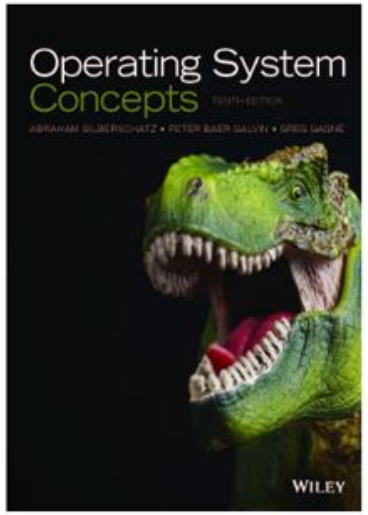
CSCI 509

OPERATING SYSTEMS INTERNALS

SYLLABUS

- Office hours
- Email
- Course description and goals
- Textbook



Operating System Concepts
Tenth Edition

Avi Silberschatz
Peter Baer Galvin
Greg Gagne

John Wiley & Sons, Inc.
ISBN 978-1-118-06333-0

CSCI-509: Operating Systems Internals

Instructor	Email	Office Hours
Tarek Idriss	idrisst@wwu.edu	MTF 12:00-12:45 pm CF 485

Lectures

MTWF 02:00-02:50 pm

Location: AW 203

Description

This course explores the services operating systems provide to executing processes and their secure access. Topics include memory management, concurrent process management, resource management, system call implementation, file systems, and memory protection.

Course Discord Server

Join the course discord server: https://discord.gg/hn3RZPuYQt

You can ask your colleagues questions. Do not post homework/lab solutions. Do not share code beyond simple syntax explanation.

GRADES

- 7 Homework Assignments + 1-2 Labs (40%)
- Exams: Midterm and Final (40%)
- Quizzes (14%)
- Worksheet (4%)
- 2% Attendance.

LABS

- Labs are group work with individual submissions.

QUIZZES

- Will be announced in class and on canvas.
- You might be informed just a day before the quiz.
- 10-15 minutes in class quiz.
- 4-5 Quizzes are planned.

WORKSHEETS

- Most of the lectures will include a worksheet with several questions/exercises.
- You will have to submit it the answers on Canvas.
- Canvas submission deadline is same day.

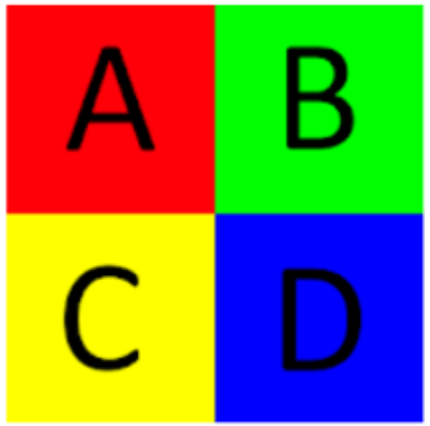
HOMEWORK

- Homework: individual work and submission.
- Each homework will include a programming assignment.
- Submission will be done through gitlab and canvas (link).
- You will be allowed a total of **two slip days** that you can use to extend assignment deadlines.

ABCD CARDS

- For in-class polls.
- Download the app
- Available for both android and apple app stores.

ABCD Cards 4+
Western Washington University
Designed for iPad
4.0 • 17 Ratings
Free



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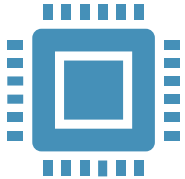
COURSE GOALS

- Process Synchronization
- Multithreading
- Virtual Memory
- File Systems

COURSE FLOW



Operating Systems Overview

- Objective of Operating Systems
- Design Variations

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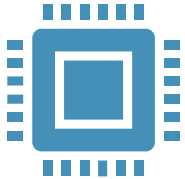

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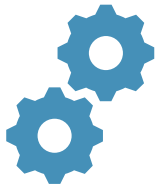

Processes and Threads

- Why do we need threads?
- Process creation and control

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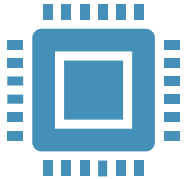

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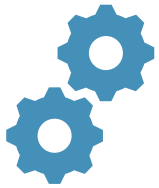

Processes and Threads

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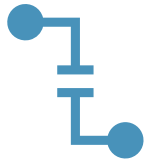
CPU Scheduling

- How to distribute CPU time among multiple threads?
- Priorities: throughput? Latency? fairness?
- How to handle real-time applications?

COURSE FLOW



Process Synchronization

- What if two threads are writing to the same database/file?
- Locks, Semaphores and Monitors
- Deadlocks

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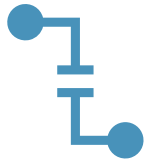

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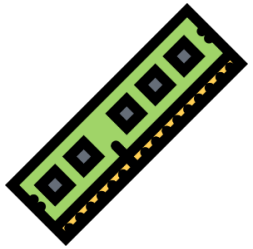

Memory management and Virtual Memory

- How to allocate memory to programs?
- What if there is not enough memory?
- How to protect process memory from illegal access?

COURSE FLOW

Disk Storage

- Disk access and scheduling.
- RAID Systems

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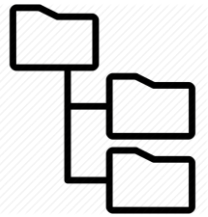

File Systems

- File System and Directories Implementations
- How to locate a certain file/folder and retrieve it quickly?
- Network File Systems

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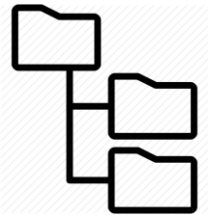

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Distributed Systems

- Brief overview

WHAT ARE WE LEARNING?

- Memorize latest algorithms?
- Memorize optimal methods?
- OS are constantly evolving.

WHAT ARE WE LEARNING?

- Memorize latest algorithms?
- Memorize optimal methods?
- OS are constantly evolving.

- Identify and understand the challenges facing OS design.
- Recognize the toolset you have as a developer to tackle these challenges.
- Most solutions are quite simple.

DESIGN PRINCIPLE: TRADEOFF

- There is one constant in every design:
  - Tradeoff

MANAGING PRIORITIES

- There is one constant in every design:
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- Managing Priorities.

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Brainstorm several design priorities for a computing system.

MANAGING PRIORITIES

- There is one constant in every design:
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  - Performance
  - Power Efficiency
  - Memory Efficiency
  - Reliability
  - User Friendliness

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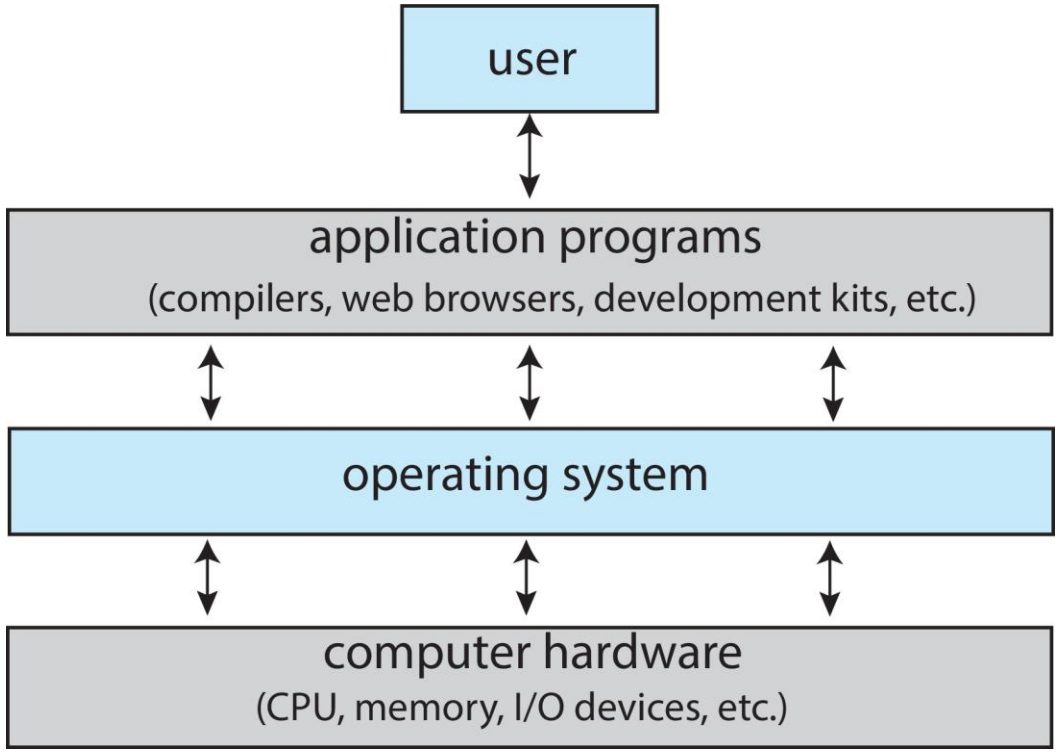
Depends on application.

TRADEOFF

- Increasing memory page size:
  - Advantage: Faster page retrieval.
  - Disadvantage: reduces memory efficiency.

OPERATING SYSTEMS

- Operating Systems is a program that interacts with software and hardware components.



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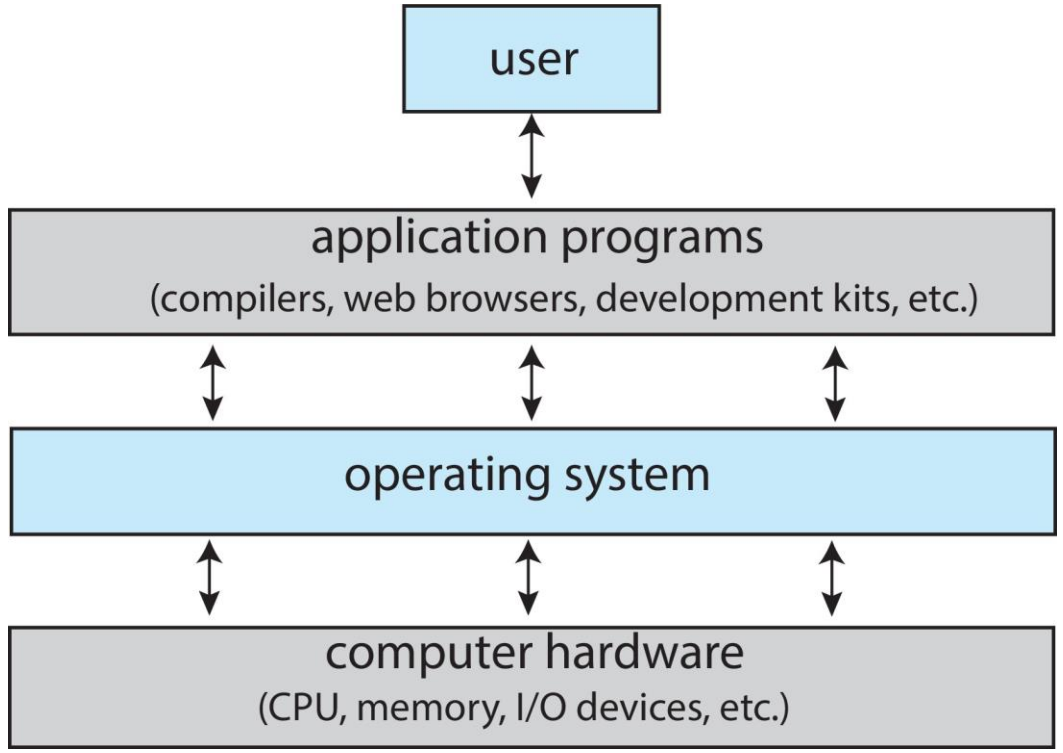

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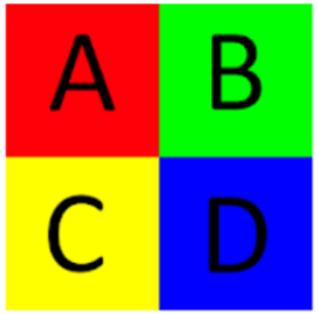

A. Yes
B. No

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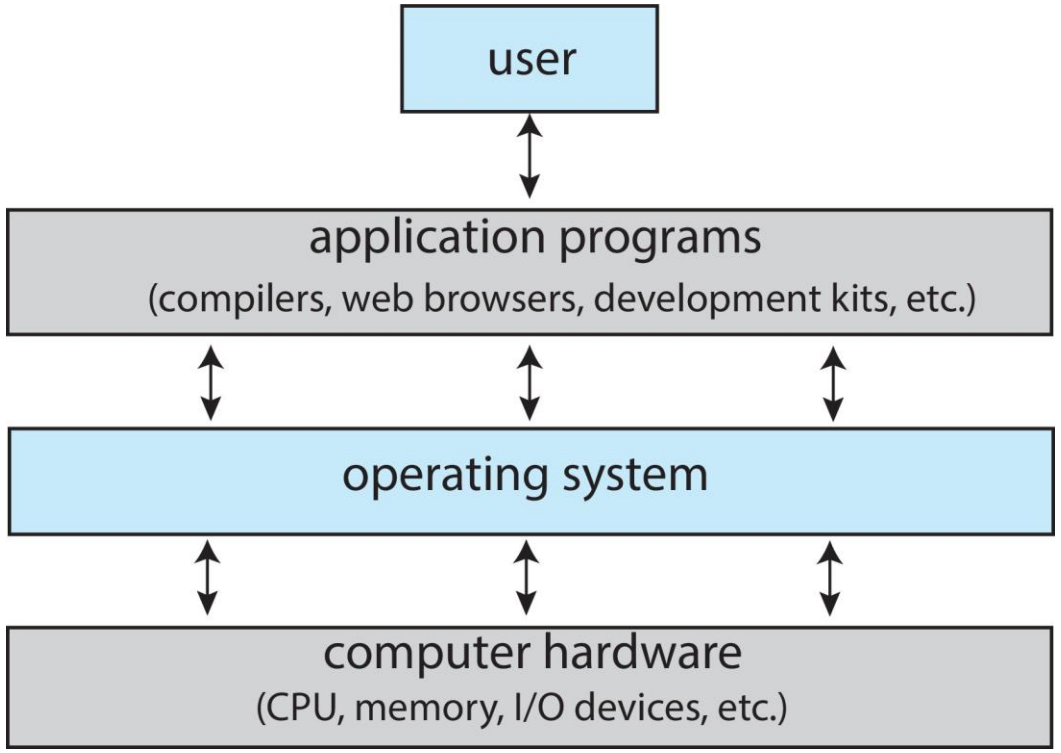

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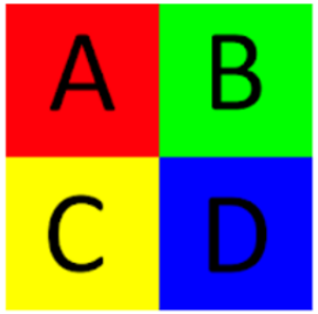

A. Yes
B. No

Some devices have no operating system at all!

OPERATING SYSTEM FUNCTIONS

- Multiprogramming
- Memory Management
- Protection and Security
- Process Management:
  - Creating, running, suspending and terminating processes.
- Mass Storage Management
  - Disk Scheduling
  - File Systems
- I/O Devices
  - Reading and Writing to I/O Devices

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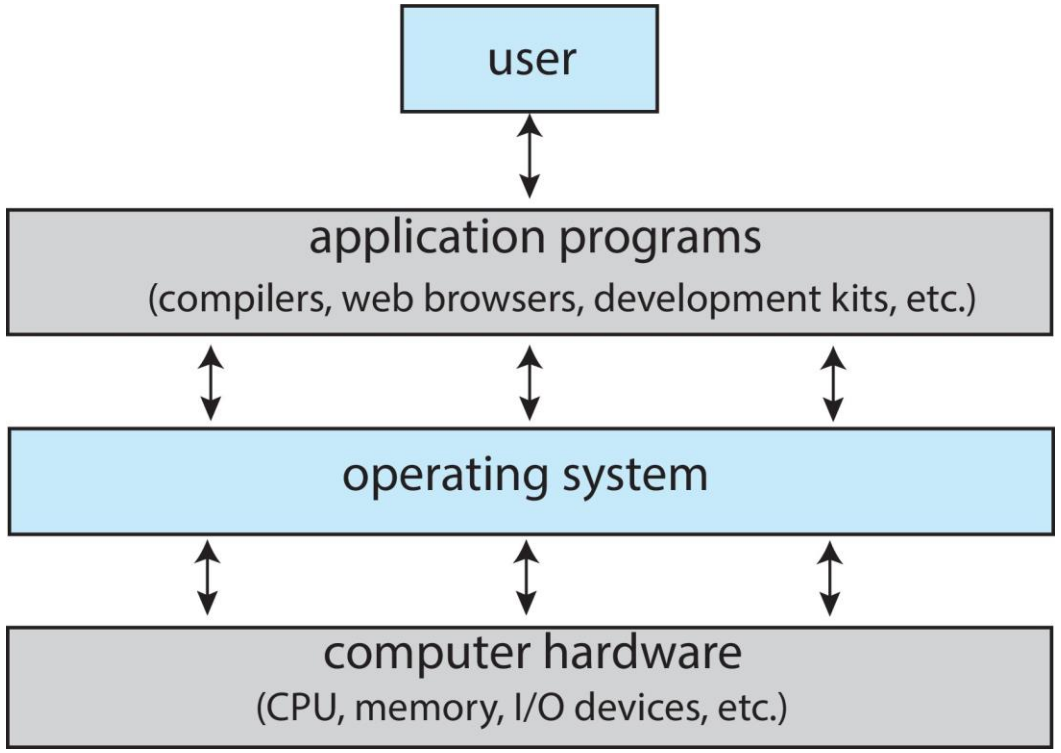
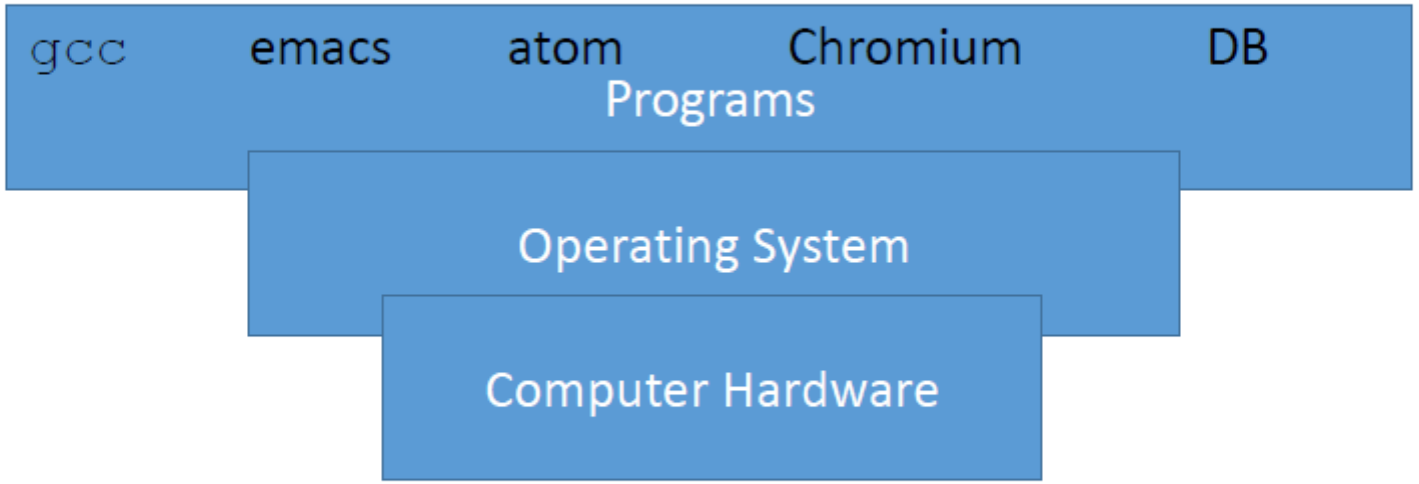


RESOURCE MANAGEMENT



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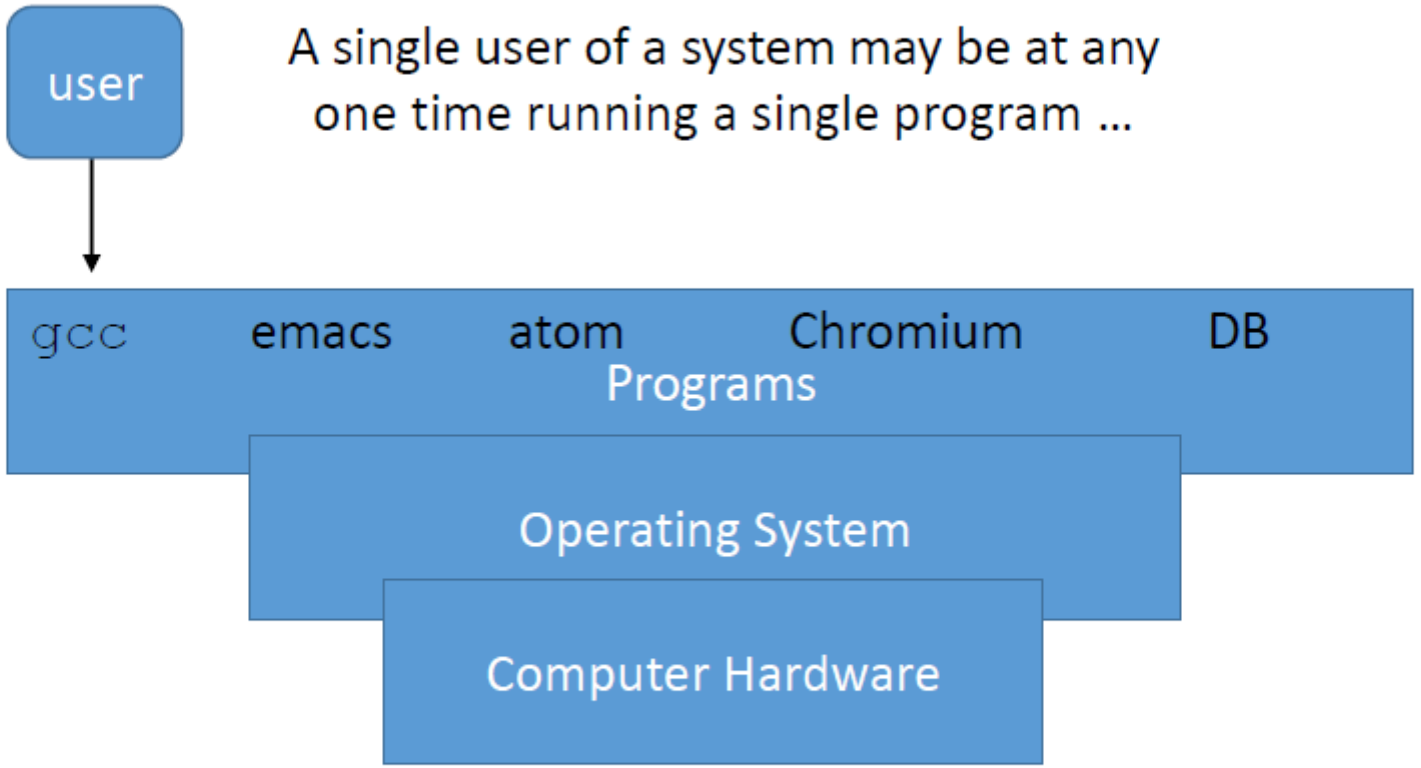

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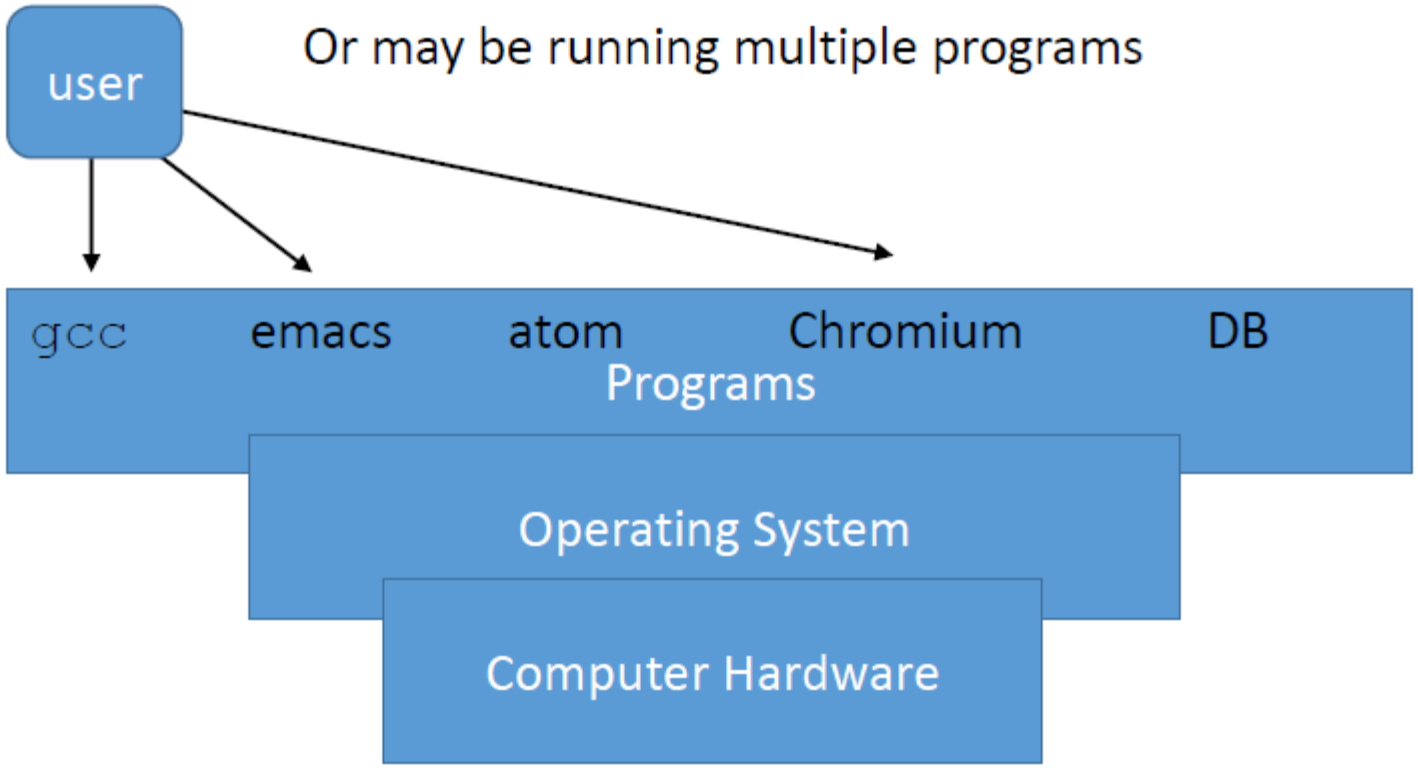

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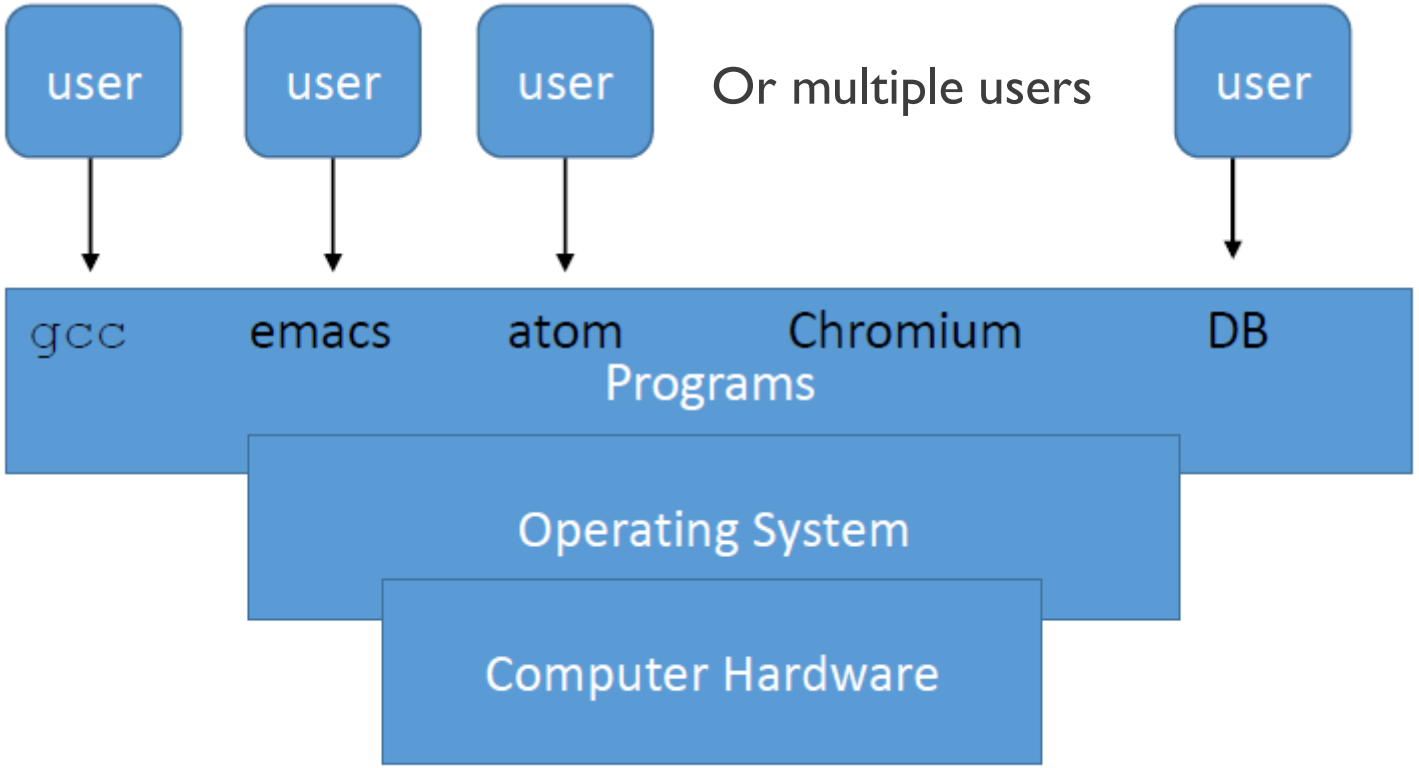

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OPERATING SYSTEMS: MULTIPROGRAMMING

- One of the major functions of operating systems is managing multiprogramming.
- Multiprogramming: beyond simply loading/unloading different programs.
- Run multiple programs simultaneously.

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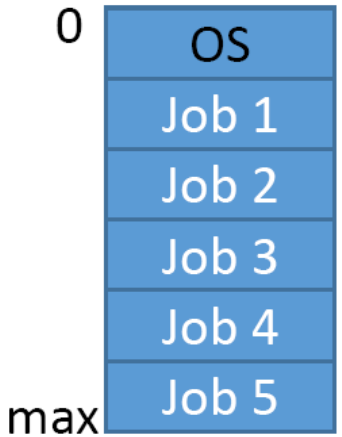
- Multiprogramming: beyond simply loading/unloading different programs.
- Run multiple programs simultaneously.
- Goal: Increases CPU utilization
  - Programs might be waiting on user input.
  - Programs might be waiting for device access.

OPERATING SYSTEMS: MULTIPROGRAMMING

- There will be multiple programs or ‘jobs’ running.



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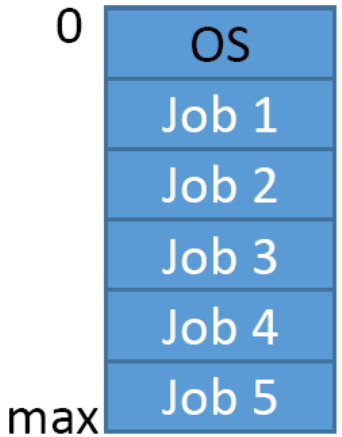

OPERATING SYSTEMS: MULTIPROGRAMMING

- There will be multiple programs or ‘jobs’ running.
- The OS alternate between running each.
- With enough speed it would *appear* that all the programs are running simultaneously. This is of course not true (unless we have multiple CPUs).