

CSE 421/521 - Operating Systems  
Fall 2012

LECTURE - I  
INTRODUCTION

Tevfik Koşar

University at Buffalo  
August 28<sup>th</sup>, 2012

## Contact Information

- Instructor: Prof. Tevfik Kosar
  - Office: 338J Davis Hall
  - Phone: 645-2323
  - Email: [tkosar@buffalo.edu](mailto:tkosar@buffalo.edu)
  - Web: <http://www.cse.buffalo.edu/~tkosar>
  - Office hours: Wed 11:00am - noon, Thu 11:00am - noon  
(Or anytime by appointment)
- Teaching Assistants:
  - Sonali Batra <[sonaliba@buffalo.edu](mailto:sonaliba@buffalo.edu)>
  - Ying Yang <[y yang25@buffalo.edu](mailto:y yang25@buffalo.edu)>
  - Weida Zhong <[weidazho@buffalo.edu](mailto:weidazho@buffalo.edu)>

## Recitations

- You need to attend one of the following recitations:
  - Tue 11:00am - 11:50am (Capen 260)
  - Wed 10:00am - 10:50am (Obrian 112)
- Recitations will include:
  - Clarification of some important course material
  - Solutions of some exercise questions
  - Project & HW guidance
  - Programming tips

3

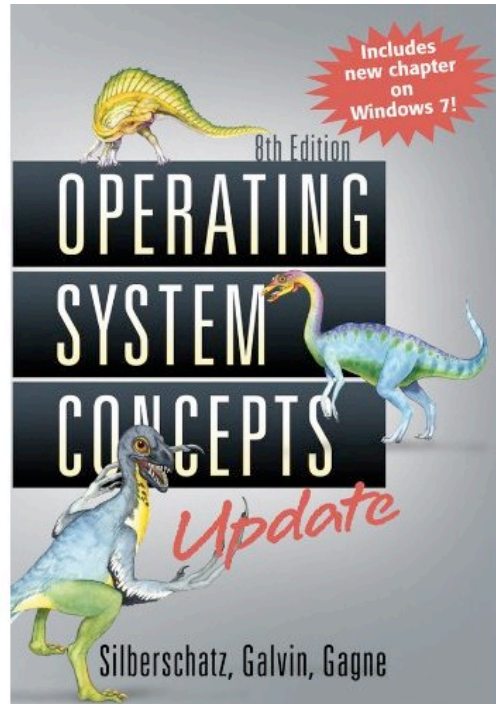
## Course Web Page

- 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

Date	Lect.	Title	Notes
Aug 28	1	Introduction	<i>Read Ch.1</i>
Aug 30	2	Operating System Structures	
Sep 4	3	Processes	
Sep 6	4	Threads	
Sep 11	5	CPU Scheduling - I	
Sep 13	6	CPU Scheduling - II	
Sep 18	7	Project-I Discussion	
Sep 20	8	Process Synchronization - I	
Sep 25	9	Process Synchronization - II	
Sep 27	10	Deadlocks – I	
Oct 2	11	Deadlocks – II	
Oct 4	12	Main Memory – I	
Oct 9	13	Main Memory – II	
Oct 11	14	Midterm Review	
Oct 16		<b>MIDTERM EXAM</b> (Room: Davis 101)	@ 9:30am-10:50am
Oct 18	15	Midterm Discussion	
Oct 23	16	Project-II Discussion	

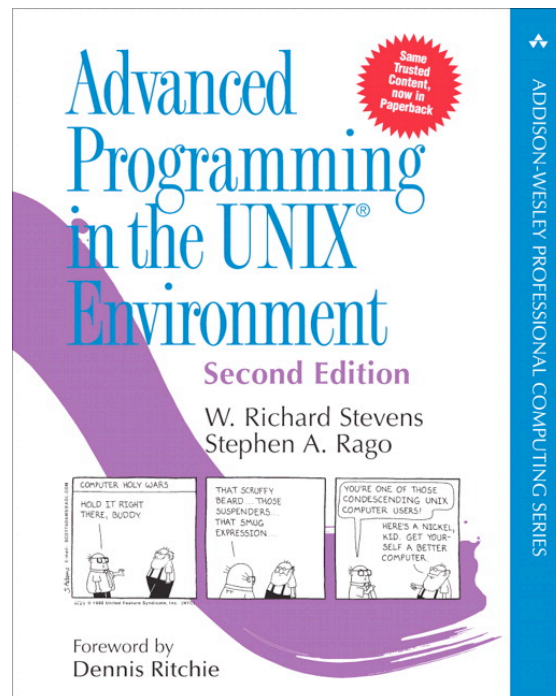
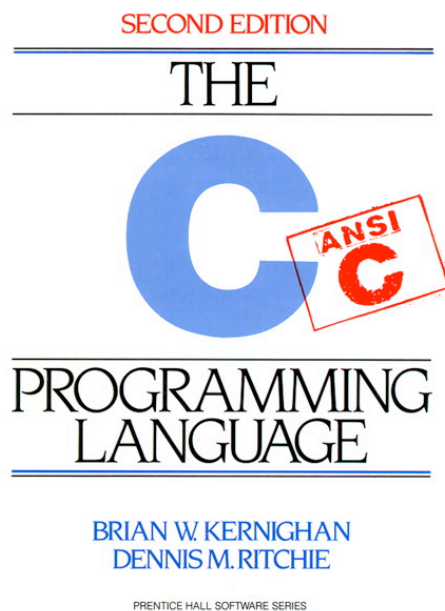
4

## Textbook: Required

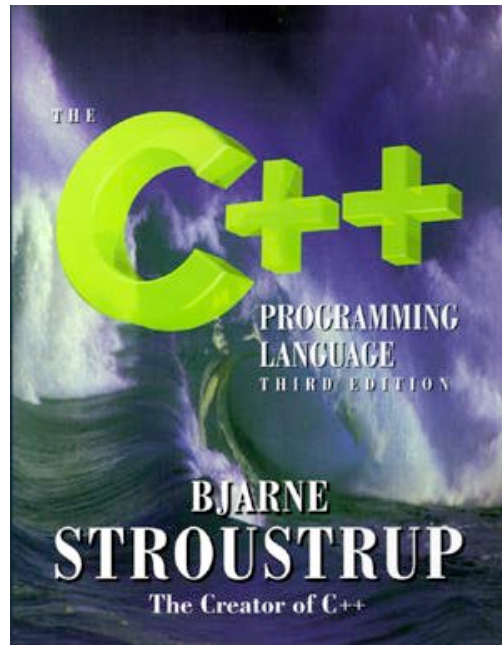


5

## Recommended Supplementary Text



## Recommended Supplementary Text



7

## 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.

8

## Grading Scale

- Final grades will be given according to this scale:

Point Range	Letter Grade
95.00-100	A
90.00-94.99	A-
85.00-89.99	B+
80.00-84.99	B
75.00-79.99	B-
70.00-74.99	C+
65.00-69.99	C
60.00-64.99	C-
55.00-59.99	D+
50.00-54.99	D
0-49.99	F

- \* I will use “curve” to adjust grades (up) to this scale.
- \* There will be separate curves for graduate & undergraduate students.

## Rules

- No use of laptops/phones during the lectures!
- 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

11

## 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.

12

## 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

13

## INTRODUCTION

14

## 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.

15

## 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

16



## 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

17

## Computer System Overview

### 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.

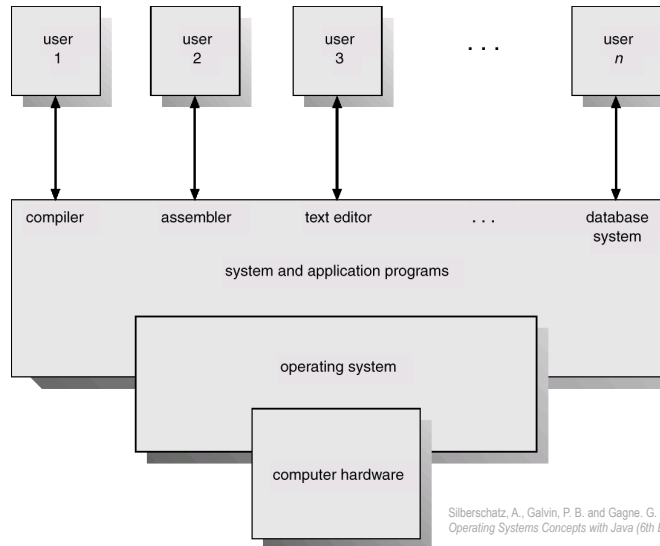
### 6. Users

- ✓ people, other computers, machines, etc.

18

## Role of an Operating System

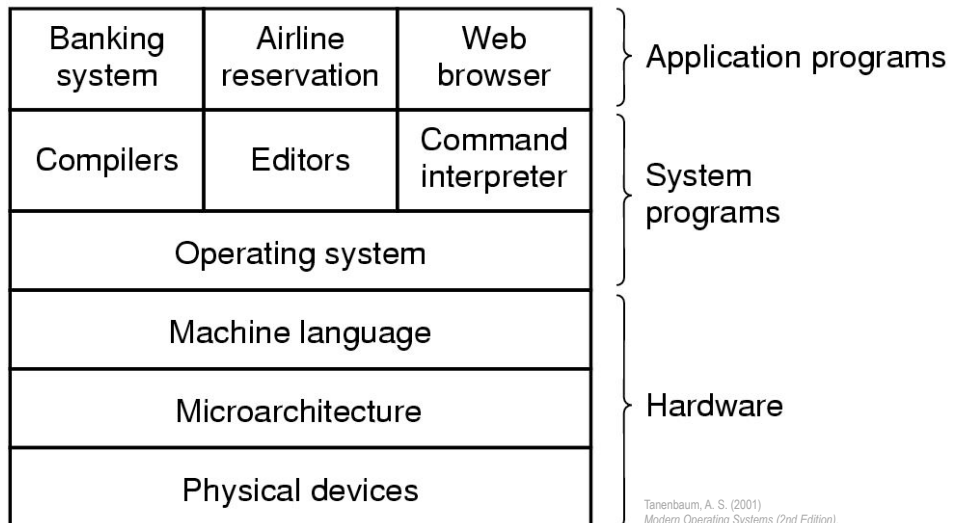
- The Silberschatz "pyramid" view



Abstract view of the components of a computer system

## Role of an Operating System

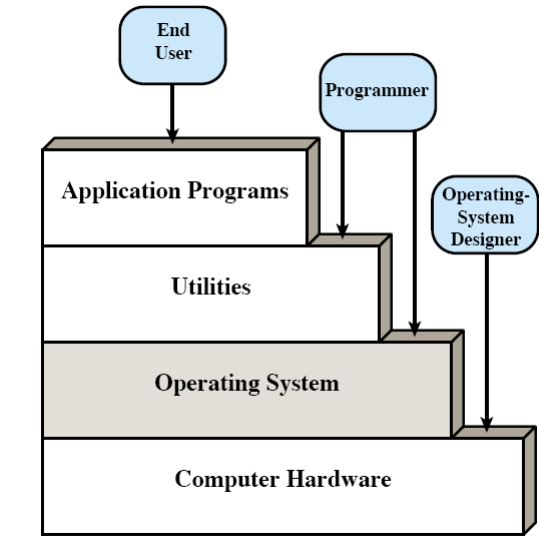
- The Tanenbaum "layered" view



**A computer system consists of hardware, system programs and application programs**

## Role of an Operating System

- The Stallings "layered & stairs" view



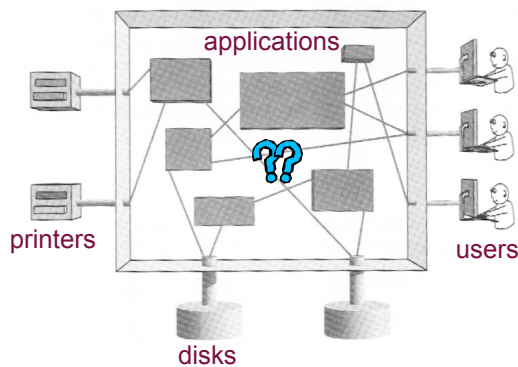
Layers and views of a computer system

21

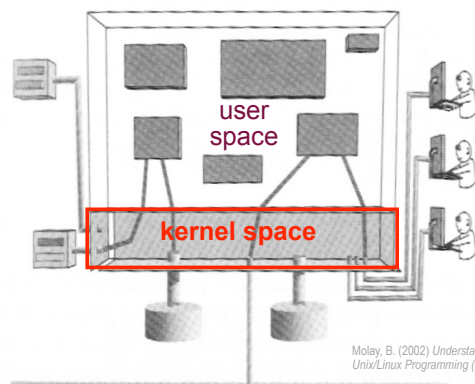
## Role of an Operating System

- 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

Molay, B. (2002) Understanding Unix/Linux Programming (1st Edition).

22

## Key Point

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

23

## 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

24

## 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

25

## OS Services for Users

- **Communications**
  - The OS allows exchange of information between processes, which are possibly executing on different computers
- **Error Detection and Response**
  - The OS properly handles HW failures and SW errors with the least impact to running applications (i.e. terminating, retrying, or reporting)

26

## 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

27

## 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.**

28

## 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