

Paper Name : Operating System

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Memory management :

Fragmentation:

As processes are loaded and removed from memory, the free memory space is broken into little pieces. It happens after sometimes that processes cannot be allocated to memory blocks considering their small size and memory blocks remains unused. This problem is known as Fragmentation. It is of two types –

- External Fragmentation – It exists when there is enough total memory space to satisfy a request but the available spaces are not contiguous; storage is fragmented into a large number of small holes
- Internal Fragmentation – allocated memory may be slightly larger than requested memory; this size difference is memory internal to a partition, but not being used

Consider a multiple-partition allocation scheme with a hole of 18,464 bytes. Suppose that the next process requests 18,462 bytes. If we allocate exactly the requested block, we are left with a hole of 2 bytes. The overhead to keep track of this hole will be substantially larger than the hole itself. The general approach to avoiding this problem is to break the physical memory into fixed-sized blocks and allocate memory in units based on block size. With this approach, the memory allocated to a process may be slightly larger than the requested memory. The difference between these two numbers is internal fragmentation.

- Statistical analysis of first fit, for instance, reveals that, even with some optimization, given N allocated blocks, another $0.5 N$ blocks will be lost to fragmentation. That is, one-third of memory may be unusable! This property is known as the **50-percent rule**.

One solution to the problem of external fragmentation is **compaction**. The goal is to shuffle the memory contents so as to place all free memory together in one large block. Compaction is not always possible, however. If relocation is static and is done at assembly or load time, compaction cannot be done; compaction is possible only if relocation is dynamic and is done at execution time. If addresses are relocated dynamically, relocation requires only moving the program and data and then changing the base register to reflect the new base address. When compaction is possible, we must determine its cost. The simplest compaction algorithm is to

move all processes toward one end of memory; all holes move in the other direction, producing one large hole of available memory. This scheme can be expensive.
