Operating System Overview

An os is a state it controls the execution of application programs and acts as an interface, and it connects application and hardware.

Main concerns are: Convenience, Efficiency, Evolving.

Its major services are program dev, execution, I/O device access, file management, system access, error detecting, and accounting.

Basic Elements of a Computer System

Processor: Controls computer and carries data processing out.

Main Memory: Holds data and programs; is volatile, losing contents when power goes off.

I/O Modules: Handle transfer of data between the computer and external devices.

System Bus: Provides communication paths among processors, memory and I/O modules.

Instruction Execution

Fetches instructions from memory and executes them in a processor.

The Instruction Cycle consists of fetch and execute instructions, where the program counter is used to track which address has the next instruction.

Interrupts are capabilities that allow other modules to interrupt typical processor sequencing. Such an architecture is more effective because it manages slower I/O devices.

Memory Hierarchy

The constraints in designing memory include capacity, speed, and cost.

Following the principle of locality, memory references tend to be clustered, making it possible to use cache memory effectively.

Cache Memory: is small fast memory that exploits locality to speed data access to what is frequent.

Virtual Memory: Permits programs to logicate memory so that physical memory limits concern it from overhanging, using paging techniques to achieve these ends.

I/O Techniques

Programmed I/O: I/O modes are under direct control of CPU; they become an important cause of performance degradation.

Interrupt Driven I/O: Provides the processor with the capability of issuing and continuing to perform other tasks after an I/O command is issued.

Direct Memory Access: A specific module that performs direct data interaction of memory endpoints of I/O devices leaves processing I/O commands to DOM.

Process Management

A process is associated with program execution and has its own context in terms of the registers, priority, and state.

Process Components: An executable program, relevant data, and execution context.

Process Isolation: Guarantees that processes do not interfere with each other.

Memory Management

Process isolation, automatic distribution, modular programming support, protection, and long-term memory involvement: these are the memory management responsibilities.

Paging: the division of memory into blocks of fixed size, along with efficient use of physical memory.

OS Architectural Approaches

Microkernel Architecture: It delegates to the kernel some base functions. This enables a lightweight installation that is improved in flexibility and simplicity.

Multithreading: It specifies a process divided into threads that execute in sync at the same time.

Symmetric Multi-Processing (SMP): Making use of multiple processor systems to carry serious computation in parallel.

Distributed OS: Achieves a single view of multiple systems' resources.

Object-Oriented Design: It improves modularity and integrity of the system.