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CLASS TASK

Operating System Assignment

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1. Introduction

An operating system (OS) is system software that manages computer hardware, software resources, and provides common services for computer programs. It serves as an interface between the user and the hardware, ensuring that hardware resources are utilized efficiently. Some popular examples of operating systems include Windows, Linux, macOS, and Android.

2. Operating System Basics

What is an Operating System?

An operating system is a collection of programs that controls the execution of application programs and acts as an intermediary between a user and the computer hardware. It performs basic tasks such as file management, memory management, process handling, and device control.

Functions of an Operating System:

- **Process Management:** Managing the processes in the system, including multitasking and process synchronization.
- **Memory Management:** Allocating and managing primary memory for various tasks.
- **File System Management:** Handling the storage, retrieval, and organization of data.
- **Device Management:** Controlling and coordinating hardware devices.
- **Security and Access Control:** Ensuring system security and user data protection.

3. Process Management

What is a Process?

A process is a program in execution. It consists of the program code, current activity, and resources allocated to it. The operating system is responsible for managing processes to ensure efficient execution and resource utilization.

Process Lifecycle:

1. **New:** The process is created.
2. **Ready:** The process is waiting to be assigned to a processor.
3. **Running:** The process is being executed.
4. **Waiting:** The process is waiting for an event or resource.
5. **Terminated:** The process has completed its execution.

Key Concepts in Process Management:

- **Multitasking:** Running multiple processes concurrently.
- **Inter-process Communication (IPC):** Mechanisms for processes to communicate and synchronize.
- **Deadlock:** A situation where two or more processes are unable to proceed because each is waiting for the other to release resources.

4. Memory Management

Memory management is a critical function of an operating system. It involves managing the computer's primary memory (RAM) and ensuring that each process gets the necessary memory to execute.

Functions of Memory Management:

- **Memory Allocation:** Assigning memory to processes.
- **Memory Protection:** Ensuring that processes do not interfere with each other.
- **Virtual Memory:** Using a combination of RAM and disk space to run large processes.
- **Paging and Segmentation:** Techniques for memory organization and management.

Example:

Virtual memory allows a computer to run applications that require more memory than physically available by using disk storage as an extension of RAM.

5. File Systems

The file system is responsible for organizing and storing data on storage devices. It provides a structured way to store, retrieve, and manage data.

Types of File Systems:

- **FAT32:** Common in older systems and portable storage devices.
- **NTFS:** Default file system for Windows.
- **EXT4:** Common in Linux systems.
- **APFS:** Used in macOS.

Functions of a File System:

- **File Creation and Deletion:** Handling file operations.
- **Directory Management:** Organizing files in a hierarchical structure.
- **Access Control:** Managing file permissions.

6. Scheduling Algorithms

Scheduling algorithms are used by the operating system to manage how processes are assigned to the CPU. Efficient scheduling ensures better performance and resource utilization.

Types of Scheduling Algorithms:

1. **First-Come, First-Served (FCFS):** Processes are executed in the order they arrive.
2. **Shortest Job Next (SJN):** The process with the shortest execution time is executed next.
3. **Round Robin (RR):** Each process is assigned a fixed time slice (quantum).
4. **Priority Scheduling:** Processes are executed based on priority.

Example of Round Robin Scheduling:

In a time-sharing system, each process gets 2 milliseconds of CPU time before the next process takes over. This ensures fairness among processes.

7. Conclusion

The operating system is a crucial component of any computing device. It manages hardware, software, and resources to provide a seamless user experience. Understanding concepts like process management, memory management, file systems, and scheduling algorithms is essential for anyone studying computer science or working in IT.

8. References

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