
# Chapter 1: Introduction

## (OS Structure, Modes and Services)

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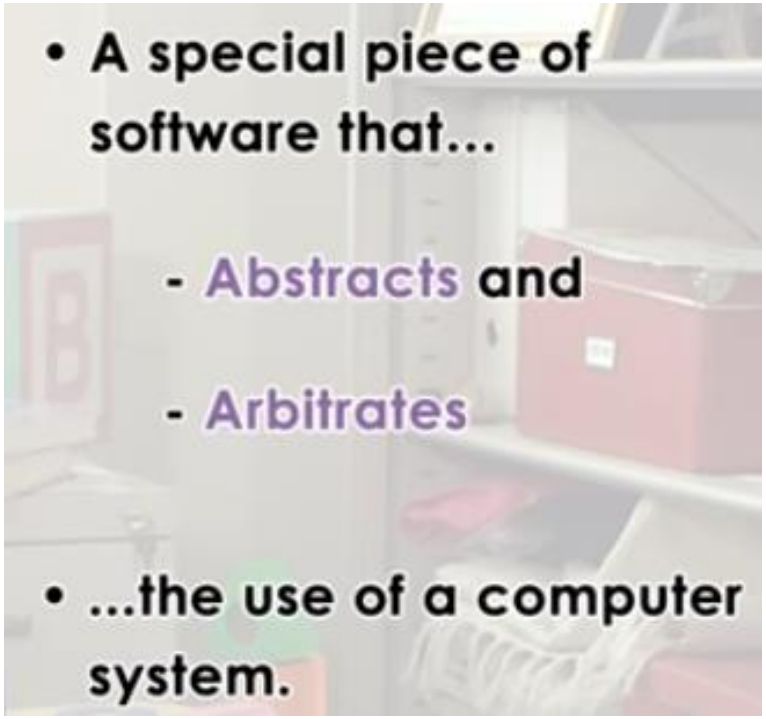
# OPERATING SYSTEM?




- Abstract: To simplify how hardware actually looks like.
- Arbitrate: To manage , to oversee the hardware use

# What is an Operating System?

- It is a layer of system software that:
  - directly has privileged access to underlined hardware
  - hides hardware complexity
  - manages hardware on behalf of one or more applications according to policies.

# What is an Operating System?

- What is an Operating system?
  - A program that acts as an intermediate/ interface between a user of a computer and the computer hardware.
  - Resource allocator (Managing the resources efficiently)
  - Control Program

- Operating system goals:
  - Execute user programs and make problem solving easier.
  - Make the computer system convenient to use
  - Efficiently use available resources

# What is an Operating System?

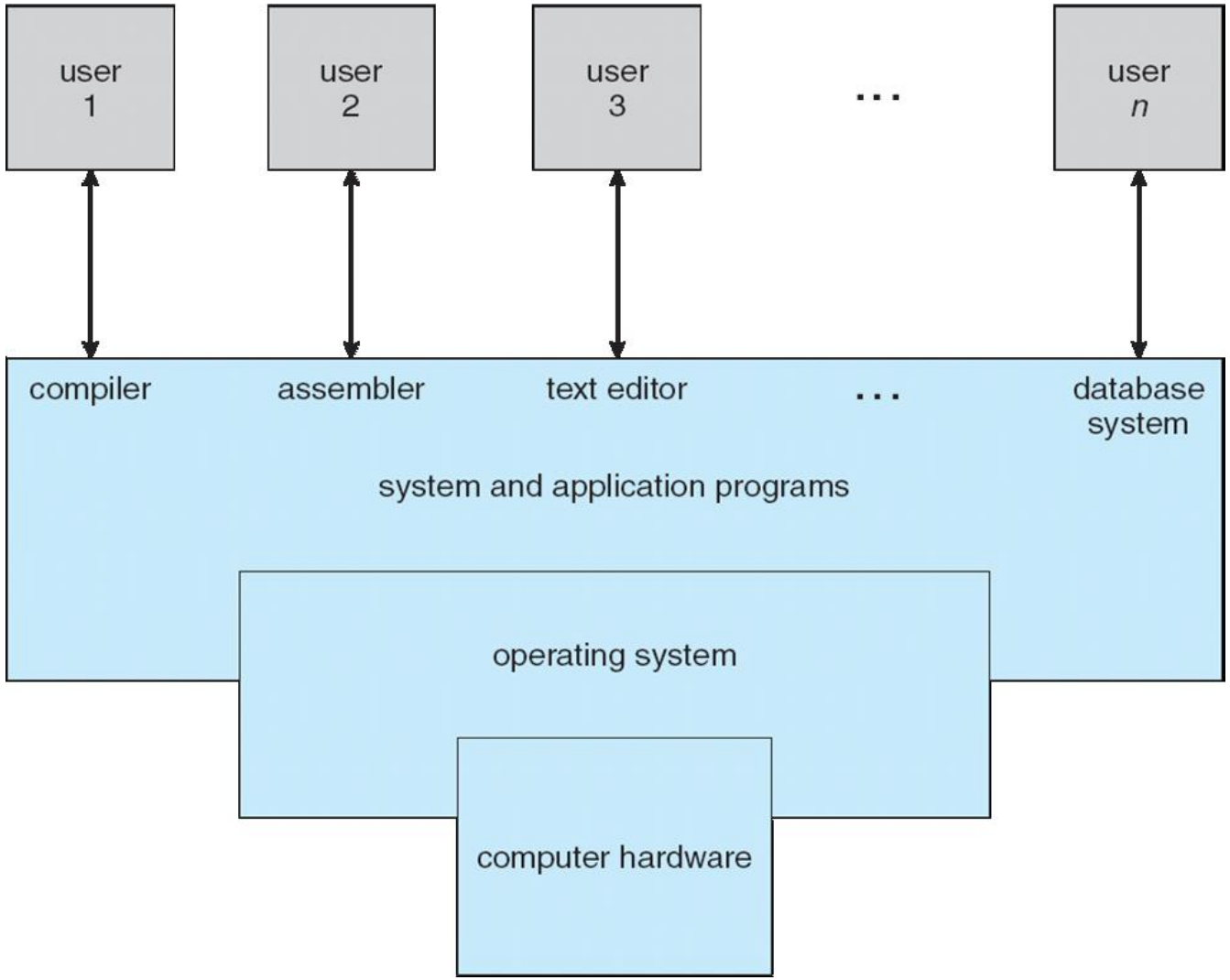
- An operating system is the one program that is running at all the times on the computer- usually called the kernel.

- Kernel is a program that (allow) let the hardware to recognize and read the program/process.

# Computer System Structure

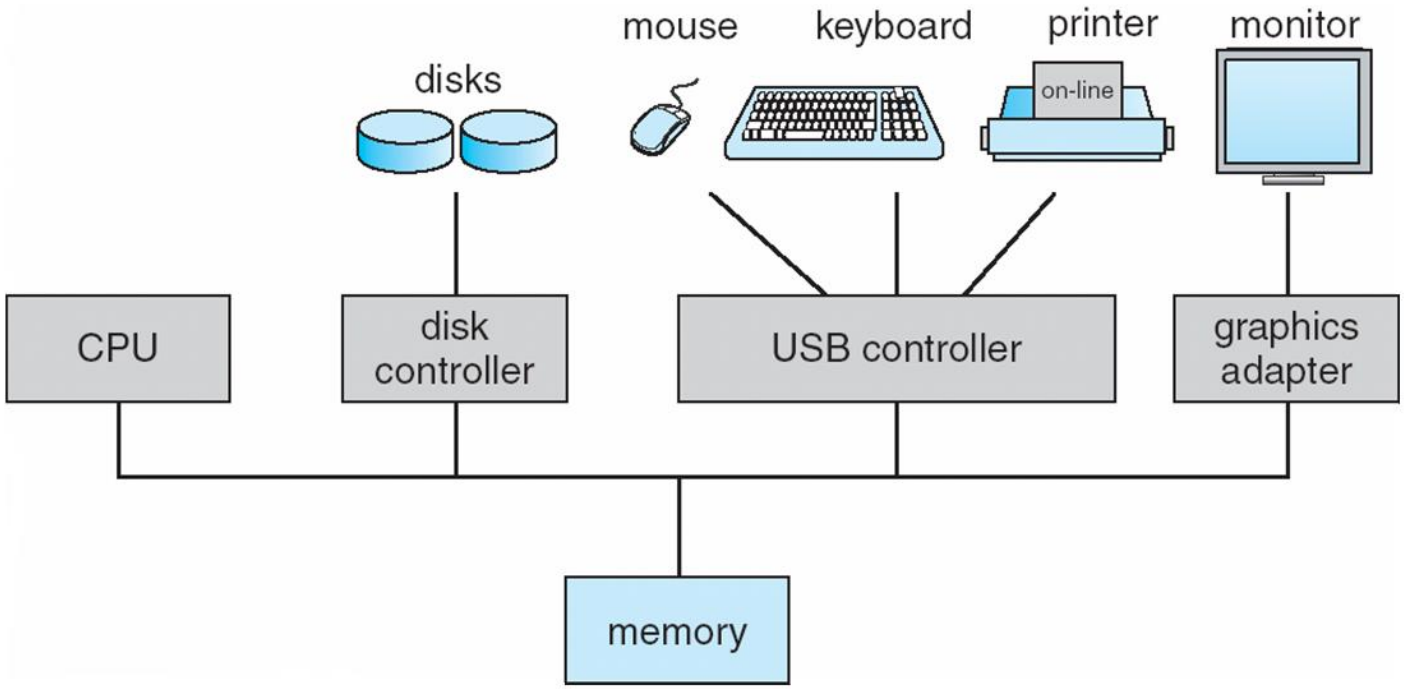
- **Computer system can be divided into four components:**
  - **Hardware** – provides **basic computing resources**
    - CPU, memory, I/O devices
  - **Operating system**
    - **Controls and coordinates use of resources** among various applications and users
  - **System/Application programs** – define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

# Four Components of a Computer System



# Computer System Organization

- Computer-system
  - 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



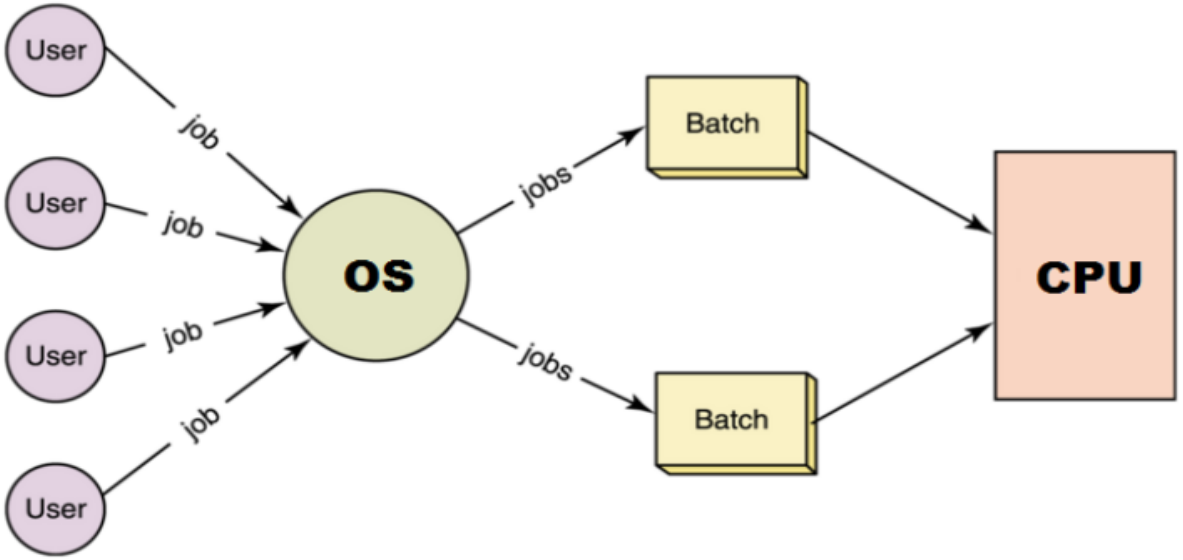
# TYPES OF OS

## Batch Systems

“Batch operating system” The users of a batch operating system do not interact with the computer directly.

Each user prepares his job on an off-line device like punch cards and submits it to the computer operator.

To speed up processing, jobs with similar needs are batched together and run as a group.



# TYPES OF OS: Batch Systems


- There is no direct interaction between user and the computer.
- The user has to submit a job (written on cards or tape) to a computer operator.
- Then computer operator places a batch of several jobs on an input device.
- Jobs are batched together by type of languages and requirements.
- Then a special program, the monitor program, manages the execution.

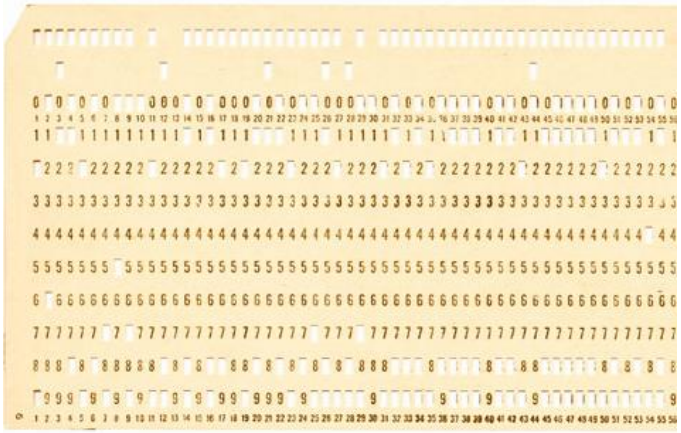
**Disadvantages:**

- No interaction between user and computer.
- No mechanism to prioritize the processes

# TYPES OF OS: Batch Systems

- Early computers were machines run from a console
- The common **input devices** were **card readers and tape drives**.
- The common **output** devices were **line printers, tape drives, and card punches.**

**User Prepares a JOB (Program) using Punch Cards → Computer Operator→ Wait for Output**



# Multiprogrammed OS

**Multiprogramming: When 2 or more processes reside in memory at the same time**

- Single user processes cannot keep CPU and I/O devices busy at all times
- **Multiprogramming organizes jobs (code and data) so CPU always has one to execute**
- Multiprogramming assumes a **single shared processor.** One job selected and run via **job scheduling**
- Multiprogramming increases CPU utilization.
- **It is mixture of I/O bound and CPU bound processes**

# Multiprogrammed OS

- In this the operating system picks up and begins to execute one of the jobs from memory.
- Once this job needs an I/O operation operating system switches to another job (CPU and OS always busy).
- Jobs in the memory are always less than the number of jobs on disk(Job Pool).

# Multiprogrammed OS

- If several jobs are ready to run at the same time, then the system chooses which one to run through the process of **CPU Scheduling**.

- In Non-multiprogrammed system, there are moments when CPU sits idle and does not do any work.

- In Multiprogramming system, CPU will never be idle and keeps on processing.

# Multiprogrammed OS

CPU scheduling is the basis of  multiprogramming operating systems

# Multitasking/Timesharing OS

- **Timesharing (multitasking)** when multiple jobs are executed by the CPU simultaneously by switching between them.
  - There is at least one program is executing in memory ⇨**process**
  - If several jobs ready to run at the same time ⇨ **CPU scheduling**
  - If processes don't fit in memory, **swapping** moves them in and out to run
  - **Only one CPU is involved**, but **it switches** from one process to another **so quickly** that it gives the appearance of **executing all of the processes at the same time.**

# Multitasking/ Time Sharing

- Types of Multitasking:

1. **Preemptive:** the operating system parcels CPU *time slices* to each program.
2. **Cooperative:** each program can control the CPU for as long as it needs it.

If a program is not using the CPU, however, it can allow another program to use it temporarily.

In time sharing systems the prime focus is on minimizing the response time, while in multiprogramming the prime focus is to maximize the CPU usage.

# Multiprocessing OS

- A multiprocessor system consists of several processors that share a common physical memory.
- Multiprocessor system provides higher computing power and speed.
- In multiprocessor system all processors operate under single operating system.

# Multiprocessing OS

- Multi-processor systems; that is, they **have multiple CPU.**

- **Also known as parallel systems** or **tightly coupled systems**

- **Such systems have more than one processor** in close communication, sharing the computer bus, the clock, and sometimes memory and peripheral devices.

# Distributed Systems

- A network is a communication path between two or more systems.
- Each system over the network keeps copy of the data, and this leads to Reliability (Because if one system crashes , data is not lost).

- CLIENT SERVER SYSTEMS
- PEER TO PEER SYSTEMS

# Real Time Systems

- **Time bound systems**
- Real time systems are of 2 types:

- **1. Soft Real time Systems:** Process should complete in specific time but May have some delay (Positive delay) and will not harm the system.

**Exp: Session expires but can be re-logged in.**

- **2. Hard Real Time Systems:** Each process is assigned a specific time instance, and Process must complete in that time otherwise system will crash.

# Operating System Views

**OS can be explored from 2 view points:**

**1. User view**:

- The goal of the Operating System is to **maximize the work and minimize the effort of the user**.
- Operating System gives an effect to the **user as if the processor is dealing only with the current task**, but in background processor is dealing with several processes.

# Operating System Views

**OS can be explored from 2 view points:**

## 2. System View:

Operating System is a program involved with the hardware.

- OS is a **resource allocator**
  - Allocates and Manages all resources and their sharing.
  - 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**
  - **It prevents** improper usage, error and handle **deadlock** conditions.

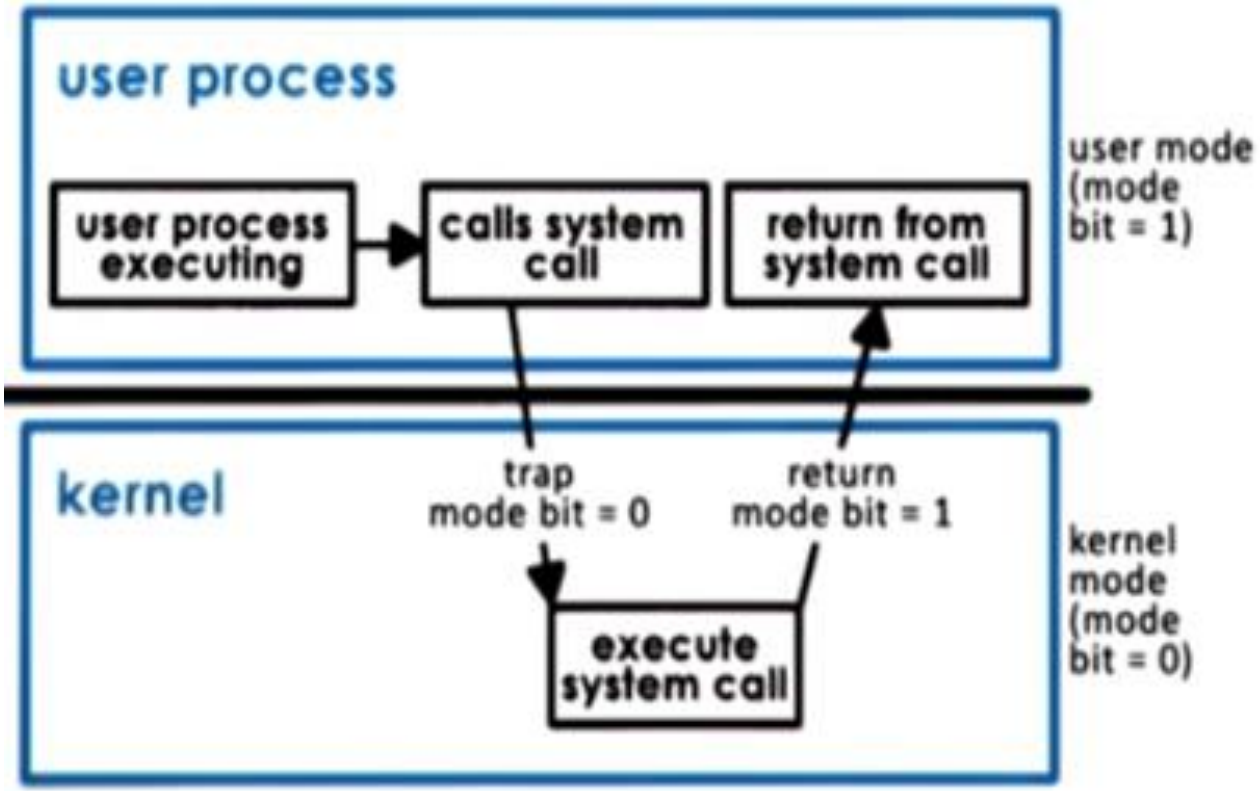
# Operating-System Operations

- **OS's are Interrupt driven**. If no process, no I/o devices, No users then OS will sit quietly waiting for some event to occur.

# Operating-System Operations

- **To protect OS, Dual-mode** operations exist:
  - **User mode (1)** and **kernel mode (0)**
  - A **Mode bit is added to** hardware to indicate mode
    - Provides ability to distinguish when system is running user mode or kernel mode
    - System call changes mode to kernel, return from call resets it to user

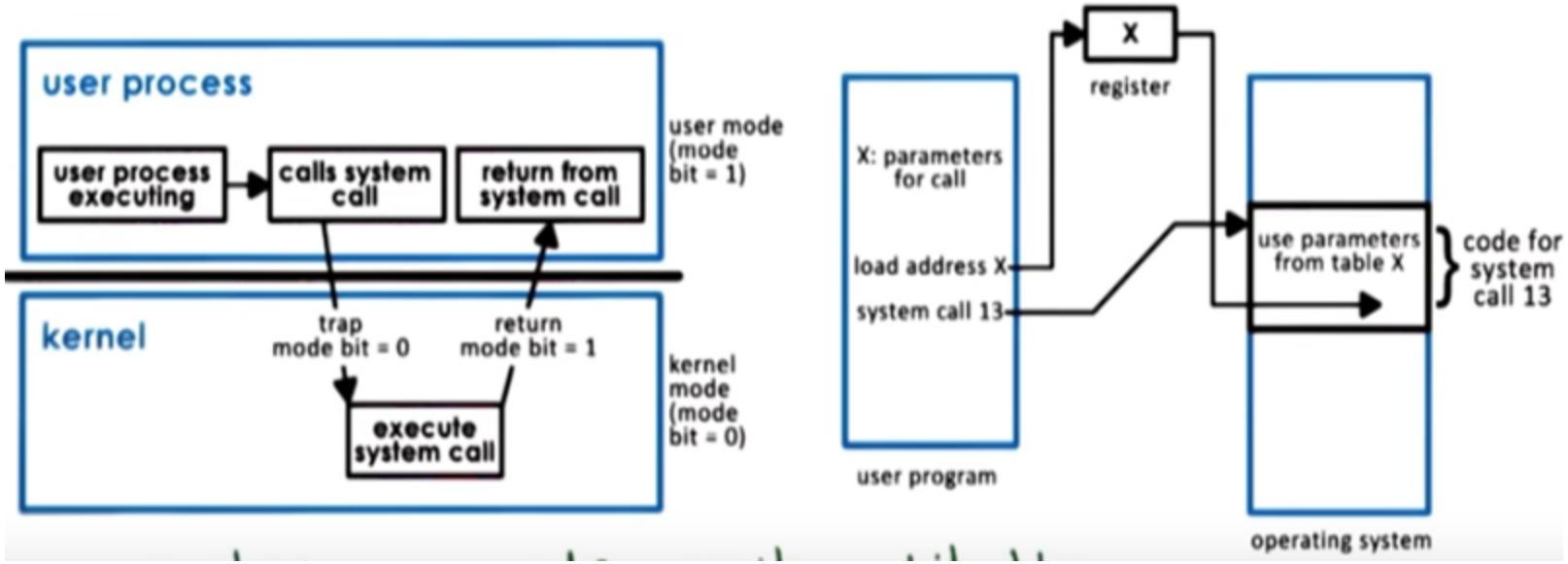
# Transition from User to Kernel Mode




To make a system call an application must

- write argoments
- save relevant data at well-defined location
- make system call

# Transition from User to Kernel Mode



# Operating System Structure

- Various ways to structure  a system

Q1. Which program controls the execution of programs to prevent errors and improper use of computer?

a) Resource allocator

b) Control Program

c) Hardware

d) None of the above

Q2. The operating system switches from user mode to kernel mode so the mode bit will change from?

a) 0 to 1

b) 1 to 0

c) Remain constant

d) None

Q3. In which type of operating system users do not interact directly with the computer system?

a) Multiprogramming operating systems

b) Multiprocessing operating systems

c) Batch operating systems

d) Distributed operating systems

Ans 3) c

Q4. What is the objective of multiprogramming operating systems?

a) Maximize CPU utilization

b) Switch the CPU among processes

c) Achieve multitasking

d) None of the above

Ans4. a)

Q5. Which program/unit signalled for the occurrence of an event either from the hardware or the software?

a) Bootstrap program

b) Interrupt

c) Disk Controller

d) CPU

Ans5: b

Q6. In which type of I/O interrupts the control return to the user program after the completion of I/O operation?

a) Synchronous I/O interrupts

b) Asynchronous I/O interrupts

c) System Call

d) Hardware

Ans 6) a

Q7: The device-status table contains

a) each I/O device type

b) each I/O device state

c) each I/O device address

d) all of the above

(d)

Ans 7 (d)