Memory in Operating System

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Table of Contents

Abstract

An operating system, or "OS," is software that controls the execution of application programs and communicates between the computer hardware and other applications. It performs the basic tasks like handling Input and output "I/O", controlling peripherals, process management, file management and memory management.

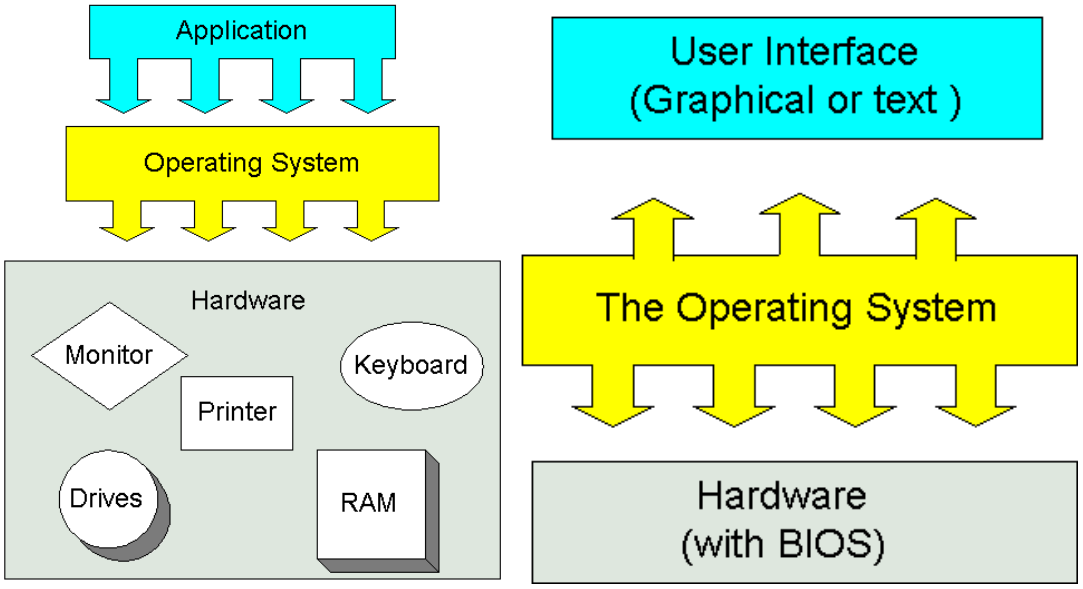
One of the main functions of the Operating System is memory management, which is the process of controlling and coordinating computer memory to optimize the system's overall performance, which can also refer to as the management of Primary Memory or Main memory. Main memory is providing a fast storage that can be accessed by the CPU. Memory management helps the OS in allocating the main memory space to the processes and their data at the time of execution.which utilize the memory space. And it can execute multiple processes at the same time in the OS.

Memory management is a crucial function in an operating system that uses various techniques to help manage the primary memory or main memory. Memory management techniques such as segmentation in which the memory is divided into unequal variable-sized blocks, known as the segment. Paging, similarly to segmentation, the memory is divided but into equal fixed-sized blocks called pages. Lastly, swapping is a temporary exchange of a process between the main memory and secondary storage to make available memory for other processes.

The importance of memory management in an operating system is that it directly affects the execution time of the process, which depends on the availability of data in the main memory. For that reason, memory management must execute to which the essential data is always present in the main memory and must ensure the accuracy, availability, and consistency of the data imported to be effective.

I. Operating System

An Operating System (OS) is the most important system of the computer that interacts with the user and hardware. Some popular or common computer OS include Windows, Mac OS X developed by apple inc., and the open source OS is linux and nowadays we can also see an OS on our device like our smartphones that is operated by android or ios. They have different Graphical User Interface (GUI) but there are 3 main functions of OS 1st is to manage the computer's resources. Examples of these are central processing units (CPU), memory, disk drives, and other computer peripherals such as mouse, keyboard and printers. The 2nd is to establish a user interface, and the 3rd is to execute and provide services for applications software.



II. Memory in Operating System

Like human memory the functions of memory in Operating systems are used to acquire, store, retain, and later retrieve information. A portion of the OS is in main memory.

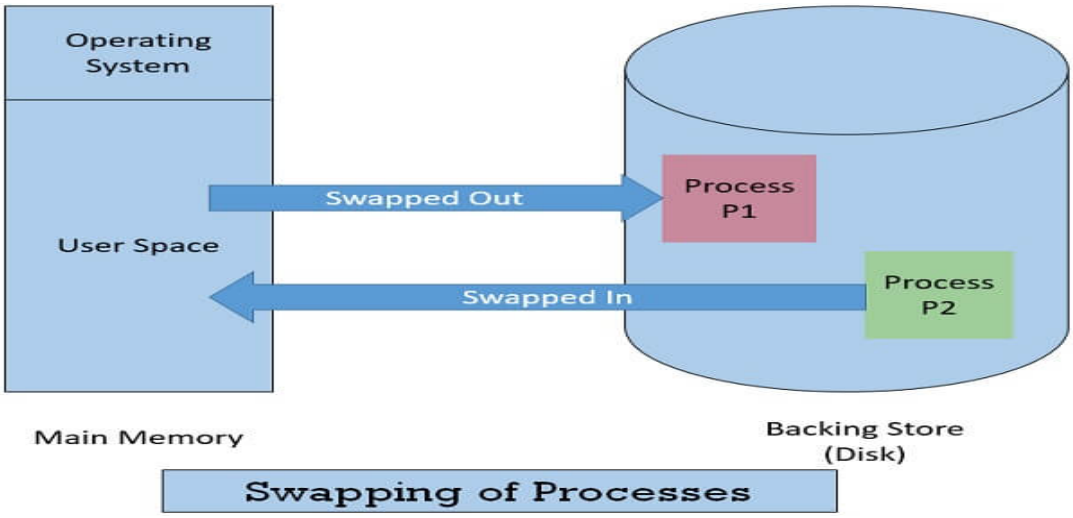
The main memory has two partitions which are low and high memory in low memory reside the operating system. Main memory is a physical memory that is the internal memory of the computer. The main memory is also known as Random-Access Memory (RAM). In every program that is running and every file you access it must be copied from storage device into the main memory.

The larger amount of main memory it means you can run or access multiple programs at the same time. The difference between Hard Drive and RAM is RAM is much faster than hard drive even though they are the same storage. RAM is only temporary memory which when you cut the power from the RAM the program and files that have been copied from it will be deleted instantly.

III. Memory Management

IV. Swapping

Computers often had a small main memory to hold all the data they needed. Computer Engineers came up with a solution to overcome this and this technique is called “swapping”. Swapping in memory management is the technique used to improve the main memory utilization by temporarily exchanging any process from the main memory to the secondary memory, which makes the main memory available for other processes. The purpose of swapping is to access the data in the secondary memory and carry it to the main memory and only be used when the data is not already in the main memory by application programs. The performance of the system is usually affected due to the swapping process but, it helps in running large and multiple processes. That is the reason why swapping is called or referred to as memory compaction.



Swapping of Processes

The concept of swapping is divided into two more concepts called Swap-in and Swap-out.

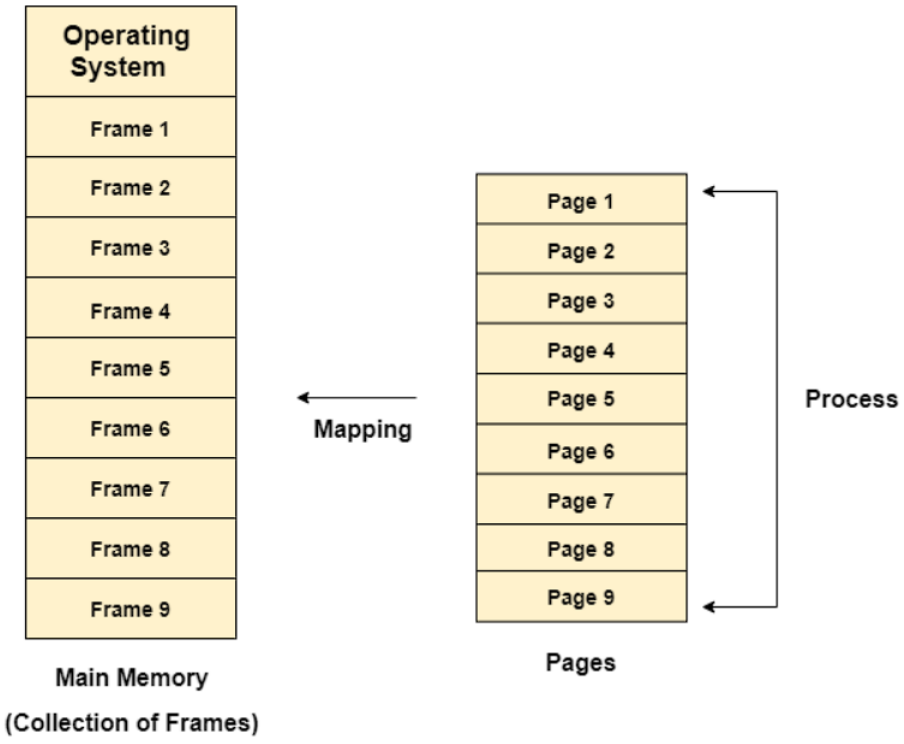
- Swap-out is to take the program from the main memory and bring them to the secondary memory.
- Swap-in is the opposite, where the programs are taken from the secondary memory then bringing them to the main memory.

V. Partitioning

Partitioning in memory management is a contiguous memory allocation technique divided into two parts called Fixed(or Static) Partitioning and Variable (or Dynamic) Partitioning. The oldest and simplest technique is the fixed partitioning in which can be used to load more than one process into the main memory. This technique divides the main memory into partitions of equal or unequal sizes and the first partition is constantly resided by the operating system, while others are for storing user processes to be used. The memory is assigned to the processes in a contiguous way.

VI. Paging

Paging in memory management is a technique that allows the operating system to retrieve processes from the secondary memory to the main memory in the form of pages. To avoid external fragmentation and have maximum utilization, this technique divides the main memory into small fixed-size blocks of physical memory called frames, which are similar in size to pages.



A single page of a process is to be stored in a single frame of the memory, which can be in different locations but, the priority is always to find the contiguous frames. The pages of the process are carried to the main memory only when they are needed. Otherwise, they stay in the secondary storage. The various operating systems define different frame sizes, and each frame must be equal. Considering that the pages are mapped to the frames, the page size must be the same as the frame size.

VII. Virtual Memory

VIII. Segmentation

Segmentation in memory management generally supports the user view of memory and is a technique similar to paging which divides the memory but into variable-sized blocks, called segments. Each segment is a different logical address space of the program.

IX. Reference

Swapping reference link:

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