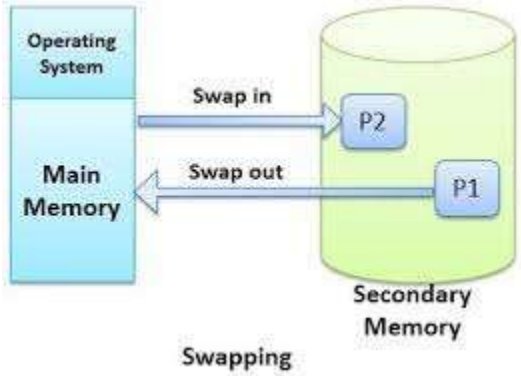
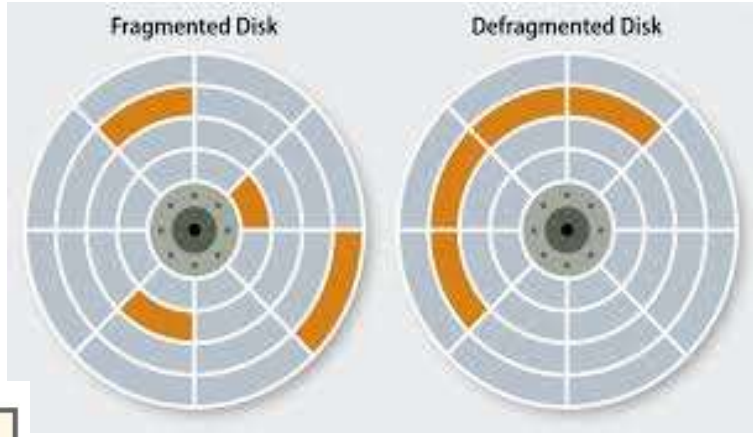
SNS COLLEGE OF TECHNOLOGY

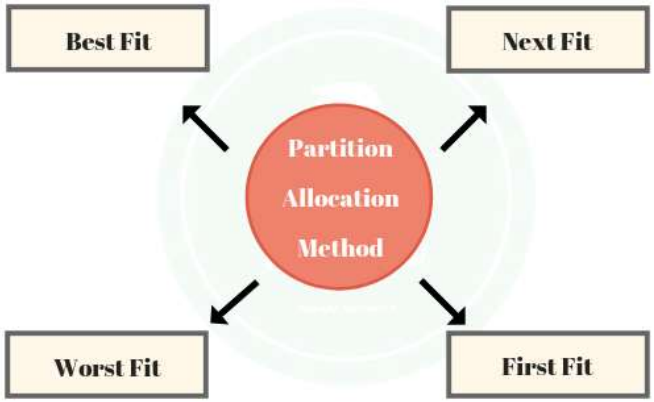
(Autonomous)

COIMBATORE-35

Swapping and Contiguous Memory Allocation





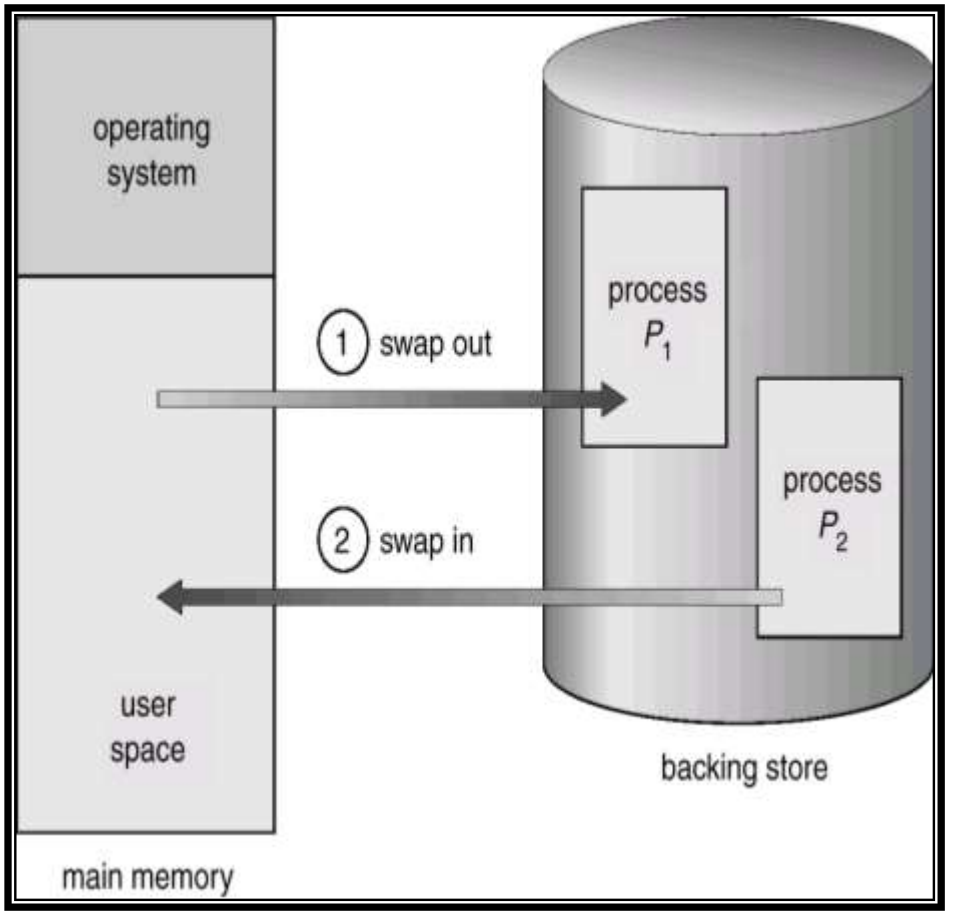


Swapping

Swapping is a mechanism in which a process can be swapped temporarily out of memory to a backing store (Swap Out) and then brought back into memory for continued execution. (Swap In).

Benefits:

- Allows higher degree multiprogramming
- Allows dynamic relocation
- Better memory utilization
- Less wastage of CPU time on compaction
- Can easily be applied on priority-based scheduling algorithms to improve performance

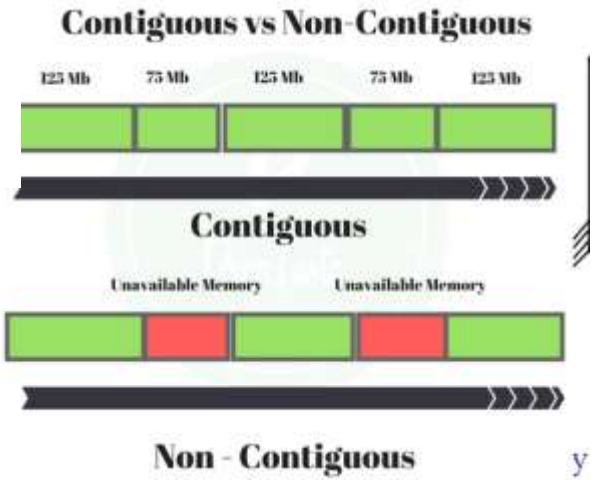


Contiguous Memory Allocation

The main memory must accommodate both the OS and the various user processes.

The main memory is usually divided into two partitions: one for the resident OS, and one for the user processes.

Usually OS will be in the low memory.



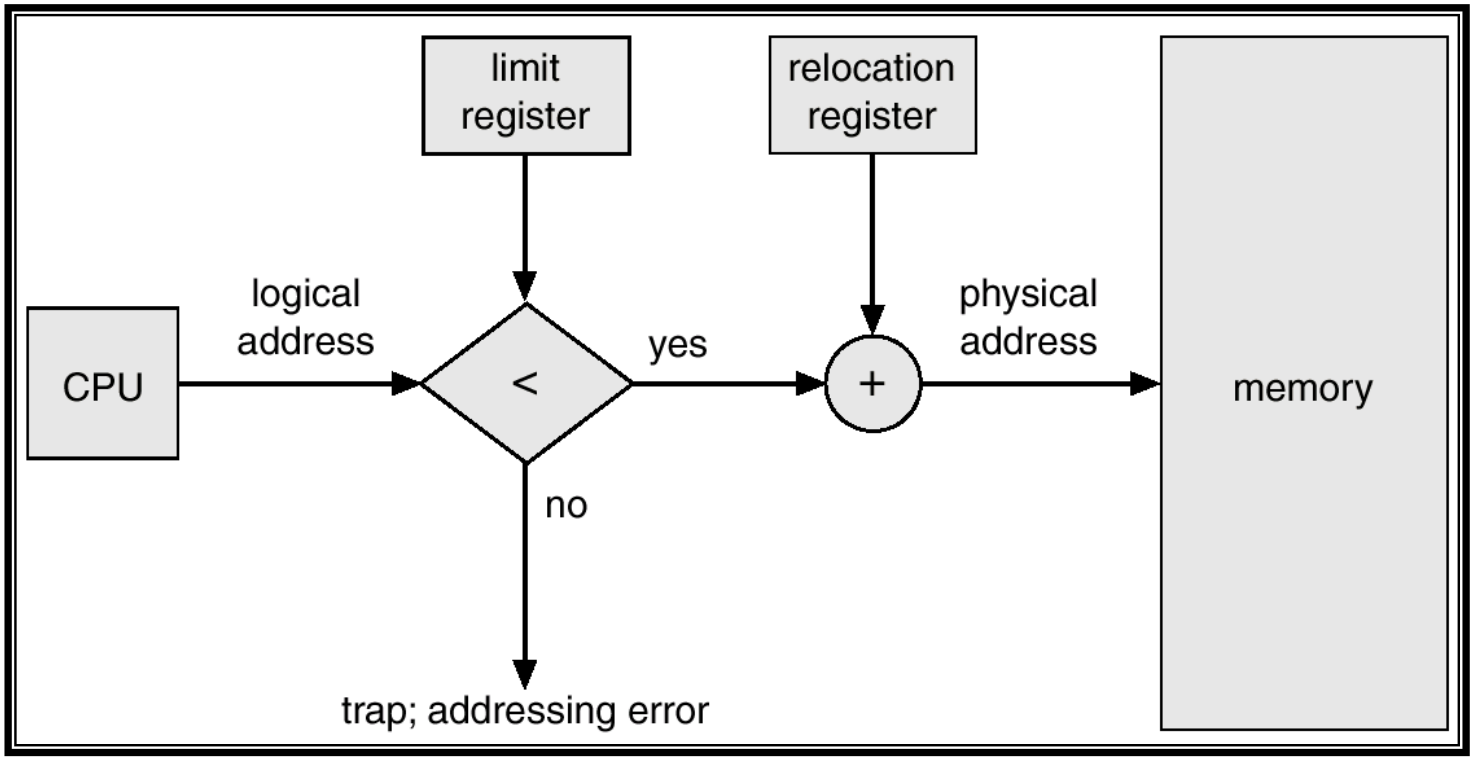
Single-Partition System

The OS will be in the lower part of the memory and other user processes in the upper part.

Protecting the OS from user processes and protecting user processes from one another with use of Relocation Register and Limit Register.

The relocation-register scheme provides an effective way to allow the OS size to change dynamically.

Hardware Support for Relocation and Limit Registers



Contiguous Memory Allocation
Multiple Partition System

Dividing the memory into several partitions. In multiple-partition method, when a partition is free, a process is selected from the input queue and is loaded into the free partition. When the process terminates, the partition becomes available for another process.

Available memory is called *hole*.

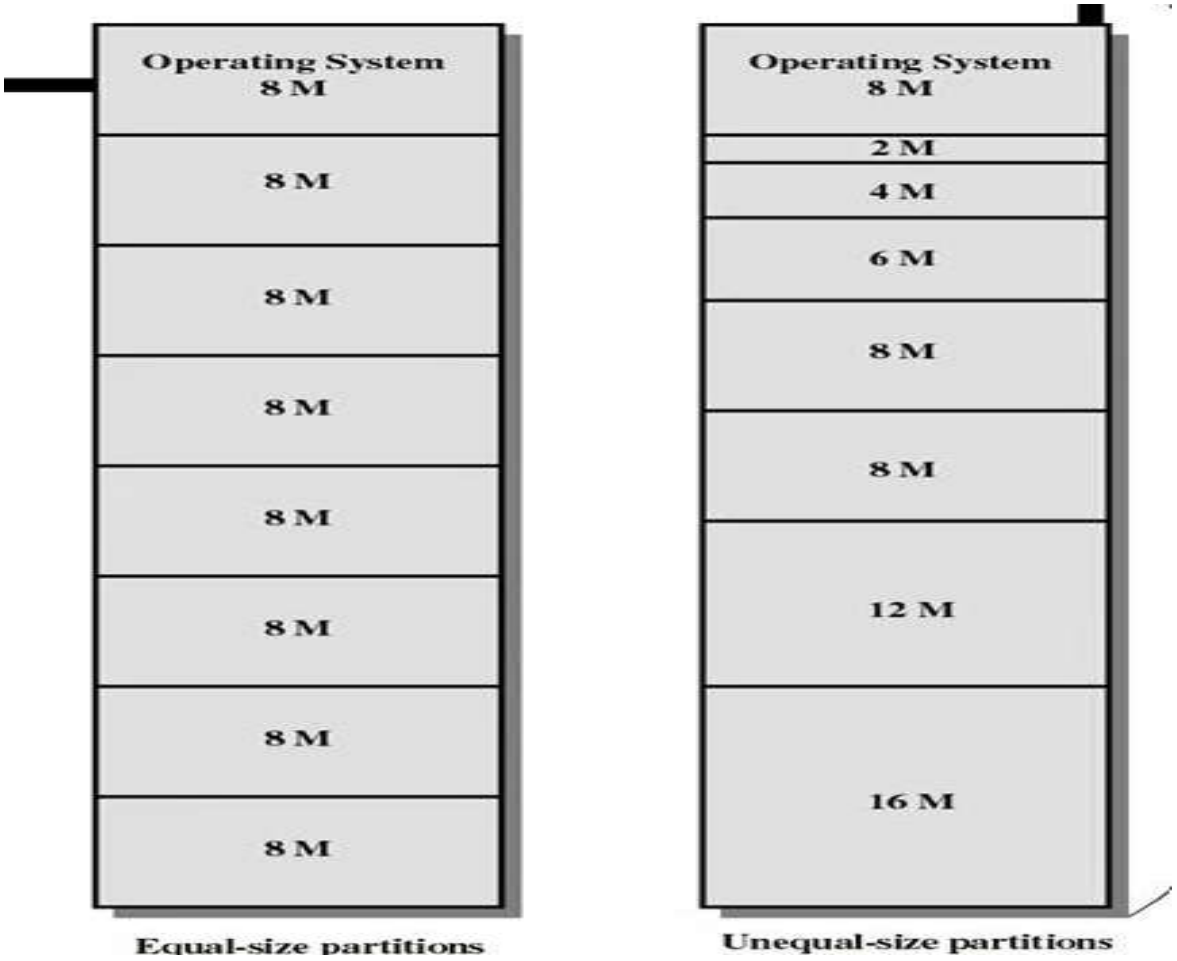
Multiple-Partition System: Fixed-sized partition

This is known as *static partitioning*.

Divide memory into n (possibly unequal) fixed sized partitions, each of which can hold exactly one process. The degree of multiprogramming is dependent on the number of partitions.

Wastage of memory within partitions is known as *Internal Fragmentation*.

Fixed and Unequal size Partitioning



Multiple-partition allocation

Multiple-partition allocation

Degree of multiprogramming limited by number of partitions

Variable-partition sizes for efficiency (sized to a given process' needs)

Hole – **block of available memory**;

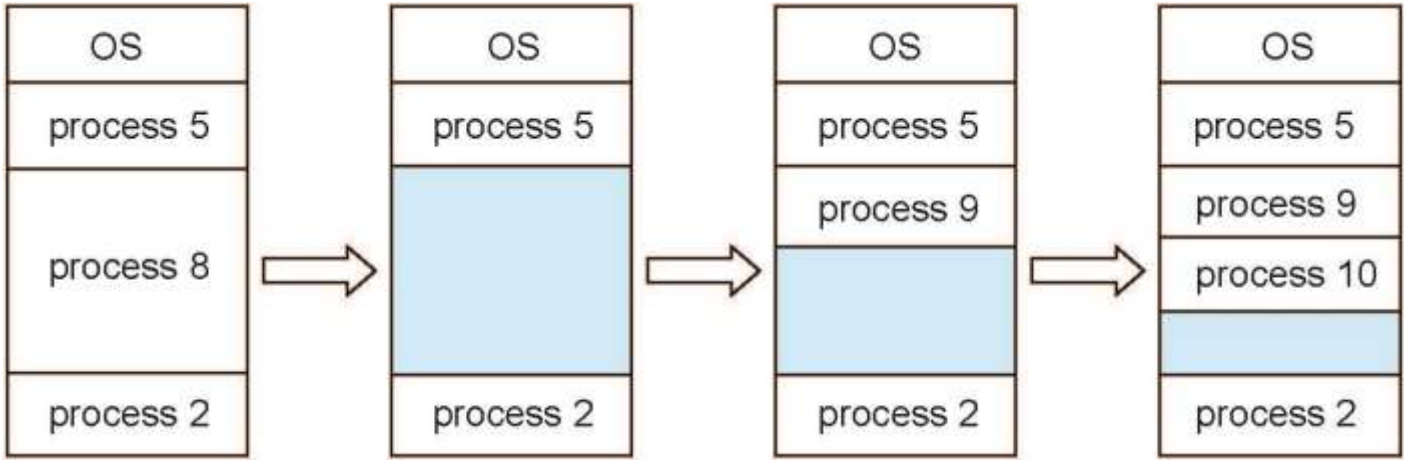
holes of various size are scattered throughout memory

When a process arrives, it is allocated memory from a hole large enough to accommodate it

Process exiting frees its partition,adjacent free partitions combined

Operating system maintains information about:

a) allocated partitions **b) free partitions (hole)**



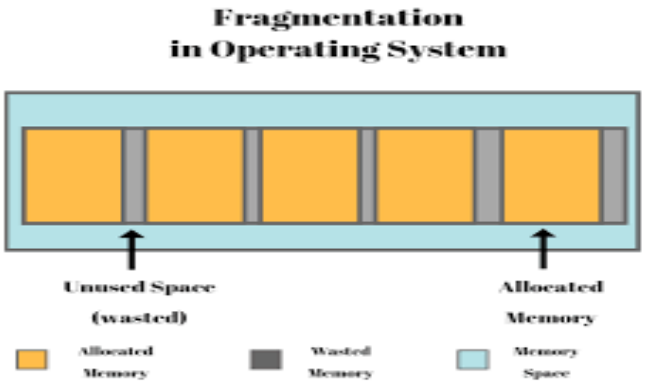
Multiple Partition System

Multiple-Partition System: Variable-sized partition

This is also known as *dynamic partitioning*.

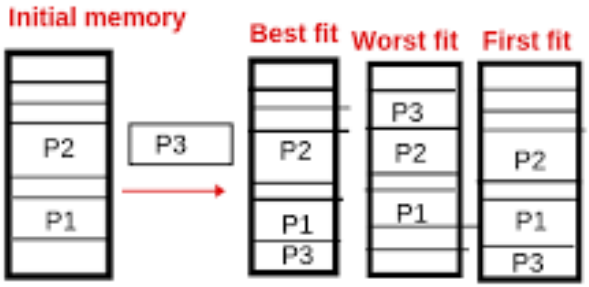
Partition boundaries are not fixed. Process accommodate memory according to their requirement. There is no wastage as partition size is exactly same as the size of the user process.

Wastage of memory which is external to partition is known as *external fragmentation*.



Dynamic storage allocation problem

First fit- Allocate the first hole that is big enough
Next fit- Same as first fit but start search always from last allocate file
Best Fit- Allocate the smallest hole that is big enough
Worst fit- Allocate the largest hole must also search entire list Produces the largest leftover hole



Contiguous Memory Allocation

Partition Allocation Algorithm

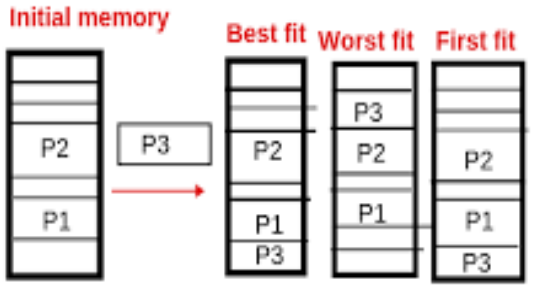
First fit- Allocate the first hole that is big enough

Next fit- Same as first fit but start search always from last allocate file

Best Fit- search whole partition, Allocate the smallest hole that is big enough

Worst fit- Allocate the largest hole must also search entire list

Produces the largest leftover hole



Fragmentation

Fragmentation is the inability to reuse memory that is free

Fragmentation

Internal Fragmentation: Wastage within partition.

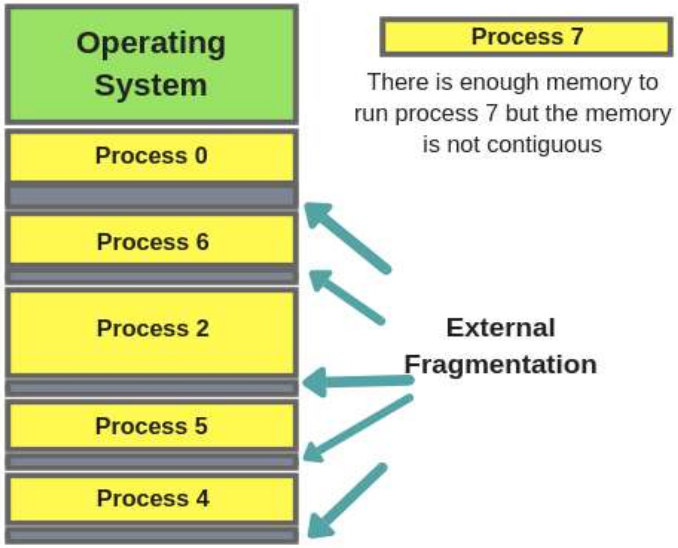
External Fragmentation: Wastage external to partition.

Compaction: Solution to the problem of external fragmentation.

Compaction is a process in which the free space is collected in a large memory chunk to make some space available for processes

Internal Fragmentation

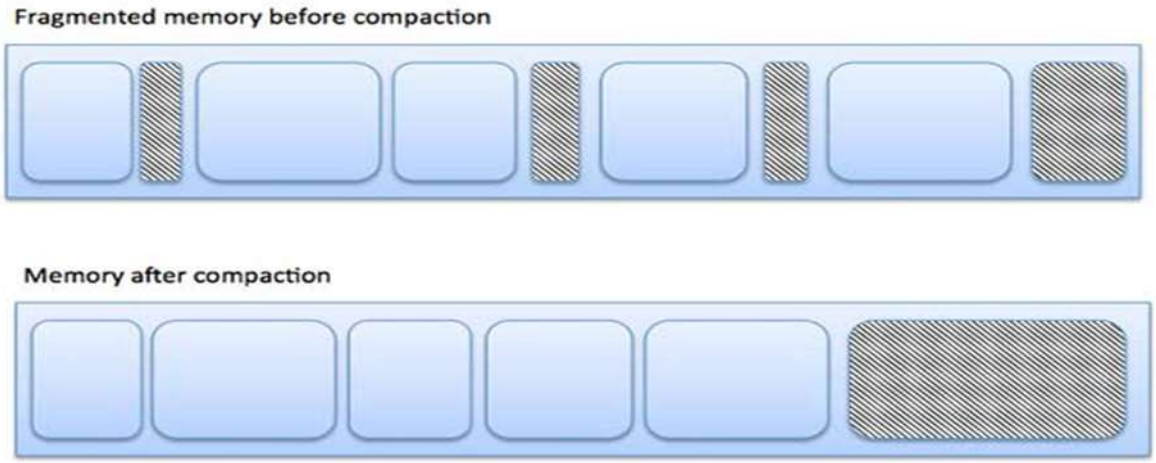
External Fragmentation



Fragmentation

- **External Fragmentation** – total memory space exists to satisfy a request, but it is not contiguous
- **Internal Fragmentation** – allocated memory may be slightly larger than requested memory; this size difference is memory internal to a partition, but not being used

- Reduce external fragmentation by **compaction**
  - Shuffle memory contents to place all free memory together in one large block
  - Compaction is possible *only* if relocation is dynamic, and is done at execution time



References

1. Silberschatz, Galvin, and Gagne, “Operating System Concepts”, Ninth Edition, Wiley India Pvt Ltd, 2009.
2 . Andrew S. Tanenbaum, “Modern Operating Systems”, Fourth Edition, Pearson Education, 2010.

Summarization