CS 460
Operating Systems

TTH 1:00 – 2:15

Chadd Williams

Office Hours
Tue 2:30-3:30
Wed 1:30-3:30
Fri 10-11
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 (7th)*, Silberschatz, et al.

● Grades:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm 1</td>
<td>15%</td>
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<td>Midterm 2</td>
<td>15%</td>
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<tr>
<td>Final</td>
<td>20%</td>
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<tr>
<td>Homework/Quizzes</td>
<td>10%</td>
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<tr>
<td>Programming Projects</td>
<td>40%</td>
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</tbody>
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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/cs460s08](http://zeus.cs.pacificu.edu/chadd/cs460s08)

● 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?

• 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

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 \rightarrow \text{calls system call} \rightarrow \text{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