
hardware
systems
Operating
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System
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details
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iOS

UNIT- 1

OPERATING SYSTEMS OVERVIEW

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
- To explore several open-source operating systems

Introduction

- What is an Operating System?
- Mainframe Systems – eg: IBM's OS/360 , z/os
- Desktop Systems – eg: Linux , windows
- Multiprocessor Systems – eg: Linux , windows ,unix
- Distributed Systems – eg: Linux , windows
- Clustered System – eg: Angel ,Amoeba , Alpha kernel
- Real -Time Systems – eg: Vxworks , QNS , RTLinux
- Handheld Systems – eg: Symbian OS,Palm os , windows CE ,Linux

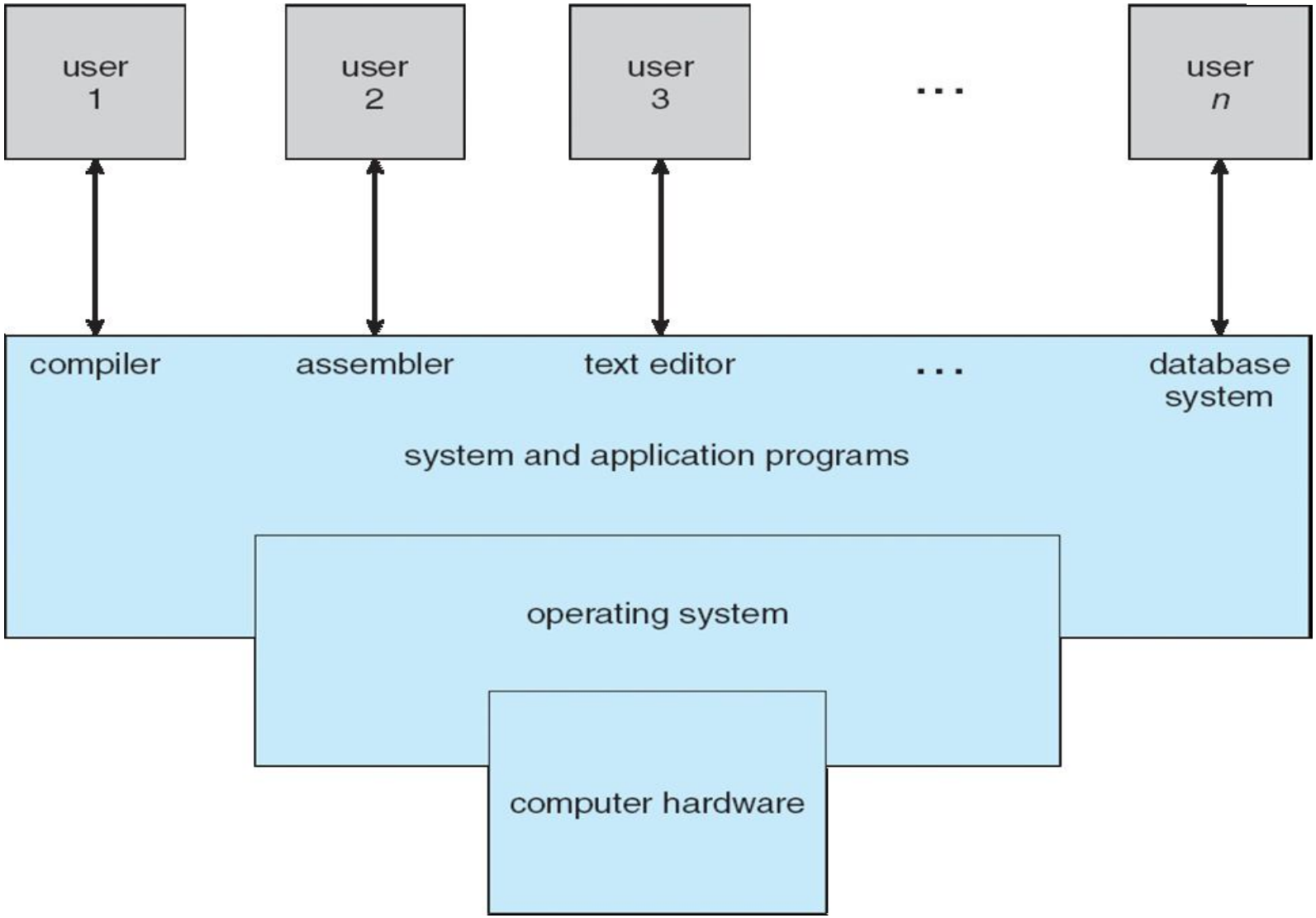
What is an Operating System?

- 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

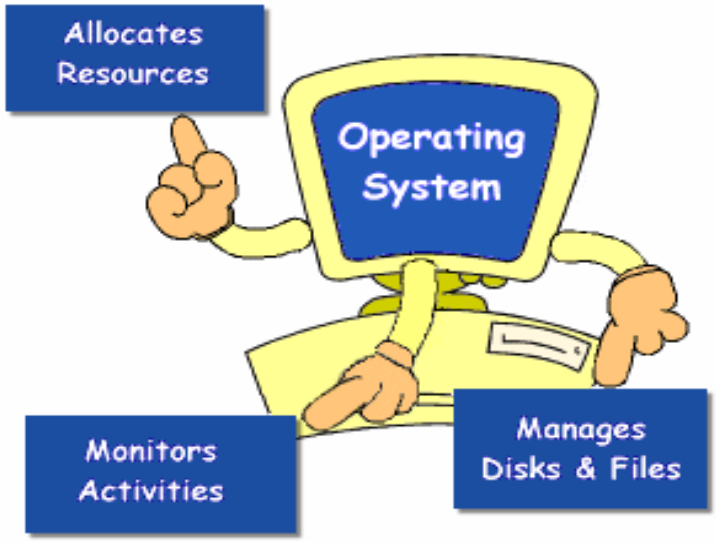


What Operating Systems Do

- 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.)

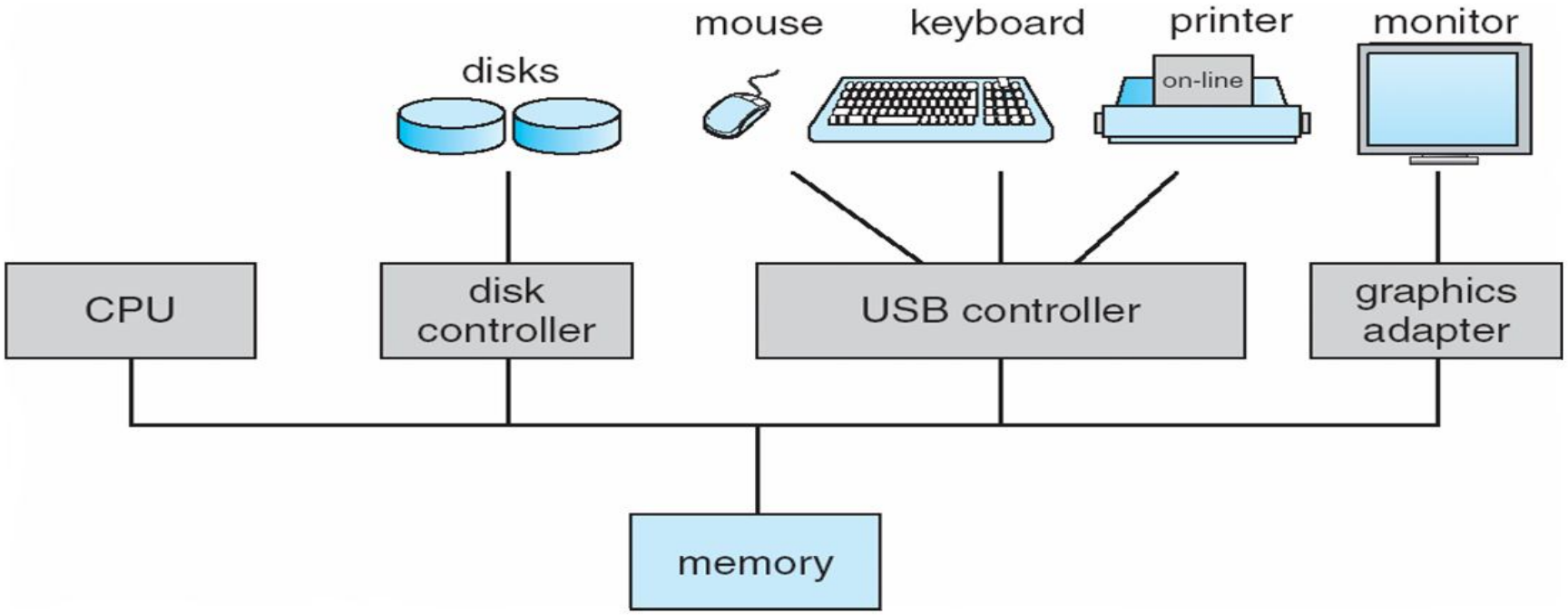
- The one program running at all times on the computer" is the **kernel**.
- Everything else is either
  - a system program (ships with the operating system) , or
  - an application program

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

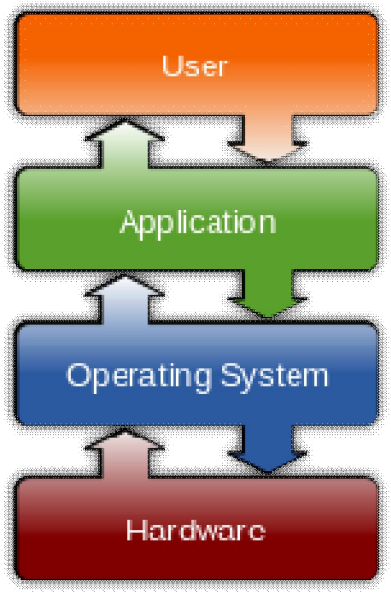
Computer System Organization

- 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 has a local buffer
- CPU moves data from/to main memory to/from local buffers
- Device controller informs CPU that it has finished its operation by causing an interrupt
- Interrupt is an event external to the currently executing process that causes a change in the normal flow of instruction execution; usually generated by hardware devices external to the CPU



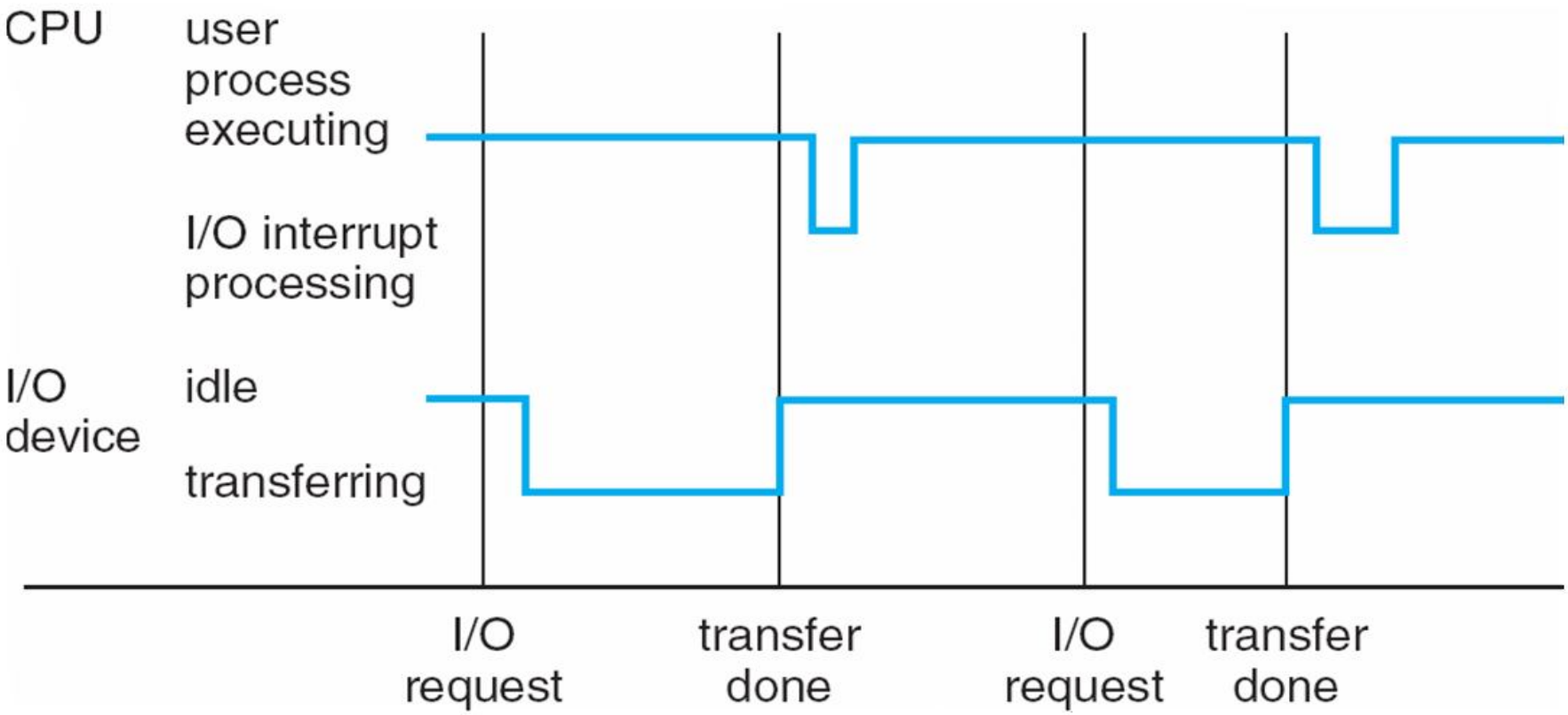
Common Functions of Interrupts

- 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
- Incoming interrupts are *disabled* while another interrupt is being processed to prevent a *lost interrupt*.
- A **trap** or **exception** is a software-generated interrupt caused either by an error or a user request
- An operating system is **interrupt driven**

Interrupt Handling

- The operating system preserves the state of the CPU by storing registers and the program counter
- Determines which type of interrupt has occurred:
  - **polling**
  - **vectored** interrupt system
- Separate segments of code determine what action should be taken for each type of interrupt

Interrupt Timeline



I/O Structure

- After I/O starts, control returns to user program only upon I/O completion
  - Wait instruction idles the CPU until the next interrupt
  - Wait loop (contention for memory access)
  - At most one I/O request is outstanding at a time, no simultaneous I/O processing
- After I/O starts, control returns to user program without waiting for I/O completion
  - **System call** – request to the OS to allow user to wait for I/O completion
  - **Device-status table** contains entry for each I/O device indicating its type, address, and state
  - OS indexes into I/O device table to determine device status and to modify table entry to include interrupt

Storage Definitions and Notation Review

The basic unit of computer storage is the **bit**. A bit can contain one of two values, 0 and 1. A **byte** is 8 bits, and on most computers it is the smallest convenient chunk of storage.

Computer storage, along with most computer throughput, is generally measured and manipulated in bytes and collections of bytes.
A **kilobyte**, or **KB**, is 1,024 bytes
a **megabyte**, or **MB**, is $1,024^2$ bytes
a **gigabyte**, or **GB**, is $1,024^3$ bytes
a **terabyte**, or **TB**, is $1,024^4$ bytes
a **petabyte**, or **PB**, is $1,024^5$ bytes

Common Data Storage Measurements

UNIT	VALUE
bit	1 bit
byte	8 bits
kilobyte	1,024 bytes
megabyte	1,024 kilobytes
gigabyte	1,024 megabytes
terabyte	1,024 gigabytes
petabyte	1,024 terabytes

Storage Structure

- Main memory – only large storage media that the CPU can access directly
  - **Random access**
  - Typically **volatile**
- Secondary storage – extension of main memory that provides large **nonvolatile** storage capacity
- Hard disks – rigid metal or glass platters covered with magnetic recording material
  - Disk surface is logically divided into **tracks**, which are subdivided into **sectors**
  - The **disk controller** determines the logical interaction between the device and the computer
- **Solid-state disks** – faster than hard disks, nonvolatile
  - Various technologies
  - Becoming more popular

Storage Hierarchy

- Storage systems organized in hierarchy
  - Speed
  - Cost
  - Volatility
- **Caching** – copying information into faster storage system; main memory can be viewed as a cache for secondary storage
- **Device Driver** for each device controller to manage I/O
  - Provides uniform interface between controller and kernel

Storage-Device Hierarchy