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Memory Management Part-2

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Multiprogramming with Variable Partition
Static partitioned of memory is generally suitable for static environment where, the workload is predicable and its characteristic are known . Static partitioning is at disadvantage , in a environment with varying and generally unpredictable memory requirements of programs, prior to their submission.
Most of the disadvantage of static partitioning are directly attributed to its inflexibilty and inability to adapt to changing system needs. One of its primary problem is **internal fragmentation of memory.**
To remove such problems attributed to static partitioning of memory, dynamic (variable) partitioning is used in which partitions are defined dynamically rather than static.
In dynamic partitioning, the partitions used are of variable length and number. When a process is brought into the memory , it is allocated exactly to that amount of memory that it needs, not more than that it requires. External fragmentation, referring to the fact that the memory that is external to all partitions becomes increasingly fragmented.

One technique for overcoming external fragmentation is compaction, which means to move the processes in the memory in such a way that the scattered pieces of unused memory (holes) can be placed together, so that any other process demanding contiguous memory for it can be use.

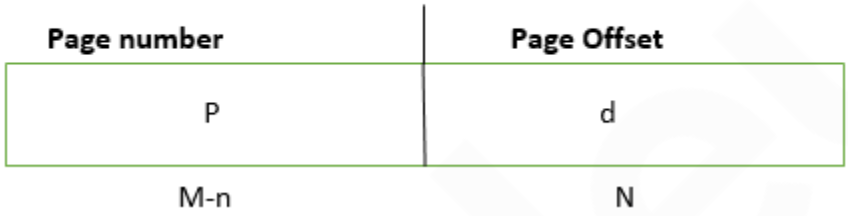
Depending upon the situation either of the following three algorithms are used for selection of a free area of memory to create partition:-
a. First fit and its variant, next fit
b. Best fit
c. Worst fit

a. In first fit , we allocate the first hole that is big enough. Searching can be started either at the beginning of the set of holes(first fit) or where the previous first fit search ended (Next fit). We stop searching as we obtain a free hole that is large enough to accommodate the coming process.
b. In best fit, we allocate the smallest hole that is large enough. Searching of entire list is done unless it is sorted by size.This strategy produces least size of unused memory space(fragments).
c. In worst case , we allocate the largest hole. Again we search the entire list, unless it is sorted by size. This strategy procures largest size of unused memory space.

Note: - first fit and Best fit is better that worst fit in terms of deceasing both time and storage utilization . Neither first fit nor best fit can be said better in terms of storage utilization as they again results to external fragmentation. One of the solution is compaction but it is time consuming approach another possible solution is to permit the logical address space of a process to be non-contiguous. Thus allowing a process to be allocated in physical memory .

Paging :- Paging is a memory management schemes that removes the requirement of contiguous allocation of physical memory. Physical address space of a process to be non-contiguous is permitted by this scheme
The physical memory is conceptually divided into a number of fixed-size blocks called frames, and the logical address space (virtual address space) is also splited into fixed size blocks called pages.
In paging system , address translation is performed with the help of a mapping table called page-map table (PMT). PMT is constructed at process loading time in order to establish the correspondence between the virtual and physical address . In PMT, there is one entry for each page of a process indexed with the page number. The value of each entry is the number or frames (Composed of high order, page level bits) in the physical memory when the corresponding page is placed.

Logical Address :-



Where 'P' is the index number in the page table and 'd' is the offset value(displacement)

Note:- If the page size is not the power of 2 then separation of 'p' and 'd' is not possible.

Segmentation :- It is another technique for non-contiguous storage allocation. The difference between segmentation and paging is , as pages are physical in nature and hence are of fixed size , whereas segments are logical divisions of a program and hence are variable size. In segmentation, logical address space is divided into different segments. The general division can be : main program , set of subroutine , procedures , functions and a set of data structure (stack, array etc). Each segment has a name and length which is loaded into the physical memory as it is . For simplicity, the segments are referred by segment number rather than segment name .
Thus , a logical address consists of two tuples :
<segment_name , offset>

Segmentation with paging (Combined Approach):
Both approaches paging and segmentation have their respective advantages and disadvantages and none is superior to other over all characteristics. Some computer systems combine the two approaches to avail the advantages of both approaches in a single system.
This approach facilitates to use the segmentation from the user's point of view also to divided each segment into pages of fixed size for allocation purposes. In this way , the combined system retains not only the advantages of segmentation but also the problems of complex segment placement and management of secondary memory eliminated by using paging.

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