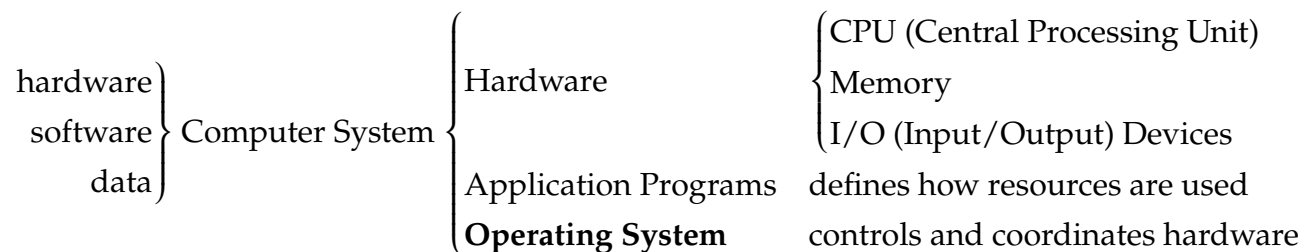


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1 Overview

1.1 What Operating Systems Do

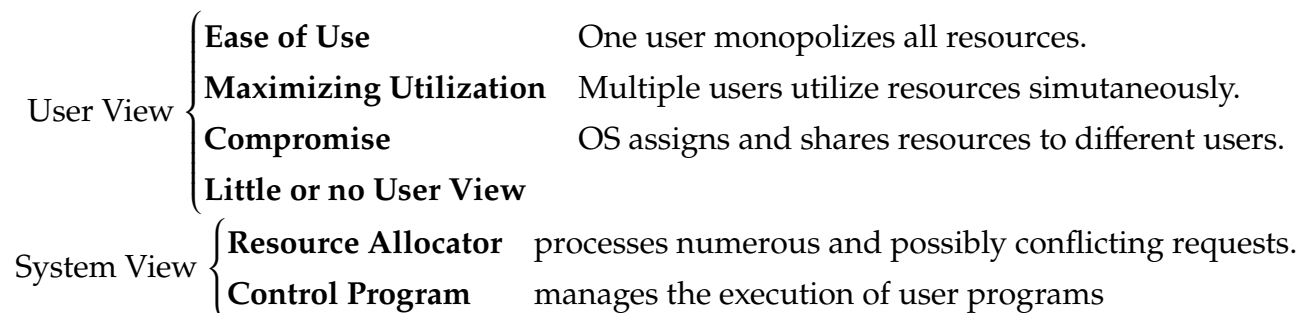


Components of a Modern Computer System

An **operating system** is a software that

- manages and controls a computer's hardware;
- coordinates and optimizes utilization of hardware;
- provides a basis for application programs.

An operating system is similar to a *government*, who performs no useful function, but provides an environment within which other programs can do useful work.



1.2 Computer-System Organization

1.2.1 Computer-System Operation

Requires Memory Controllers — Memory Cycles

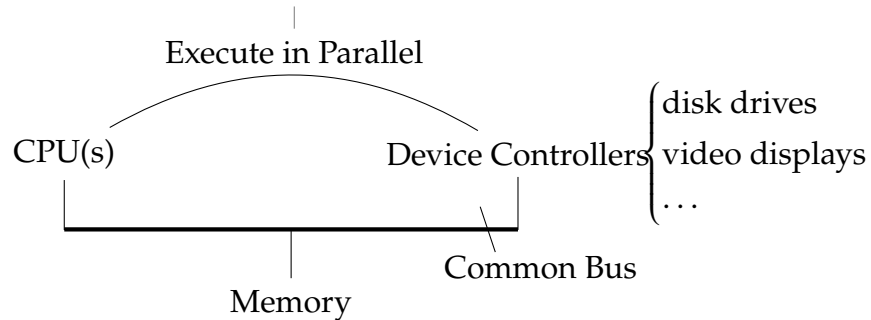
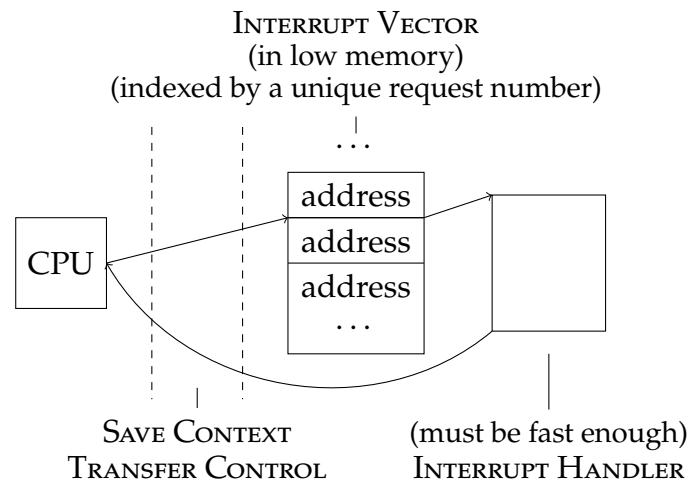


Figure: Components of Modern General-Purpose Computer

For a computer to start running, it

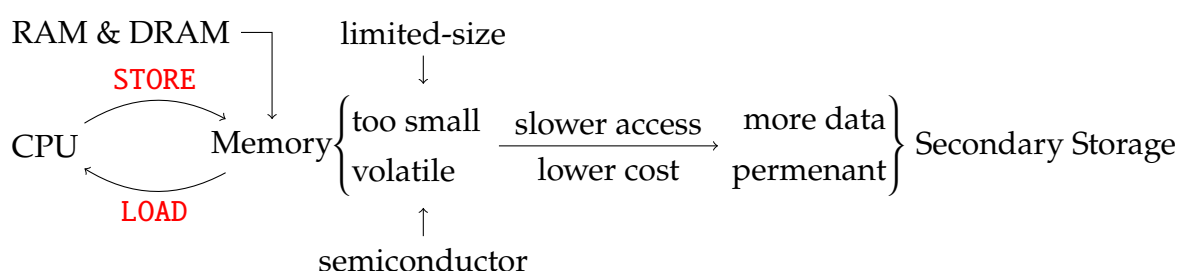
1. runs **bootstrap program**, which
 - tends to be simple.
 - is stored in **read-only memory** (ROM), or Electrically Erasable Programmable ROM
 - initializes all aspects of the OS, from CPU registers to device controllers to memory.
 - locates the operating system and loads it to memory (\Leftarrow know how to load and start)
2. loads service programs (**system daemons**: outside kernel, loaded at boot, runs entire time)

The event is signaled by an **interrupt** from either hardware or software.



1.2.2 Storage Structure

All forms of memory provide **an array of bytes**. Each byte has its own address.



Other types of memory:

- Cache: stores data to reduce time cost of further request for that data.
- ROM: cannot be changed \Rightarrow ONLY static programs (e.g., bootstamp program).
- EEPROM: change is slow \Rightarrow mostly static programs (e.g., factory-installed programs).

Hierarchy	Magnitude	Volatility	Implementation
Registers	bytes	\checkmark	MOSFET
Cache	16KB ~ 50MB	\checkmark	MOSFET
Main Memory	8GB ~ 64GB	\checkmark	MOSFET
Solid-state Disks	≥ 100 GB	\bigcirc / \times	Flash Memory
Magnetic Disks	≥ 500 GB	\times	Magnetic Poles
Optical Disks		\times	Pits & Lands
Magnetic Tapes	TB	\times	Magnetic Memory

Table: Information and Hierarchy of Storage
(higher in hierarchy \Rightarrow larger capacity, more expensive, and faster)