Introduction

Operating Systems

- An **Operating System** is system software that manages computer hardware, software resources, and provides common services to all computer programs.
- Operating Systems provide a layer of **abstraction** that programs can use to perform operations that are **independent** of the physical hardware.
- There are **two main goals** for any operating system:
  1. Provide a **user-friendly environment**, that allows the user to execute their desired programs.
  2. Manage system resources as **efficiently** as possible.

Types of Operating Systems

- There are many types of operating systems, ranging from **general-purpose operating systems**, to **embedded operating systems**.
- A **general-purpose operating system** is an operating system that support process management, memory management, IO devices, a file system, and a user interface. That can solve a wide range of problems.
- An **embedded operating system** is a specialized operating system designed to perform a specific task for a specific device. They often lack many features that general-purpose operating systems have.
- There are two ways operating systems can be viewed:
  1. **The User View** is concerned with what the end user will be using the operating system for.
  2. **The System View** is concerned with the way the operating system will control programs, and manage resources.

The Operating System Kernel

- The **kernel is the core of an operating system**, and is a process that is **always running** when the system is on.
- The kernel **facilitates interactions** between **hardware components** and **software applications**.

Hardware Controllers

- The **physical hardware components** of a computer system are managed by a **controller** which acts as an **intermediary** between the device and the rest of the system. Device controllers work by handling raw signals coming from the CPU and directing the hardware accordingly.
- The **controllers** are connected to the **system bus**, which gives the controllers access to **shared memory** that can be used to communicate with other components.
- **Drivers** are a special type of software that **manage devices**.
- To sum it up, **controllers** handle signals from the CPU and access shared memory. Whereas **drivers** are responsible for managing the device.

System Events

- An **event** is an **action** or **occurrence** recognized by software.
- Operation system are **event driven**.
- There are three main categories of events:
  1. **Hardware Interrupts** are events that are raised by **hardware devices**. They can occur at any time.
  2. **Software Interrupts (Traps)** are events that are raised by **programs to invoke an operating system functionality**.
  3. **Exceptions** are events that are **generated automatically** by the processor as the result of an **illegal instruction / operation**.
- There are two types of exception events:
  1. **Faults** are **exceptions** that the program **can recover from**.
  2. **Aborts** are **exceptions** that the program **cannot, or are very difficult to recover from**.