Operating Systems Overview

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Introduction

- What Operating Systems Do
- Computer-System Organization
- Computer-System Architecture
- Operating-System Structure
- Operating-System Operations
- Process Management
- Memory Management
- Storage Management
- Protection and Security
- Kernel Data Structures
- Computing Environments
- Open-Source Operating Systems

Objectives

- To describe the basic organization of computer systems
- To provide a grand tour of the major components of operating systems
- To give an overview of the many types of computing environments

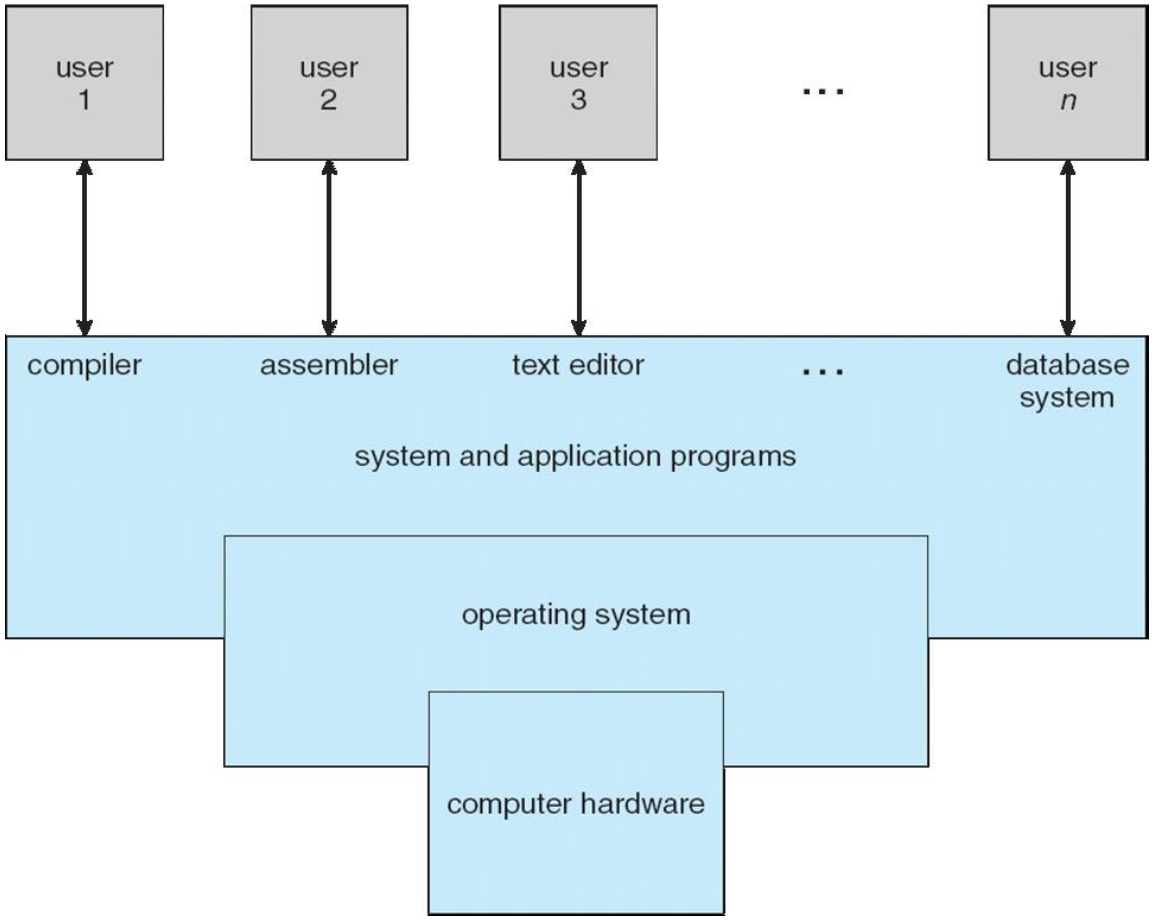
What is an Operating System?

- A program that acts as an intermediary between a user of a computer and the computer hardware
- Operating system goals:
  - Execute user programs and make solving user problems easier
  - Make the computer system convenient to use
  - Use the computer hardware in an efficient manner

Computer System Structure

- Computer system can be divided into four components:
  - Hardware – provides basic computing resources
    - CPU, memory, I/O devices
  - Operating system
    - Controls and coordinates use of hardware among various applications and users
  - Application programs – define the ways in which the system resources are used to solve the computing problems of the users
    - Word processors, compilers, web browsers, database systems, video games
  - Users
    - People, machines, other computers

Four Components of a Computer System



What Operating Systems Do

- Depends on the point of view
- Users want convenience, **ease of use** and **good performance**
  - Don't care about **resource utilization**
- But shared computer such as **mainframe** or **minicomputer** must keep all users happy
- Users of dedicate systems such as **workstations** have dedicated resources but frequently use shared resources from **servers**
- Handheld computers are resource poor, optimized for usability and battery life
- Some computers have little or no user interface, such as embedded computers in devices and automobiles

Operating System Definition

- OS is a **resource allocator**
  - Manages all resources
  - Decides between conflicting requests for efficient and fair resource use
- OS is a **control program**
  - Controls execution of programs to prevent errors and improper use of the computer

Operating System Definition (Cont.)

- No universally accepted definition
- “Everything a vendor ships when you order an operating system” is a good approximation
  - But varies wildly
- “The one program running at all times on the computer” is the **kernel**.
- Everything else is either
  - a system program (ships with the operating system) , or
  - an application program.

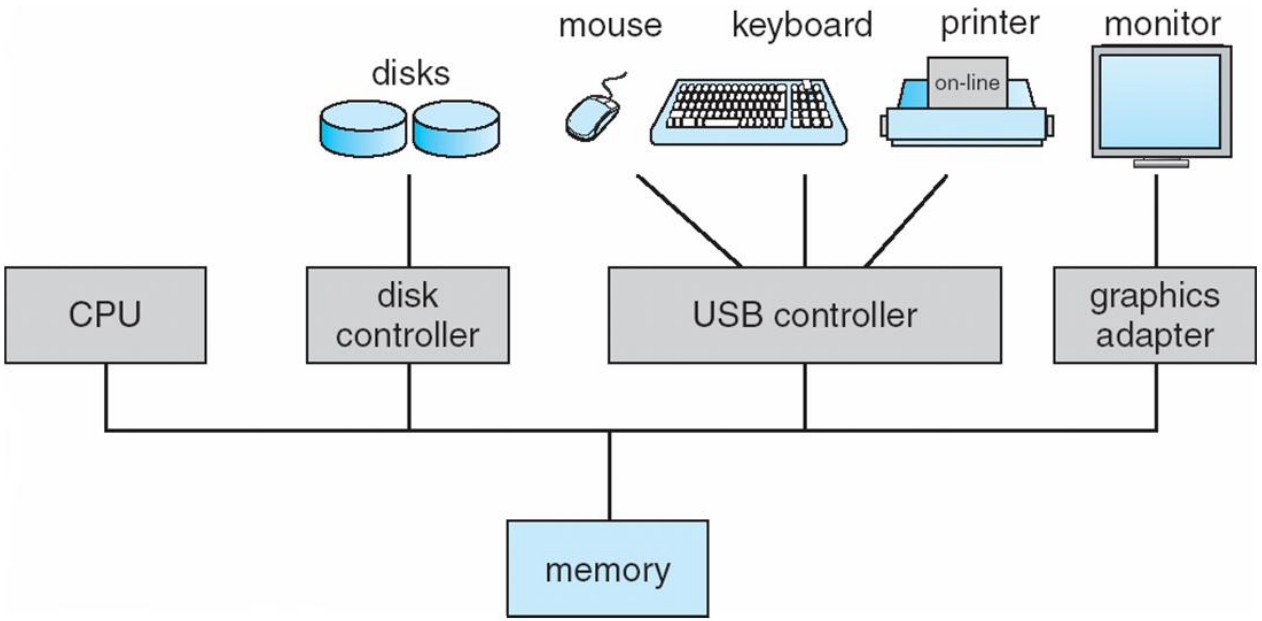
Computer Startup

- **bootstrap program** is loaded at power-up or reboot
  - Typically stored in ROM or EPROM, generally known as **firmware**
  - Initializes all aspects of system
  - Loads operating system kernel and starts execution

We are going to explore this as part of the practical assessment.

Computer System Organization

- Computer-system operation
  - One or more CPUs, device controllers connect through common bus providing access to shared memory
  - Concurrent execution of CPUs and devices competing for memory cycles



The course

- Each week there will be video material posted on Blackboard
  - It is expected that you watch these
  - They will form part of the assessment
- Assessment
  - Worksheet 0
    - Setup (most already should have done this in year 1)
    - Introduction to assembly programming
    - Introduction to building programs with make
  - Worksheet 1
    - The beginnings of a small Operating System
    - Moving to C
    - Framebuffer

Assessment

- Worksheet 0 (25%)
  - Setup (most already should have done this in year 1)
  - Introduction to assembly programming
  - Introduction to building programs with make
- Worksheet 1 (Nov, 2024) (25%)
  - The beginnings of a small Operating System
  - Moving to C
  - Framebuffer driver (output)
- Worksheet 2 (Dec, 2025) (50%)
  - Keyboard driver (input)
  - Command line interface
  - Going further

Viva (Jan 2025)

- Work will be marked through a 10-minute, in person, viva
  - In your practical
  - Last two weeks of the semester
  - You must attend your viva to get a mark

- Viva
  - Demonstrate your worksheets
  - It will be expected to:
    - Walk thorough the code explaining what you have done
    - Walk through your readme
    - Demonstrate understanding of the lecture material in the work you have done