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MEMORY MANAGEMENT IN OPERATING SYSTEMS

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ABSTRACT

Operating systems serve as an interface between users and hardware, providing essential services such as process management, disk management, and memory management. This paper explores the functionality of memory management within operating systems, emphasizing the tracking and deallocation of memory allocated to processes. Understanding memory management is crucial for optimizing system performance and resource utilization.

INTRODUCTION

An operating system acts as a bridge between hardware and application software, providing an interface between users and machines. It functions as a resource manager and virtual machine, with varying perspectives based on user and system views. From a user's perspective, the operating system's performance, efficiency, and speed are paramount, whether on a personal computer, multiuser environment, or handheld device. From a system's perspective, the operating system manages resources like memory, hardware, software, registers, code, and data to ensure smooth resource utilization.

Among the various functions of an operating system, memory management plays a vital role. Every program is first loaded into memory before execution. The central processing unit (CPU) is directly connected to primary memory components such as RAM, cache memory, and registers, but not to secondary memory. Efficient memory management involves transferring processes from secondary to primary memory, increasing the degree of multiprogramming and CPU utilization.

Memory Management Techniques

Technique	Description	Strengths	Weaknesses
Fixed-Partition	Divides memory into a fixed number of partitions; size may vary.	Simple to implement and understand.	Internal fragmentation may occur.
Dynamic-Partition	Allocates memory partitions at runtime; number is not fixed.	Effective utilization of memory; no limit on process number.	External fragmentation may occur.
Paging	Divides processes into fixed-size pages and maps them to frames in memory.	Eliminates external fragmentation; facilitates swapping.	Overhead to maintain page tables.
Segmentation	Divides memory into segments with a segment table for each location.	Enhances sharing and security.	Requires relocation of segments.
Virtual Memory	Loads only the required pages of a process into memory.	Allows execution of larger processes than physical memory.	Increased page faults may lead to thrashing.

CONCLUSION

In an era of increasing memory demands and resource consumption, efficient utilization of available resources is imperative. Selecting appropriate memory allocation techniques based on considerations like internal and external fragmentation and system policies ensures effective execution of concurrent processes. Balancing these factors is crucial for enhancing system performance.

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