



Operating Systems

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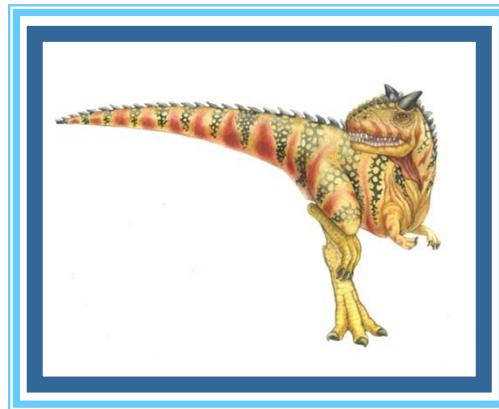
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Chapter 1: Introduction



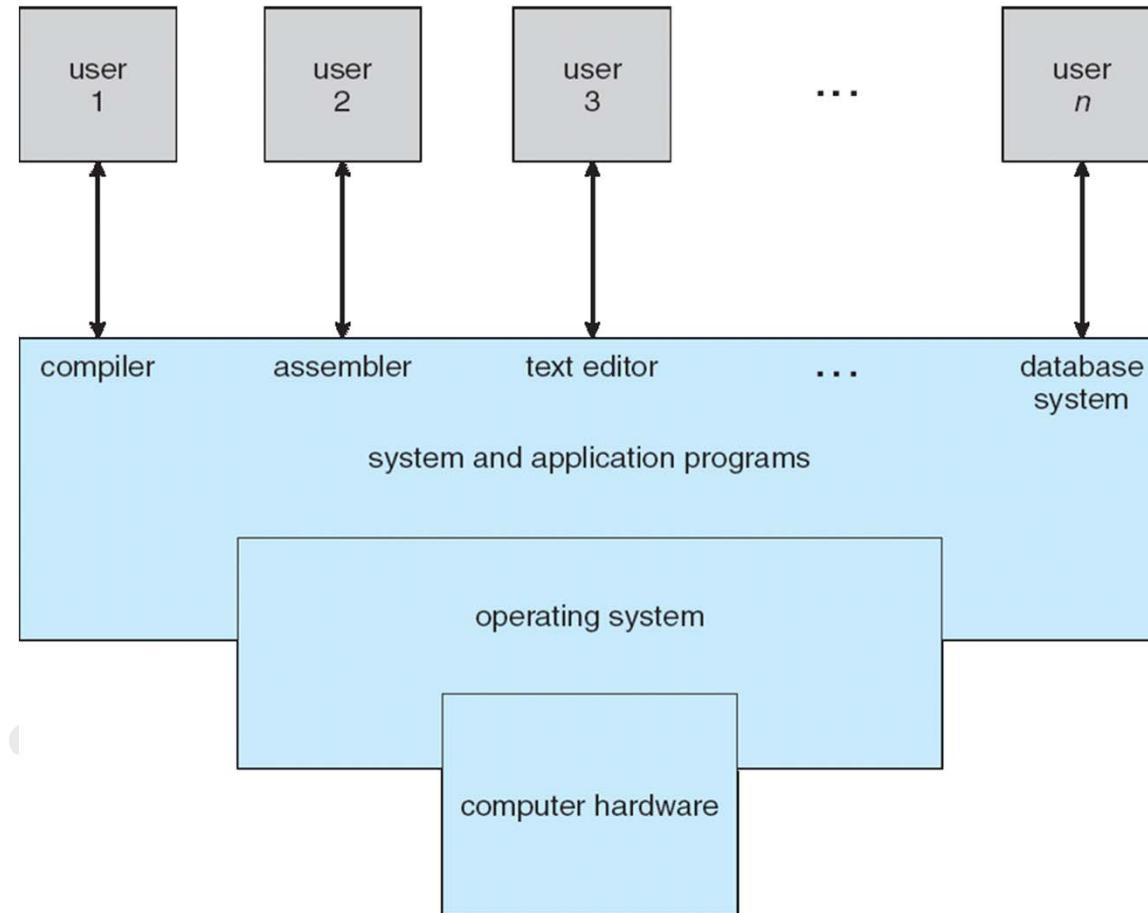


Chapter 1: Introduction

- 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



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 dedicated 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 such as CPU time, memory space, file-storage space, I/O devices and so on
 - 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

- No universally accepted definition
- “Everything a vendor ships when you order an operating system” is a good approximation
 - But varies wildly
- Controlling and allocating resources
- “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.
- 1998, US Department of justice filed suit against Microsoft and it was found guilty.



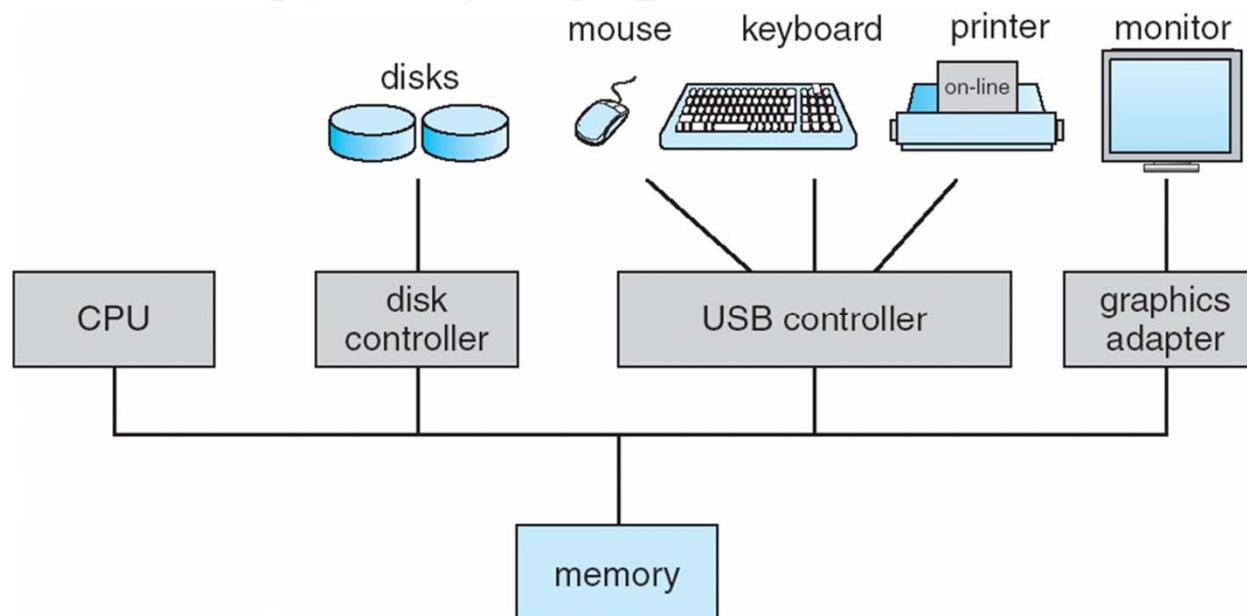
Computer Startup

- **bootstrap program** is loaded at power-up or reboot
 - Typically stored in ROM or EEPROM, generally known as **firmware**
 - Initializes all aspects of system, CPU registers to device controllers to memory contents
 - Loads operating system kernel and starts execution
 - To accomplish this bootstrap program must locate the OS Kernel and load it into memory.



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





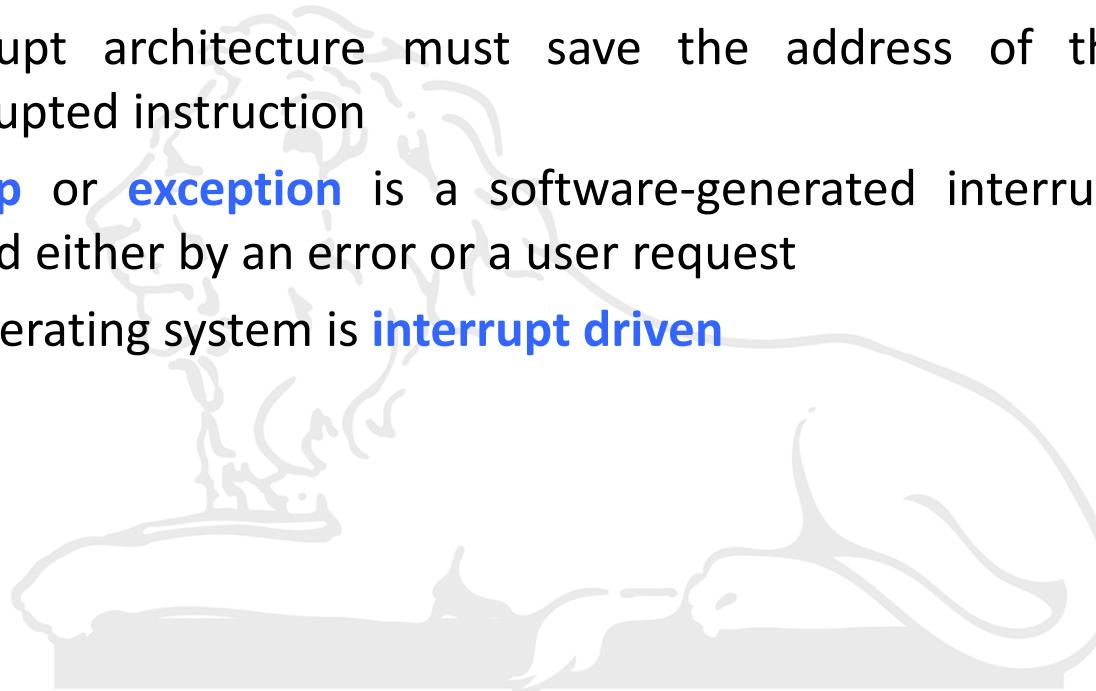
Computer-System Operation

- I/O devices and the CPU can execute concurrently
- Each device controller is in charge of a particular device type
- Each device controller has a local buffer
- CPU moves data from/to main memory to/from local buffers
- I/O is from the device to local buffer of controller
- Device controller informs CPU that it has finished its operation by causing an **interrupt**
- The occurrence of the event is usually signaled by an interrupt either by hardware or software
 - Hardware → may trigger interrupt by sending a signal to CPU, by the way of system bus
 - Software → may trigger interrupt by executing special operation called **System call** or **monitor call**



Common Functions of Interrupts

- Interrupt transfers control to the interrupt service routine generally, through the **interrupt vector**, which contains the addresses of all the service routines
- Interrupt architecture must save the address of the interrupted instruction
- A **trap** or **exception** is a software-generated interrupt caused either by an error or a user request
- An operating system is **interrupt driven**





Operations of CPU

- **Simple loop**

- An instruction is fetched from the memory location specified by the special register called the **program counter**
- The instruction is placed in a special register called the **instruction register**
- The program counter is incremented so it points to the next instruction to be executed
- The instruction decoder – **opcode**
- Depending on the operations, the value of one or more operands can be fetched from memory.