person or zoom)
- Canvas not used

Format

- Lectures
  - TR 8am-9:15am Hancock 100
  - Attendance (optional), class meetings not recorded
- Midterm + Final
- Projects and exercises
- Grading

14%	Midterm Exam
16%	Final Exam
38%	Projects
24%	Exercises
6%	Participation Points/Badges
2%	Syllabus Quiz

Project Groups

- 2 students per group
- Contribute equally
  - We won't micromanage you, up to you to split the work
- Changing group between projects allowed
- Team up across class sections allowed
- Late policies:
  - 4 late days without penalty (for projects and exercises)
  - Accommodations, case by case (University accommodations / sickness)
- Best practices
  - Start early!
  - Allocate enough time
  - Hard but rewarding!

Honor Code

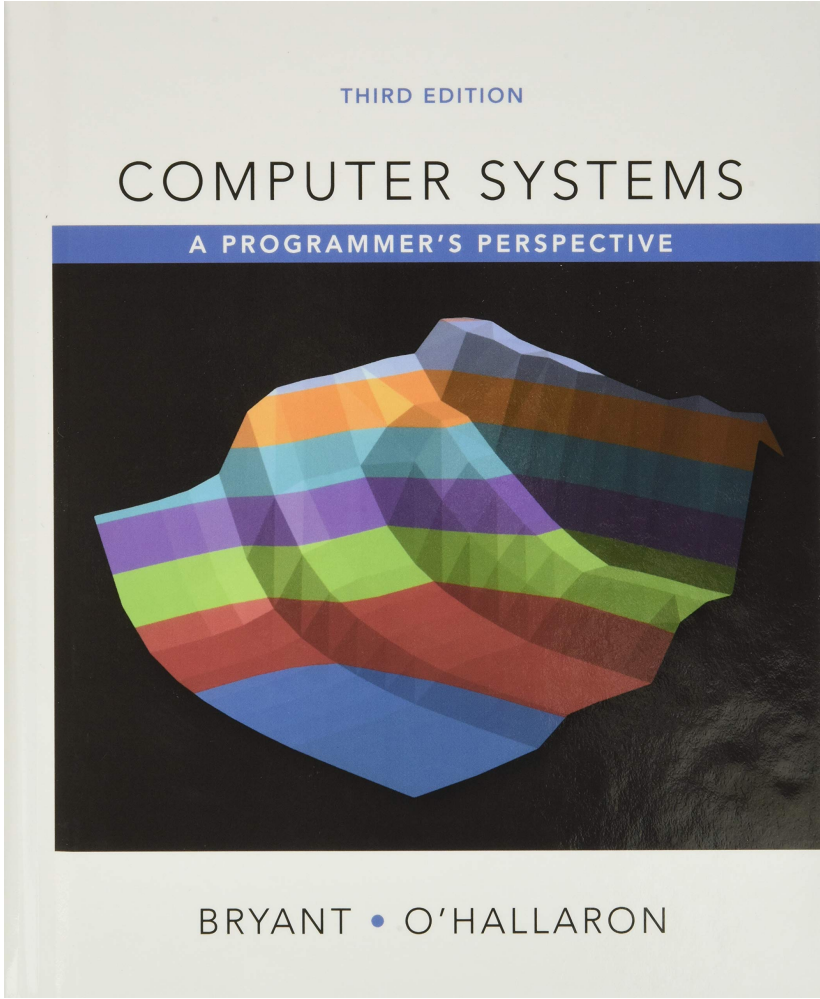
- "As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do."
- Will be strictly enforced
  - Case will be directly filed to the university without warning you
- Do NOT cheat: details in syllabus, always acknowledge the sources
- We have **very** powerful cheating detection tools
- Default penalty
  - *1st offense: F**
  - *2nd offense: Expulsion*
- Ask if in doubt!

Prerequisites

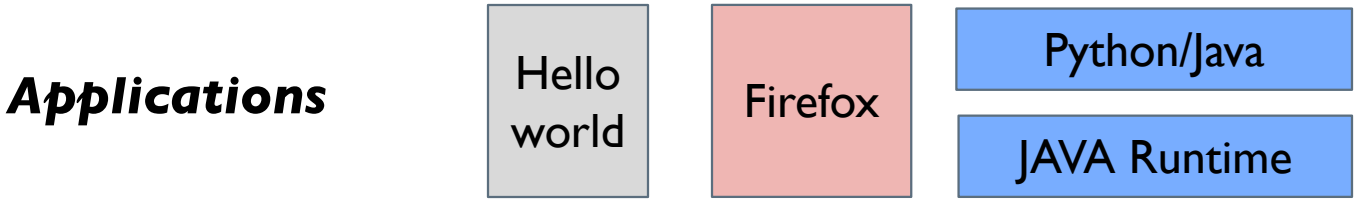
- CS 2506: Introduction to Computer Organization II (*Grade C or better*)
- CS 2114: Software Design and Data Structures (*Grade C or better*)

Textbook

- CSAPP3e
  - **User/programmer perspective**
  - Basic understand about how systems work
  - Serve as a primer for deeper Systems course
- Learning objectives
  - How does OS work?
  - How to interact with an OS via shell cmd?
  - How to write better programs by leveraging OS APIs?
- *Optional (free) textbook:*
  - *https://pages.cs.wisc.edu/~remzi/OSTEP/*

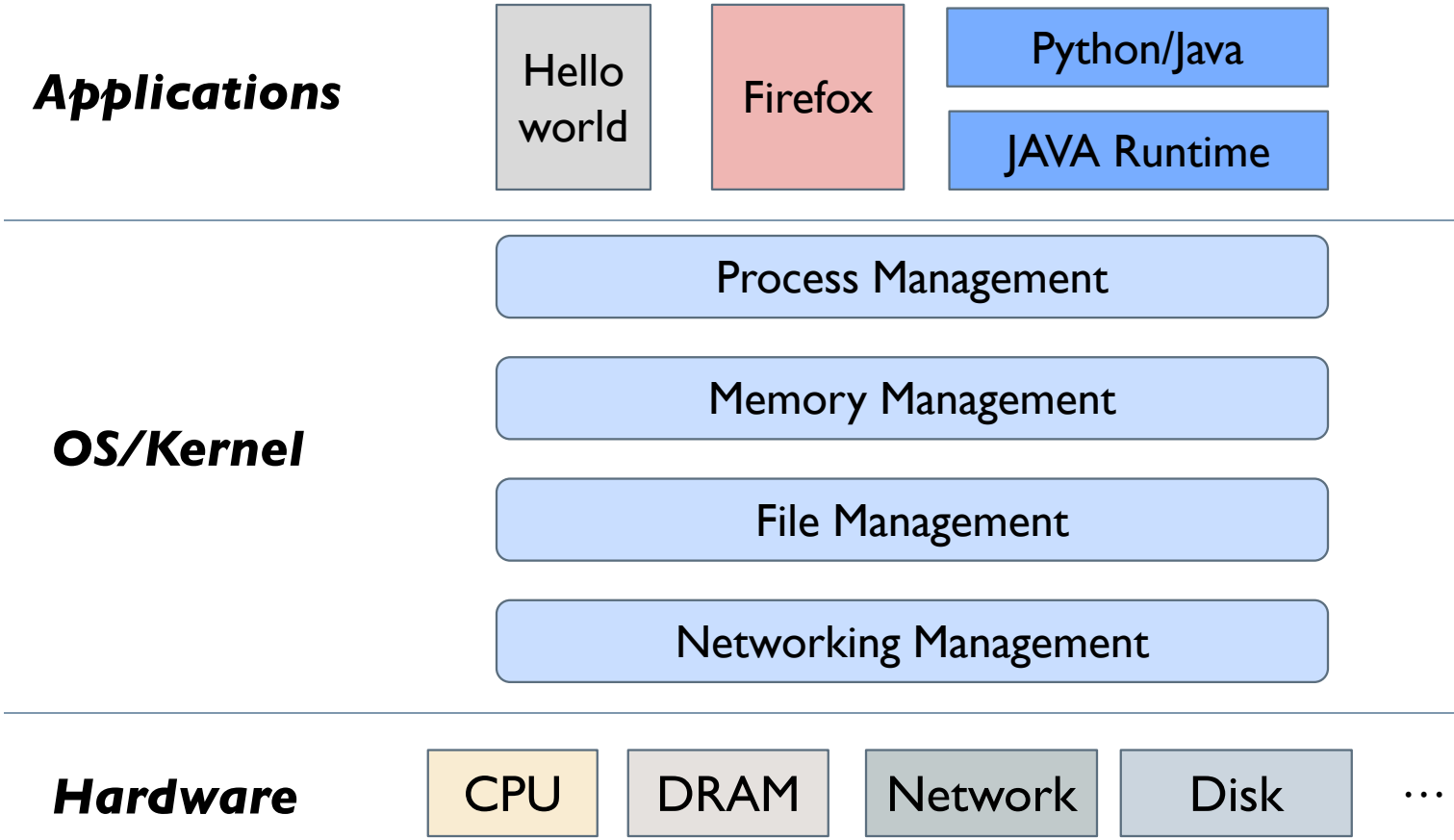


What is an Operating System?

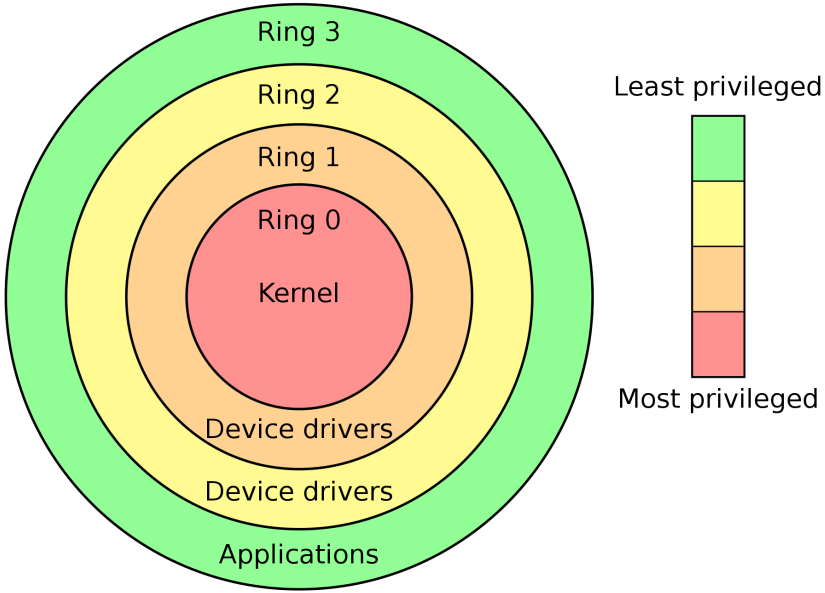


OS/Kernel

- Software *layer(s)* sitting between applications and hardware
- Resource management
  - Virtualization / scheduling
- Protection
  - Preemption (arbitration who has the right to use hardware resources)
  - Privilege levels (user mode vs. kernel mode)
- *Abstraction* (processes, memory manager, socket/file, etc.)


Applications
Hello world
Firefox
Python/Java
JAVA Runtime
OS/Kernel
Process Management
Memory Management
File Management
Networking Management
Hardware
CPU
DRAM
Network
Disk
…

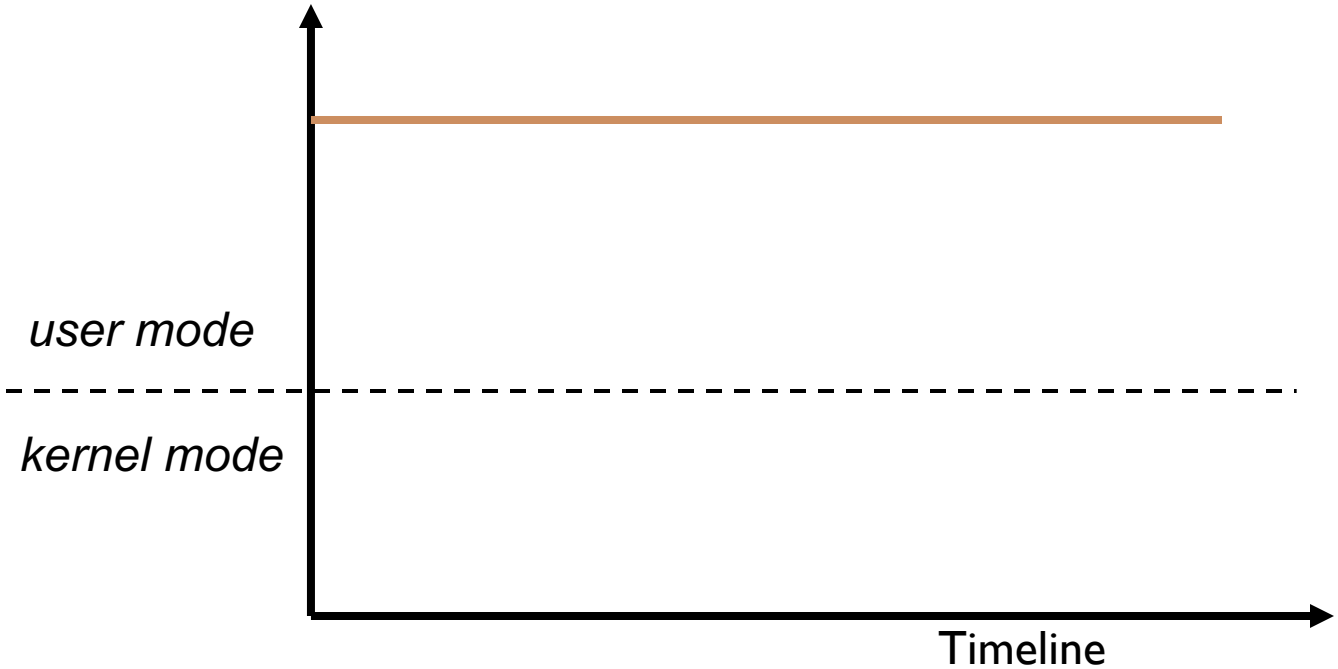
- Instruction set
- CPU privilege levels
- OS
  - User mode
  - Kernel mode
- *Context* switch:
  - User mode <-> Kernel mode
  - System calls



Source: https://en.wikipedia.org/wiki/Protection_ring

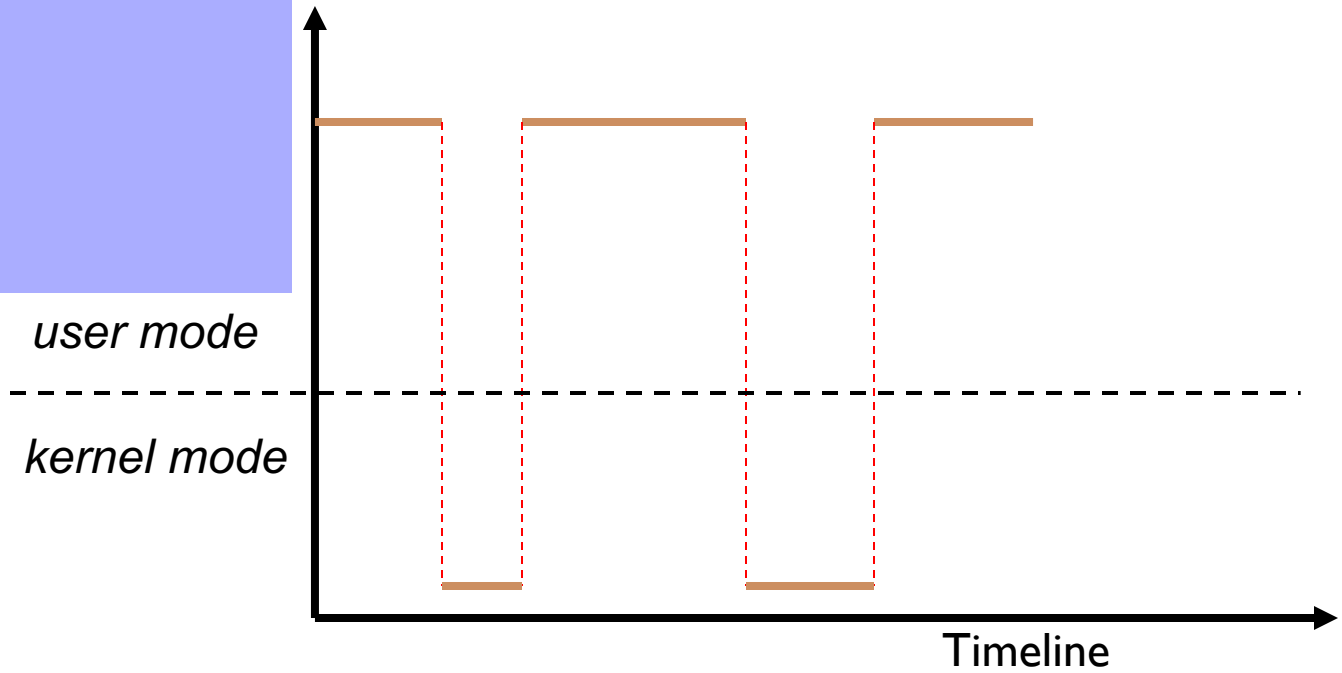
A Simplified Example

```
int main()
{
    while (1) {
        ;
    }
}
```



A Simplified Example

```
int main()
{
    char buf[1024];
    int fd = open("/foo/bar", O_RDWR);
    while (1) {
        ;
        read(fd, buf, 1024);
    }
}
```



Topics of this Course at a High Level

- Processes
  - Multi-core / Multi-processing
  - Process lifecycle management
  - Process communication (signals, inter-process communication)
- Threads
  - Concurrency / Synchronization concepts and APIs
- Memory
  - Virtual memory management
  - Linking and loading process
  - Binary file
  - Shared memory
- Network
  - Socket APIs / HTTP protocol / event-driven programming

More on Processes on Thursday!