Operating Systems : Introduction

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Agenda

- What is System
- Basics of computing systems
- OS Definition

What is System?

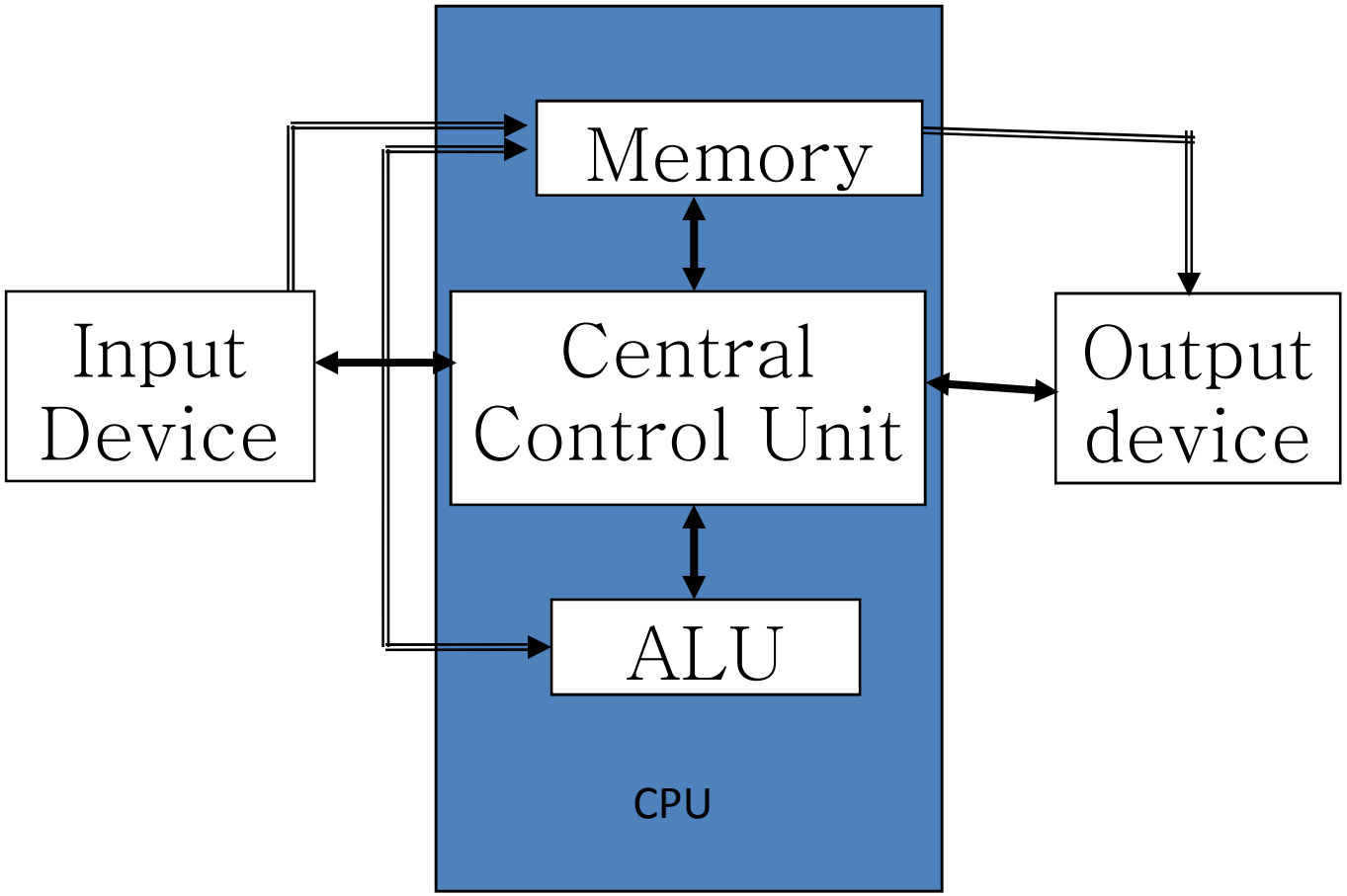
- A collection of components organized to accomplish a specific function or set of functions.

- A system is an assemblage of interdependent, inter-related elements (Components) forming a unified whole

What Is Operating System ?

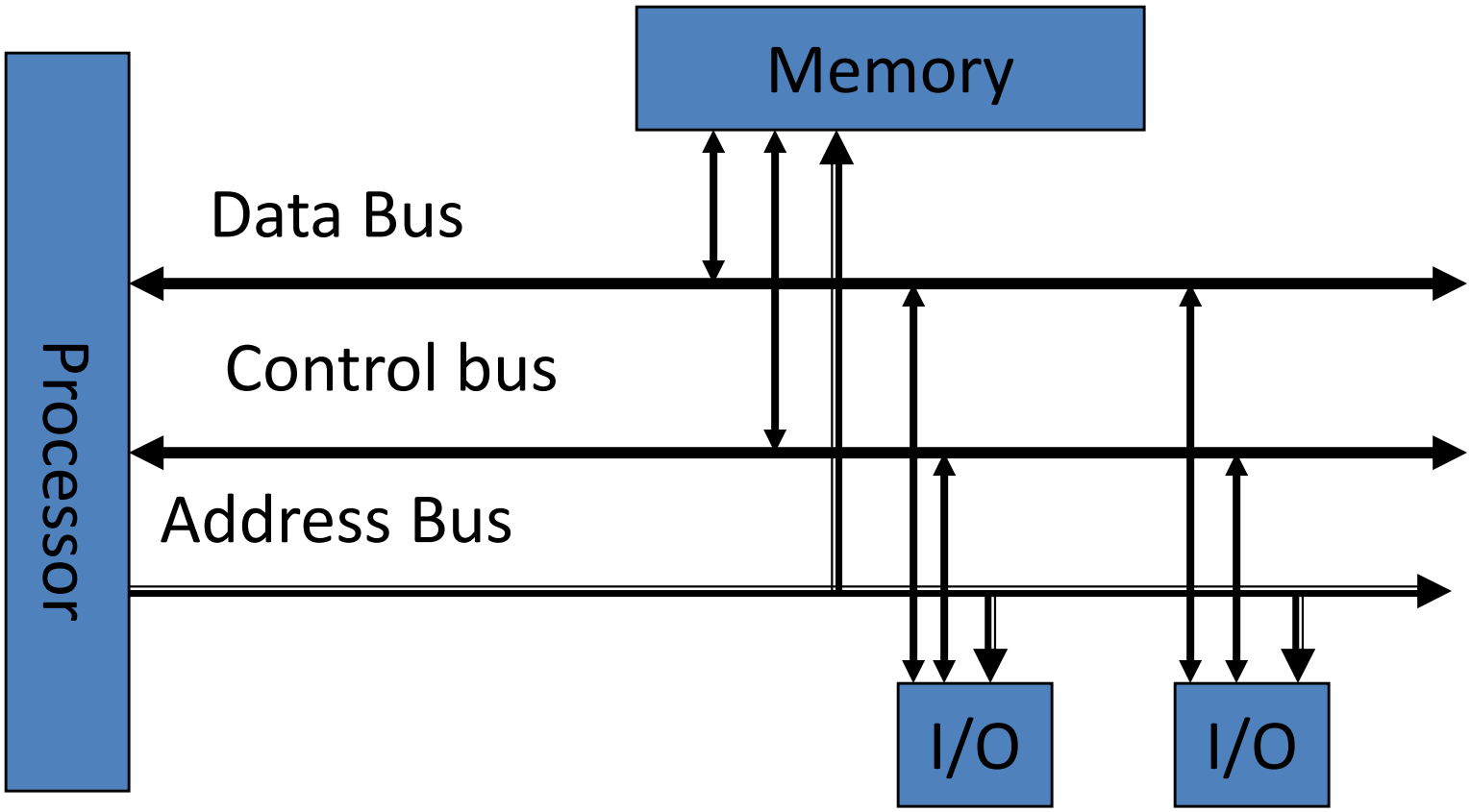
- A system that helps in operating computing systems
- Goal
  - Provides Ease of operation
  - Provides efficient resource management
- Feature
  - Its self loading and self executing code
  - OS Kernel is the code which is running all the time ?

Computer Block Diagram



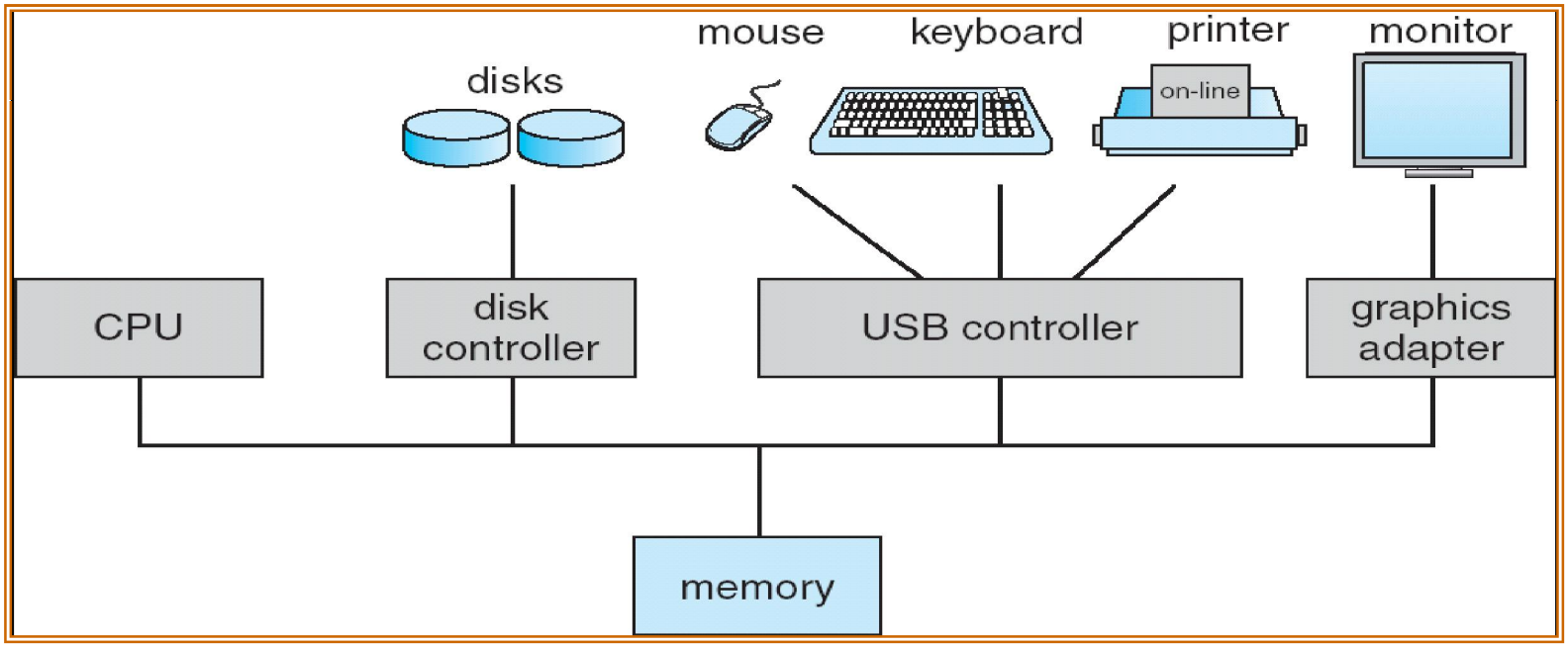
Main components of Computing systems

- CPU (Processor)
- Memory
- I/O Devices

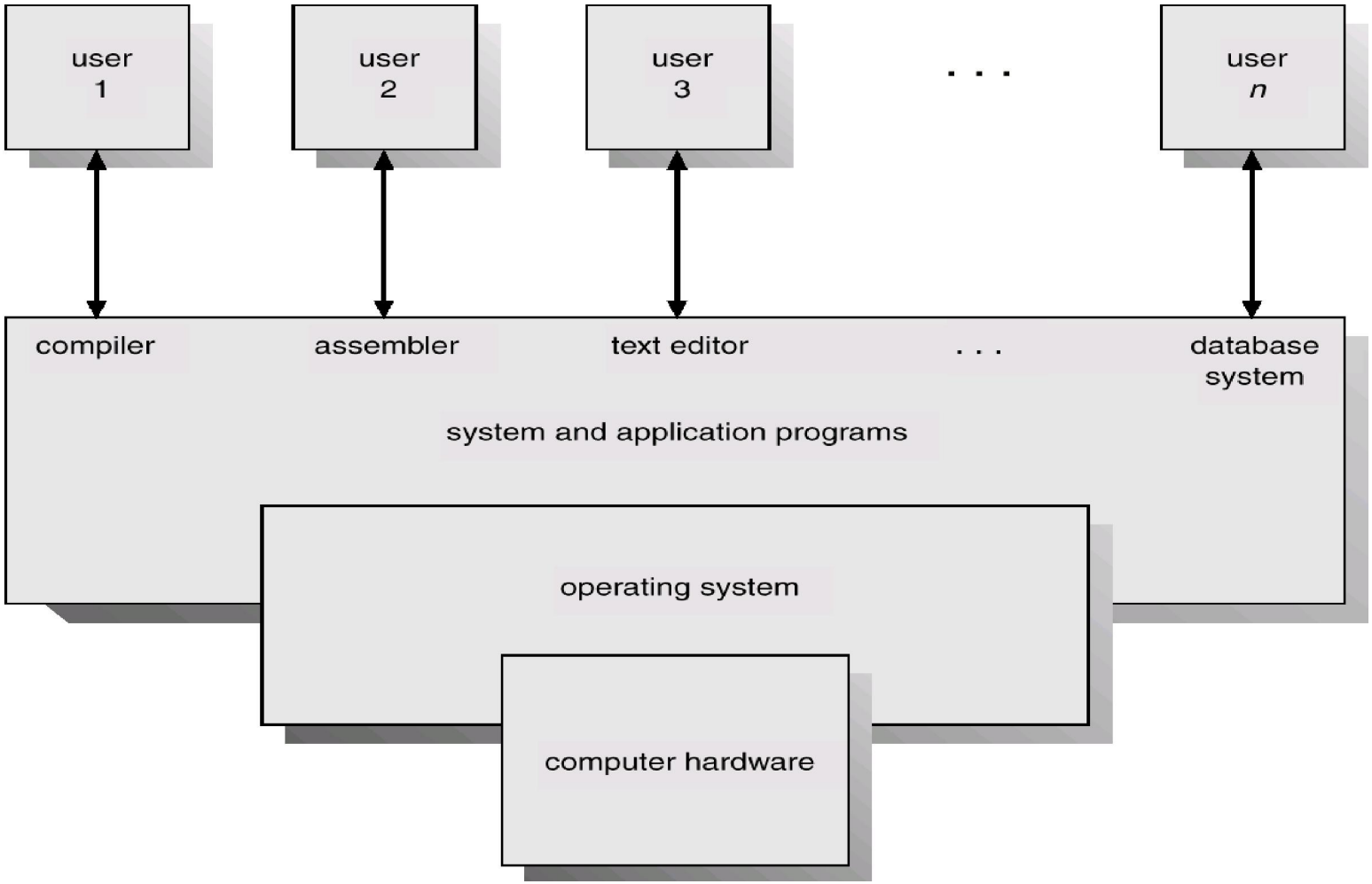

Memory
Data Bus
Control bus
Address Bus
Processor
I/O
I/O

Computer Organization

- One or more CPUs, device controllers connect through common bus providing access to shared memory
- Concurrent execution of CPUs and devices .



Computing System Components



Hardware Components

- Processor
- Memory
  - Cache Memory (Static RAM)
  - Primary Memory (RAM, ROM)
  - Secondary Memory (Hard Disk)
- I/O Devices
- System Bus eg. PCI, IDE, USB, etc.

Software components

- Operating system
- Compilers
- Assemblers
- Text editors
- Application programs

Operating System and Computer Architecture are tightly bonded together.

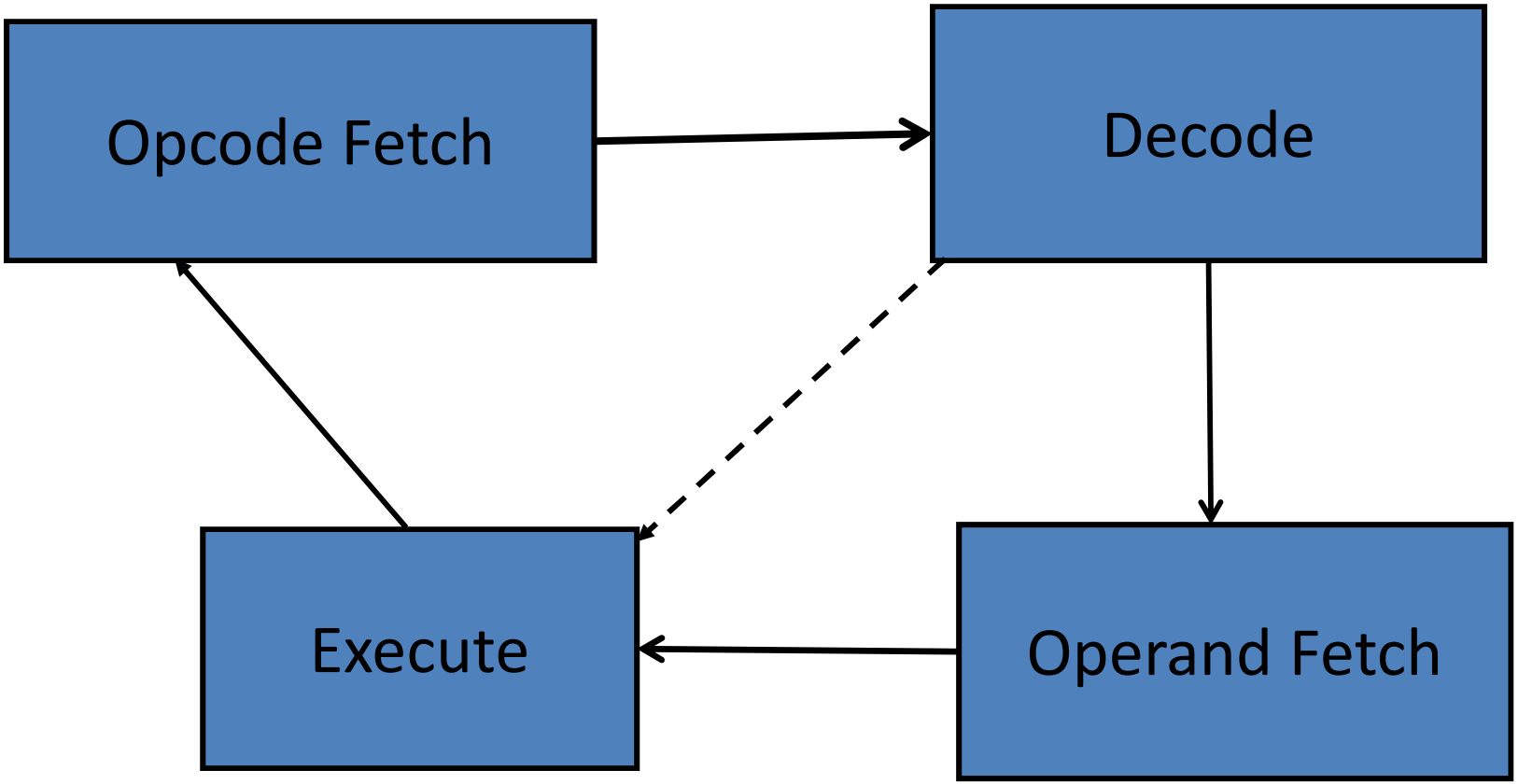
- Change in architecture usually leads to change in OS.
- The requirements of OS has led to several architectural changes.

How computers execute a program ?

What is program ?

- Program is a sequence of logically arranged instructions written to perform a specified task with a computer

Instruction execution



Instruction execution (contd..)

- Every instruction is associated with an operation code (Op-code)
- Processor decodes the op-code to determine the required operation
- If operation requires operand/s then fetch operand/s
- Execute instruction
- Eg. ADD AX,BX (AX ←— AX+BX)

Programs can execute only if it is loaded in Primary memory

Program loading issues

- Who loads it in memory ? User/System
- Who decides how much memory is required by a program? User/System
- Who decides where the program in memory is loaded? User/System
- How and when the execution begins?
- How to access memory and devices

Some more questions

- Can there be more than one program loaded in memory at the same time ? If Yes -
  - who will guarantee territorial integrity
  - Which particular program will run first and for how long?
  - How much memory should be allocated to each program?

Solution

- Bare Hardware is not enough. We need a component which will act as hardware resource manager

Operating system

- is a resource manager
- Responsible for efficient and optimal resource utilization

System resources are

- Processor
- Memory
- I/O devices
- Busses
- File system
- Network

User View of OS

- Ease of operation
- Resource sharing
  - Sequential sharing : A resource is allocated for exclusive use of program eg. CPU
  - Concurrent sharing: Two or more program concurrently use same resource eg. Files, memory, disk array etc.

Systems View of OS

- Operating systems
  - Acts as Resource allocator
  - Handles resource request & resource allocation
  - Aims at optimal utilization of system resources.
  - Acts as control program
    - that manages the execution of user program
    - Prevents error and improper use of computer

What does an Operating System do?

- Coordinator
  - Manages all resources
  - Settles conflicting requests for resources
  - Prevent errors and improper use of the computer
- Facilitator:
  - Provides facilities that everyone needs
  - Standard Libraries, Windowing systems
  - Make application programming easier, faster, less error-prone
- Some features reflect both tasks:
  - E.g. File system is needed by everyone (Facilitator)
  - But File system must be Protected (Coordinator)

Functions of the OS

- Maintain a list of authorized users
- Construct list of all resources in the system
- Initiate execution of programs
- Maintain resource usage information by programs and current status of programs
- Maintain current status of all resources and allocate resources to programs when requested
- Perform scheduling
- Maintain information for protection

Goals Of Operating System

- Provide user interface for ***ease of operation***
  - Command line interface (CLI) eg. Unix, DOS
  - Graphical User Interface (GUI) eg. Windows
- ***Efficient*** use of hardware & software resources (system)
- Maximize ***System performance***
- Protection and access control
- Ability to evolve and offer new services
- Footprint of OS should be small ?

Can we measure System Efficiency, Performance and User Convenience ?

- Efficiency---- CPU efficiency
- System performance ----- Throughput
- User services ---- Turn around time,Response time

Thank you