Lecture - I

Introduction

Tevfik Koşar

University at Buffalo

August 30th, 2011

Contact Information

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  - Office hours: Tue noon - 1:00pm, Wed 11:00am - noon
    (Or anytime by appointment)

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  - Enes Yildiz <enesyild@buffalo.edu>

Recitations

- You need to attend one of the following recitations:
  - Tue 10:00am-11:50am (Talbert 115)
  - Wed 10:00am-10:50am (Copen 10)
  - Fri 3:00pm-3:50pm (Knox 04)

- Recitations will include:
  - Clarification of some important course material
  - Solutions of some exercise questions
  - Project & HW guidance
  - Programming tips

Course Web Page

- Course web page: http://www.cse.buffalo.edu/faculty/tkosar/cse421-521/
  - All lecture notes will be available online
  - As well as homework assignments, projects and other important course information

<table>
<thead>
<tr>
<th>Date</th>
<th>Lect</th>
<th>Title</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Aug 30</td>
<td>1</td>
<td>Introduction</td>
<td>No HW</td>
</tr>
<tr>
<td>Sep 5</td>
<td>2</td>
<td>Operating System Structures</td>
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<tr>
<td>Sep 6</td>
<td>3</td>
<td>Processes</td>
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<td>Sep 8</td>
<td>4</td>
<td>Threads</td>
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<td>Sep 13</td>
<td>5</td>
<td>CPU Scheduling</td>
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<td>Sep 19</td>
<td>6</td>
<td>CPU Scheduling</td>
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<td>Sep 28</td>
<td>7</td>
<td>Projects Discussion</td>
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<td>Sep 29</td>
<td>8</td>
<td>Process Synchronization</td>
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<td>Oct 5</td>
<td>9</td>
<td>Project Discussion</td>
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<td>Oct 6</td>
<td>10</td>
<td>Deadlocks</td>
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<td>Oct 11</td>
<td>11</td>
<td>Mutex Synchronization</td>
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<td>Oct 13</td>
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<td>Oct 18</td>
<td>13</td>
<td>Multiple Review</td>
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<td>Oct 20</td>
<td>14</td>
<td>Midterm Exam</td>
<td>@ P-Main 10:15am</td>
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<td>Oct 24</td>
<td>15</td>
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<tr>
<td>Oct 27</td>
<td>16</td>
<td>Virtual Memory</td>
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Textbook: Required

Recommended Supplementary Text
Recommended Supplementary Text

Grade Components

- The end-of-semester grades will be composed of:
  - Pop Quizzes: 5% (4-5)
  - Homework: 10% (4)
  - Projects: 30% (3)
  - Midterm: 25% (1)
  - Final: 30% (1)

You are expected to attend the classes and actively contribute via asking and/or answering questions.

Grading Scale

- Final grades will be given according to this scale:

<table>
<thead>
<tr>
<th>Point Range</th>
<th>Letter Grade</th>
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<tr>
<td>95.00-100</td>
<td>A</td>
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<tr>
<td>90.00-94.99</td>
<td>A</td>
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<tr>
<td>85.00-89.99</td>
<td>B+</td>
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<td>80.00-84.99</td>
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<td>75.00-79.99</td>
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<td>55.00-59.99</td>
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<td>50.00-54.99</td>
<td>D</td>
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<tr>
<td>49.99-00</td>
<td>F</td>
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I may use a “curve” to adjust grades to this scale.

Rules

- No late homework/project submissions accepted!
- Exams will be closed book.
- You are only responsible from material covered in the class, homework, and projects.
- Academic dishonesty will be treated “very” seriously!

Passive vs Active Learning

Passive learning: learning through reading, hearing & seeing
Active learning: learning through saying and doing

After 2 weeks, we tend to remember:

Passive learning
- 10% of what we read
- 20% of what we hear
- 30% of what we see (i.e. pictures)
- 50% of what we hear and see

Active learning
- 70% of what we say
- 90% of what we say and do

How to Become an Active Learner

- Recall prior materials
- Answer a question
- Guess the solution first (even guessing wrong will help you to remember the right approach)
- Work out the next step before you have to read on
- Think of an application
- Imagine that you were the professor and think about how you would give a test on the subject material so that key concepts and results will be checked.
- Summarize a lecture, a set of homework or a lab in your own words concisely.
What Expect to Learn?

- Key Concepts of Operating Systems
  - Design, Implementation, and Optimization
- Topics will include:
  - Processes, Threads and Concurrency
  - CPU and I/O Scheduling
  - Memory and Storage Management
  - File System Structures
  - Synchronization and Deadlocks
  - Protection and Security
  - Distributed Computing & Related Issues

What is an Operating System?

- A program that manages the computer hardware.
- An intermediary between the computer user and the computer hardware.
- Manages hardware and software resources of a computer.

Introduction

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Computer System Overview

- **A computer system consists of (bottom-up):**
  1. hardware
  2. firmware (BIOS)
  3. operating system
  4. system programs
  5. application programs
  6. users

Computer System Overview

1. **Hardware**
   - provides basic computing resources
   - CPU, memory, disk, other I/O devices
2. **Firmware (BIOS)**
   - software permanently stored on chip (but upgradable)
   - loads the operating system during boot
3. **Operating system**
   - controls and coordinates the use of the hardware among the various application programs for the various users
4. **System programs**
   - basic development tools (shells, compilers, editors, etc.)
   - not strictly part of the core of the operating system
5. **Application programs**
   - define the logic in which the system resources are used to solve the computing problems of the users
   - database systems, video games, business programs, etc.
6. **Users**
   - people, other computers, machines, etc.
Role of an Operating System

- The Silberschatz “pyramid” view

Abstract view of the components of a computer system

Role of an Operating System

- The Tanenbaum “layered” view

<table>
<thead>
<tr>
<th>Banking system</th>
<th>Airline reservation</th>
<th>Web browser</th>
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<tbody>
<tr>
<td>Compilers</td>
<td>Editors</td>
<td>Command interpreter</td>
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<tr>
<td>Operating system</td>
<td>Machine language</td>
<td>Microarchitecture</td>
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<td>Physical devices</td>
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A computer system consists of hardware, system programs and application programs

Role of an Operating System

- The Stallings “layered & stairs” view

Layers and views of a computer system

Key Point

- An operating system is a program that acts as an intermediary between users/applications and the computer hardware.

Role of an Operating System

- The Molay “aquarium” view

- The only not-layered view
- everything must transit through the O/S or “kernel”

How are they all connected?
The kernel manages all connections

Operating System Goals

- From the user perspective:
  - Executes user programs and make solving user problems easier
  - Makes the computer system convenient to use
    - hides the messy details which must be performed
    - presents user with a virtual machine easier to use

- From the System/HW Perspective:
  - Manages the resources
  - Uses the computer hardware in an efficient manner
    - time sharing: each program gets some time to use a resource
    - resource sharing: each program gets a portion of a resource
OS Services for Users

· Program Execution
  - The OS loads programs and data into memory, initializes I/O devices and files, schedules the execution of programs

· Access to I/O Devices
  - The OS hides I/O device details from applications (direct I/O access is forbidden) and offers a simplified I/O interface

· Controlled Access to Files & Directories
  - The OS organizes data into files and directories, controls access to them (i.e. create, delete, read, write) and preserves their integrity

OS Services for System/HW

· Resource Allocation
  - The OS allocates resources to multiple users and multiple jobs running at the same time

· Operation Control
  - The OS controls the execution of user programs and operations of I/O devices

· System Access
  - The OS ensures that all access to resources is protected, including authorization, conflict resolution etc.

· Accounting and Usage Statistics
  - The OS keeps performance monitoring data

Summary

· What is an OS?
· Role of an OS
· Operating System Goals
  - User View vs System View
· Operating System Services
  - For Users and HW

· Reading Assignment: Chapter 1 from Silberschatz.

Questions?

Acknowledgements

· “Operating Systems Concepts” book and supplementary material by A. Silberschatz, P. Galvin and G. Gagne

· “Operating Systems: Internals and Design Principles” book and supplementary material by W. Stallings

· “Modern Operating Systems” book and supplementary material by A. Tanenbaum

· R. Doursat and M. Yuksel from UNR