Amirkabir University of Technology
(Tehran Polytechnic)

Operating Systems

Introduction

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My Background and Contact Details

- Seyyed Ahmad Javadi
  - PhD from New York State University at Stony Brook
  - Postdoc from University of Cambridge
  - Interest: Cloud computing, operating systems, performance analysis

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Course Introduction

- Saturday and Monday (13:30-15:00)
  - Attend class on time
- Course web page
  - Check the webpage on regular basis
  - Everything will be posted on CW
  - Post All your Questions on CW Forums
    - Check forum history before posting any question
- Office hours and TA classes
  - TBD

Cell Phone and Laptop Policy

- Class use policy: Don't!
- Cell phones should be off or silenced
- Texting is strictly prohibited in class

- Laptops and tablets may NOT be used in class: No email, browsing, Facebook, Twitter, Instagram during class lectures

- Violations may result penalties

Textbook

- **Operating System Concepts**, 10th Edition, Wiley publishing
  - By A. **Silberschatz**, P. Galvin, & G. Gagne

- Other References:
  - Operating systems: design & implementation,
    - By A. Tanenbaum and A. Woodhull, 3rd edition, 2006.
  - Operating systems: internals and design principles,
    - By W. Stallings, 5th edition, 2005.

Grading

Section	Score	Considerations
assignments	2.5 + 0.5	five homework
midterm exam	4	1401/08/14
project	4.5 + 1	in three phases
final exam	8	1401/10/19
quiz	0.5	one or two
class participation	0.5	Considering number of attendance
Total	20 + 1.5	Good luck ☺

Harsh penalty for plagiarism and cheating

Project

- Adding new features to XV6 created in MIT's Operating System Engineering course; isn't this exciting ☺
  - XV6 is used in most of the well-known universities.
  - https://pdos.csail.mit.edu/6.828/2012/xv6.html
- **Three Phases:**
  - Phase 1: getting to know XV6 basics (solo work)
  - Phase 2: getting to know XV6 advanced features (teamwork)
  - Phase 3: final project (teamwork)

Syllabus

- Introduction to operating systems
- Process management
  - Threads
  - Synchronization
  - Scheduling
- Memory management
- Protection and security

Copyright Notice

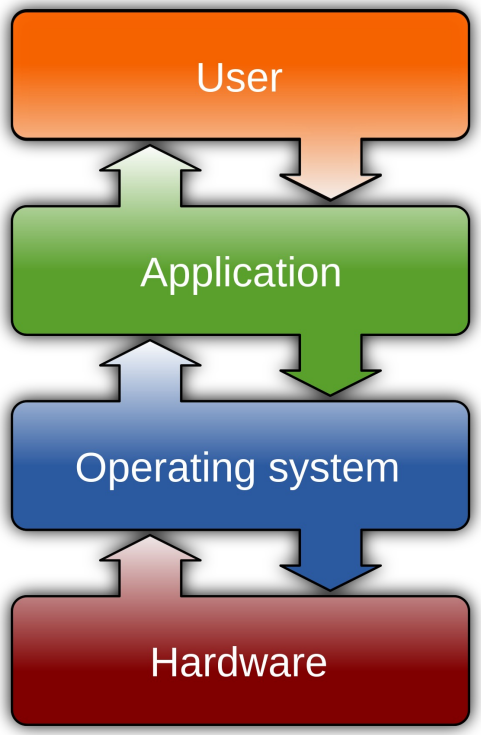
Slides are based on the slides of the main textbook.

Silberschatz

https://www.os-book.com/OS10/slide-dir/index.html

What is an Operating System?

- A program that acts as an intermediary between a user of a computer and the computer hardware.
  - User can execute programs conveniently & efficiently

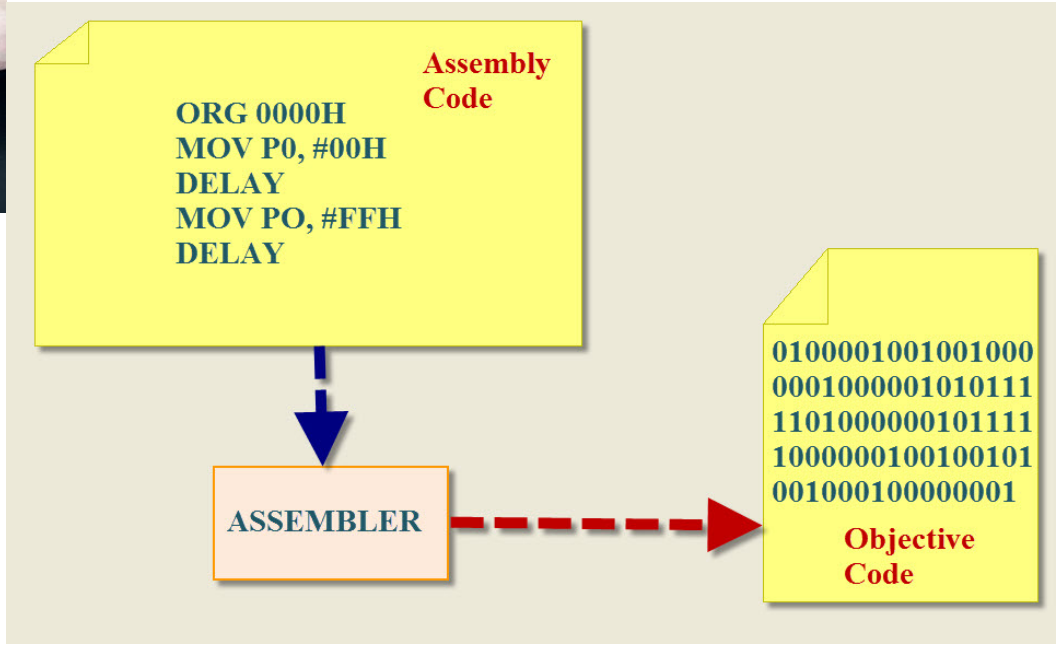


Operating System Goals

- Execute user programs and make solving user problems easier.

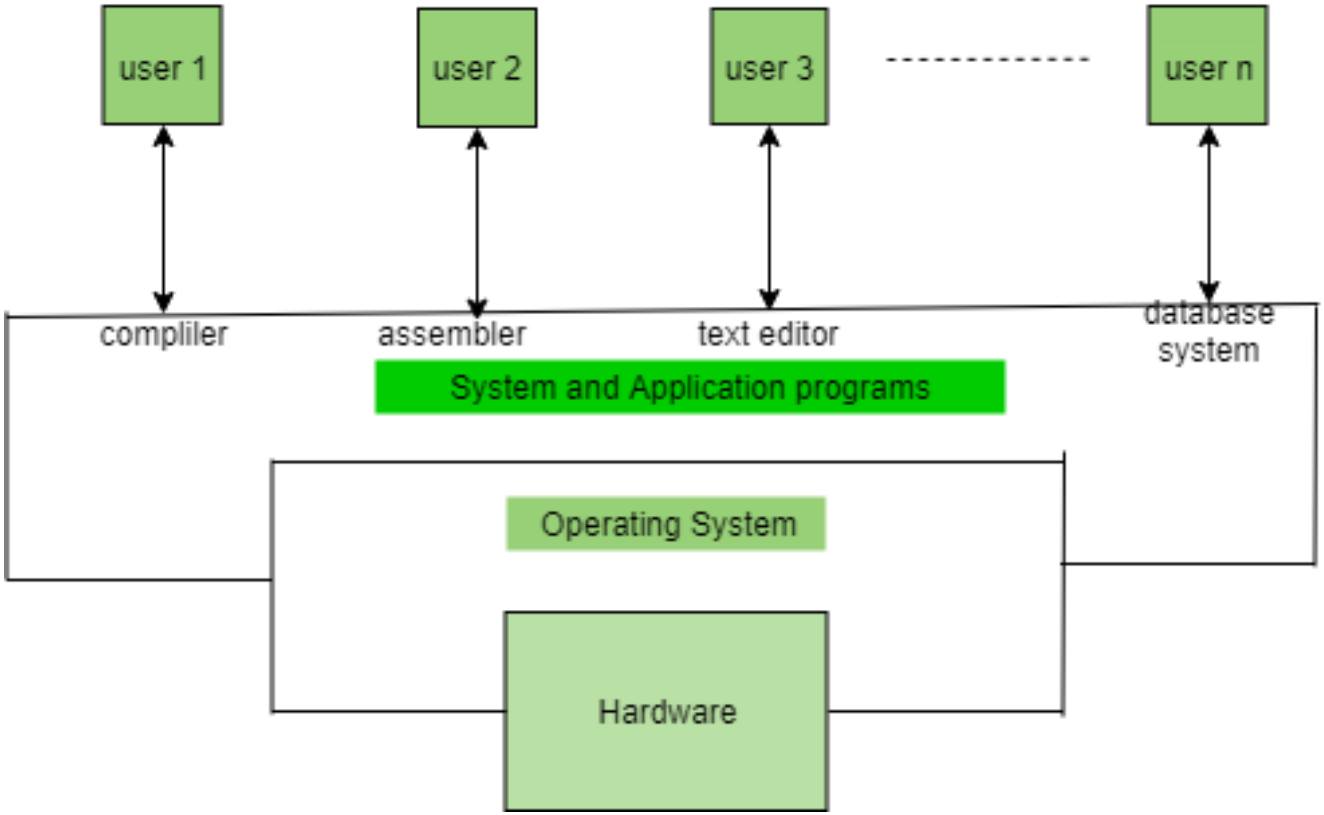
Operating System Goals (cont.)

- Make the computer system convenient to use.



Operating System Goals (cont.)

- Use the computer hardware in an efficient manner.

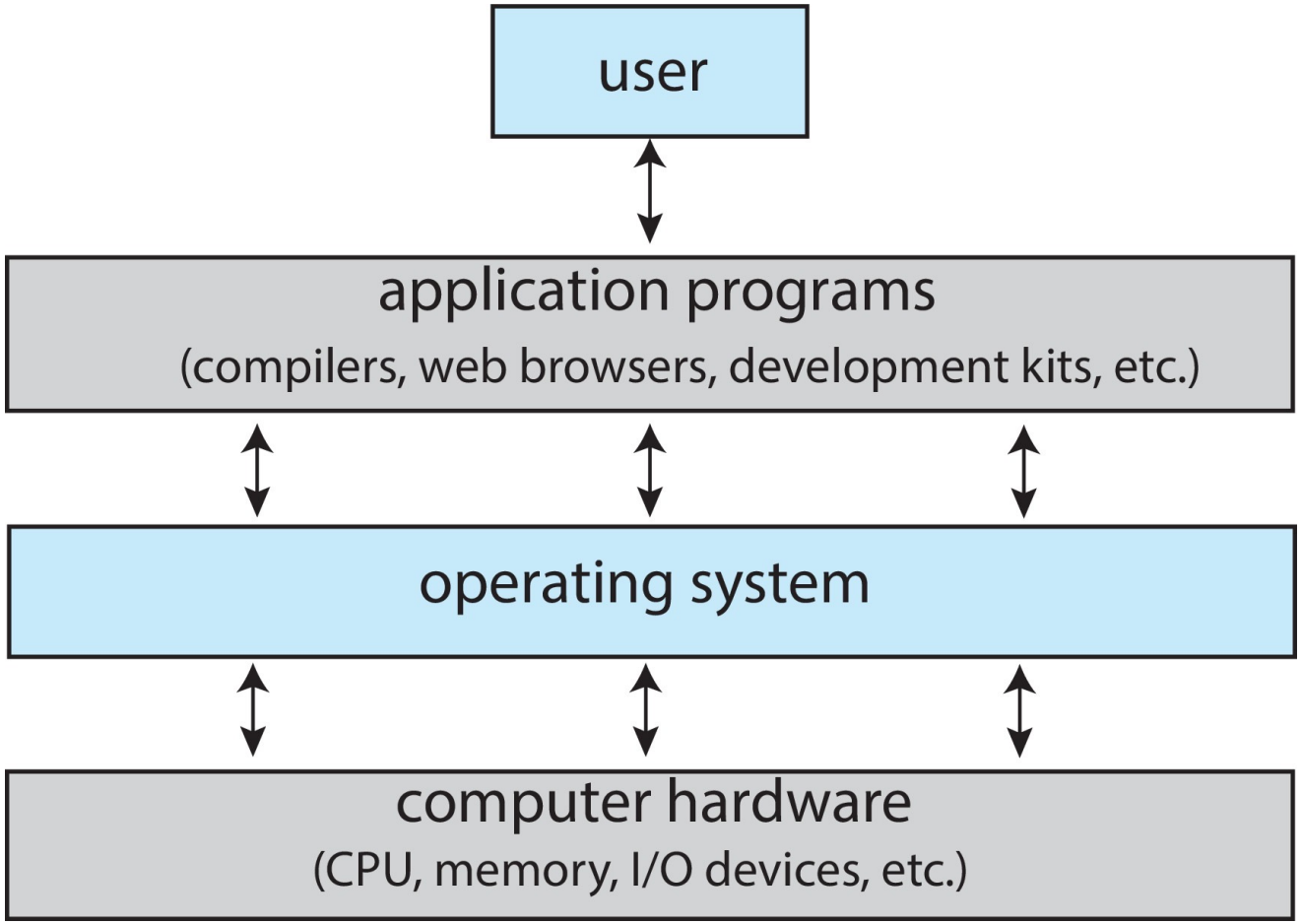


https://www.geeksforgeeks.org/need-and-functions-of-operating-systems/

OS: Mandatory or Optional?

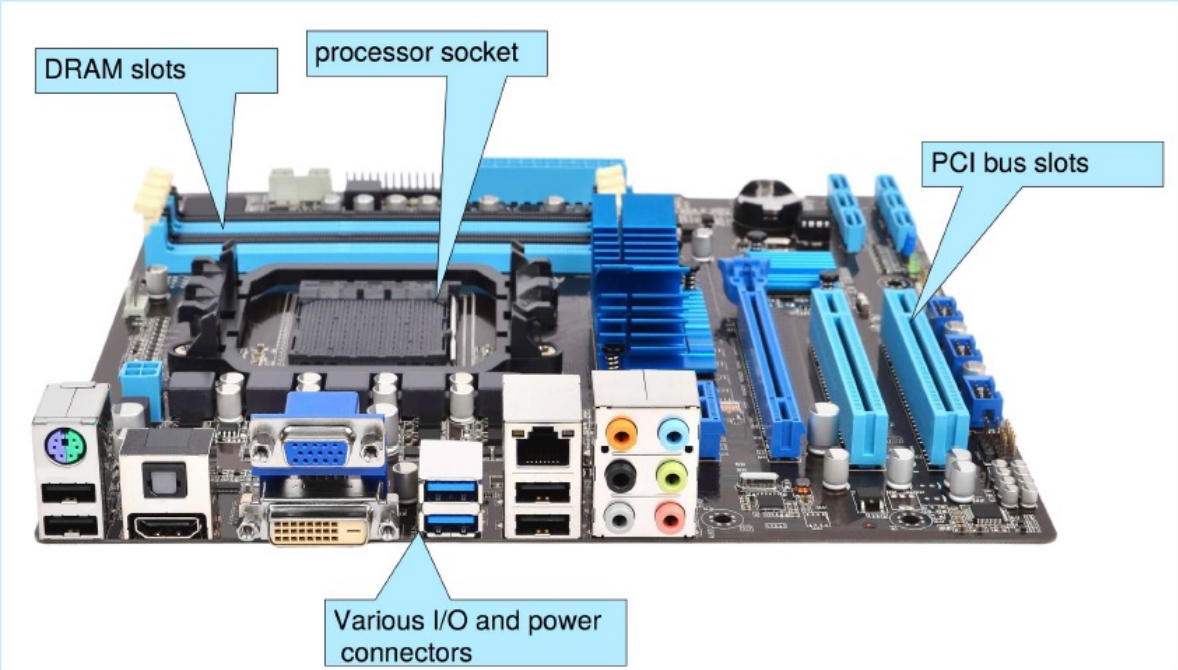
- **Can we run a computer without an operating system?**
  - Yes, earliest computers did not have OS.
- **What does a compute without an OS look like?**
  - Machines tasked with one program at a time.
    - Cannot read a pdf while listening to a music.
  - Each program has a lot of work to do.
    - Where to load a program
    - IO access

Abstract View of Components of Computer



PC Motherboard

Consider the desktop PC motherboard with a processor socket shown below:



This board is a fully-functioning computer, once its slots are populated. It consists of a processor socket containing a CPU, DRAM sockets, PCIe bus slots, and I/O connectors of various types. Even the lowest-cost general-purpose CPU contains multiple cores. Some motherboards contain multiple processor sockets. More advanced computers allow more than one system board, creating NUMA systems.

Operating System Story

- **Vital goal of a computer system**
  - Execute user program and make solving user problem easier.

- **Shall user program use hardware directly?**
  - Hardware alone is ***not easy to use.***
  - Application programs require certain ***common operations.***
    - Example: I/O operations

Common functions of controlling and allocating resources brought together into one piece called **OS**

Operating System Definition (cont.)

- No universally accepted definition.
- "The one program running at all times on the computer" is the **kernel,** part of the operating system.
- Everything else is either
  - A ***system program*** (ships with the operating system, but not part of the kernel) , or
  - An ***application program***, all programs not associated with the operating system.