




SWAPPING IN MEMORY MANAGEMENT UNIX

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2019202049

What is Swapping?

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- Swapping is a mechanism in which a process can be swapped temporarily out of main memory (or move) to secondary storage (disk) and make that memory available to other processes. At some later time, the system swaps back the process from the secondary storage to main memory.
 - Though performance is usually affected by swapping process but it helps in running multiple and big processes in parallel and that's the reason Swapping is also known as a technique for memory compaction.



Why Swapping?

- First, when the system requires more memory than is physically available, the kernel swaps out less used pages and gives memory to the current application (process) that needs the memory immediately.
- Second, a significant number of the pages used by an application during its start up phase may only be used for initialization and then never used again. The system can swap out those pages and free the memory for other applications or even for the disk cache.




What is Swap Space or Swap File?

- ❖ Swap space is storage space that is used as temporary memory capacity, when physical memory space is already exhausted.
- ❖ The swap file is the physical disk storage file for swap space that is used by an operating system to extend usable memory.
- ❖ In Linux, swap space can be checked from the command line with by typing 'swapon-s', which will show allocated swap space usage.



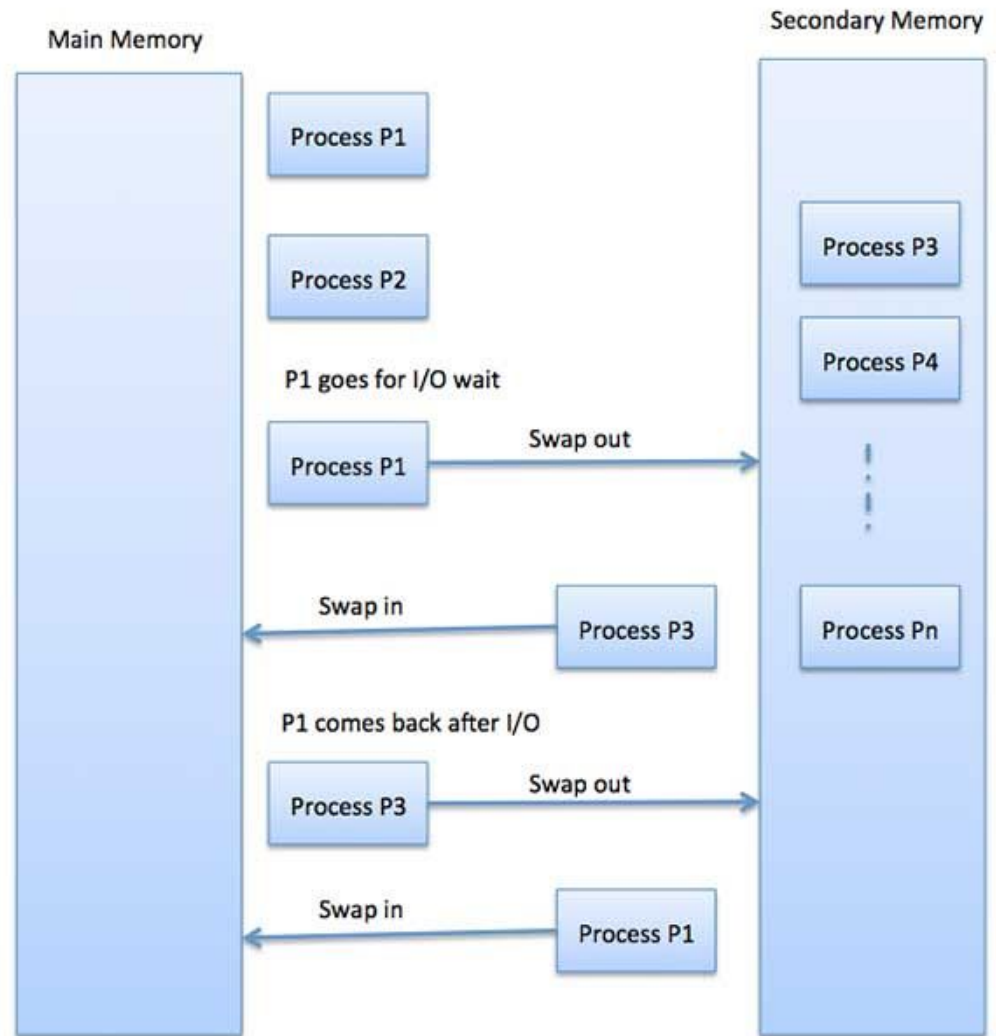
All about Swapping

- ❑ Allocation of both main memory and swap space is done first-fit. • A page fault occurs when the CPU tries to access a page that is not in main memory, thus forcing the CPU to wait for the page to be swapped in.
- ❑ Since moving data to and from disks takes a significant amount of time, the goal of the memory manager is to minimize the number of page faults.
- ❑ When the size of a process memory image increases (due to either stack expansion or data expansion), a new piece of memory big enough for the whole image is allocated.

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- ❑ If no single piece of main memory is large enough, the process is swapped out such that it will be swapped back in with the new size.
 - ❑ Decisions regarding which processes to swap in or swap out are made by the scheduler process (also known as the swapper).
 - ❑ A process is more likely to be swapped out if it is idle or has been in main memory for a long time, or is large ; if no obvious candidates are found, other processes are picked by age.
 - ❑ A process is more likely to be swapped in if its has been swapped out a long time, or is small.

Swapping Technique

The total time taken by swapping process includes the time it takes to move the entire process to a secondary disk and then to copy the process back to memory, as well as the time the process takes to regain main memory.





Example:

User Process size = 2048KB

Data transfer rate for swapping = 1MB per sec

The actual transfer of the 1000K process to or from memory will take =

$2048\text{KB} / 1024\text{KB}(1\text{MB}) \text{ per second} = ?$

Considering in and out time, it will take complete of _____ms plus overhead where the process competes to regain main memory.



Advantages of Memory Swapping

- **More Memory.** Memory swapping is a critical component of memory management, enabling an operating system to handle requests that would otherwise overwhelm a system.
- **Continuous Operations.** Swap file memory can be written to disk in a continuous manner, enabling faster lookup times for operations.
- **System Optimization.** Application processes of lesser importance and demand can be relegated to swap space, saving the higher performance physical memory for higher value operations.



Limitations of Memory Swapping

- Performance. Disk storage space, when called up by memory swapping, does not offer the same performance as physical RAM for process execution.
- Disk Limitations. Swap files are reliant on the stability and availability of storage media, which might not be as stable as system memory.
- Capacity. Memory swapping is limited by the available swap space that has been allocated by an operating system or hypervisor.



THANK you!!