CS 460
Operating Systems

TTH 9:40-10:55am

Chadd Williams

Office Hours
M  2:00-3:30
Tues 11-noon
Wed  2:00-3:30
Overview

• Practical introduction to Operating Systems

• Topics
  – Purpose
  – History
  – Design Issues/Structure
  – Devices
  – System (Kernel) vs User mode
  – Concurrency/Deadlock
  – Processes/Threads
  – Multi-Core CPUs
  – Memory Management
  – Security
Syllabus

• *Operating System Concepts* (7\textsuperscript{th}), Silberschatz, et al.

• Grades:

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<tbody>
<tr>
<td>Midterm 1</td>
<td>15%</td>
<td>March 11</td>
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<td>Midterm 2</td>
<td>15%</td>
<td>April 20</td>
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<td>Final</td>
<td>25%</td>
<td>May 14</td>
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<tr>
<td>Homework/Quizzes</td>
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<tr>
<td>Programming Projects</td>
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• Quizzes: frequent, unannounced, open–note quizzes will be given

• Late Policy: No late assignments accepted

• Grade Complaints: one paragraph summary of why the grade is wrong, within one week of receiving the graded material

• All projects are *individual* projects

• http://zeus.cs.pacificu.edu/chadd/cs460s10

• Don't forget about the CS Message boards
Introduction to Operating Systems

• Read Chapter 1!
  – Definition of an Operating System:

  – Kernel:

  – What is not part of the OS?

  – Linux vs GNU/Linux?

• Computers that need an OS:
  – How are their needs different?
Goals of the OS

• Perspectives:
  – User View:
    • Who is the user?
  – System View:
    • Who is the system?
The Computer

- What does a computer really look like?

- Startup Sequence
We booted!

- Now what?
- Interrupts:
  - Characteristics:
    - Hardware:
      - Software:
        - Trap
      - Interrupt vector:
Memory System

• Random Access Memory

• Registers
  – Instruction register
  – data registers
  – load
  – store

• Caches
Disk Storage

- Magnetic Tape

- Magnetic Disks
  - RAM spills over to disk
  - Virtual memory

- USB drives
  - Flash memory
Devices

• Device controller
  – specialized chip
  – buffer

• Device driver
System Architecture

- Single Processor System

- Multiprocessor System
  - Increased throughput
    - Speed up approaches $N$ for $N$ processors (Ahmdal's Law)
  - Economy of scale
  - Increased reliability
  - Asymmetric MP
  - SMP

- Multi core System
  - dual-core
  - quad-core
System Architecture, cont.

• Blades

• Clusters
  – One OS many computers
  – Beowulf cluster – http://www.beowulf.org/
OS Pieces

• Multiprogramming
  – Job
  – Switching

• Time sharing/multitasking
  – Response time
  – Pre-emptive MT

• Process

• Scheduling
  – Job
  – CPU
OS Pieces, cont.

- Virtual Memory
- Physical Memory
- Security
Operation

- Dual Mode
  - Kernel mode
    - \{ Supervisor | System | Privileged \} mode
    - Hardware bit
    - Privileged instructions
      - Based on CPU type
      - I/O control
      - Interrupt management
      - Stop/Halt
      - Memory management
  - User mode
    - System calls

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No mode bit on the original Intel 8088 chip

Hence, MS-DOS originally not dual mode!
Dual-Mode, in action

user process

user process executing → calls system call → return from system call

kernel

trap mode bit = 0

execute system call

return mode bit = 1

user mode (mode bit = 1)

kernel mode (mode bit = 0)
Process Management

• Process
  – Active program
  – Resources
Memory Management
Read Chapter 2