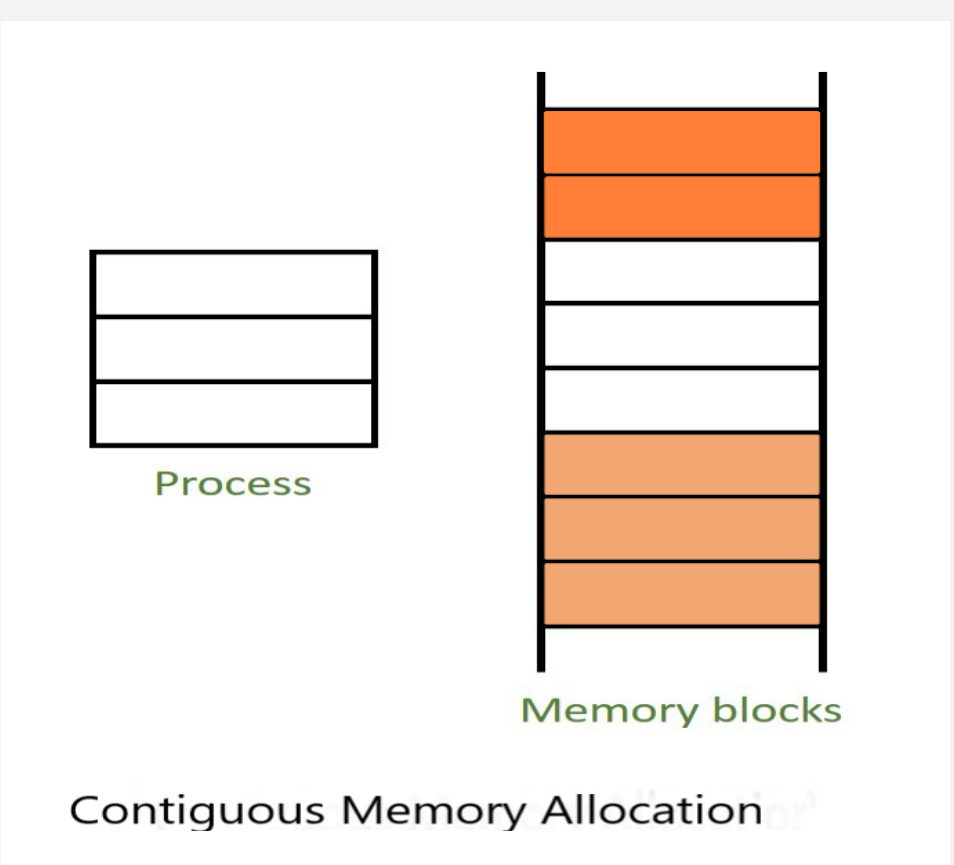
Storage Allocation Methods in Memory Management

Storage Allocation and Management TechniquesThe Storage allocation can be of two types:
(i) Contiguous storage allocation.
(ii) Non-contiguous storage allocation.

Contiguous Storage Allocation

► Contiguous storage allocation implies that a program's data and instructions are assured to occupy a single contiguous memory area.
► It is further subdivided into Fixed-partition storage allocation strategy and variable-partition storage allocation strategy.



Contiguous:Divide the memory into fixed-sized blocks

1. Fixed-partition contiguous storage allocation

The processes with small address space use small partitions and processes with large address space use large partitions. This is known as fixed partition contiguous storage allocation.

2. Variable - partition contiguous storage allocation

This notion is derived from parking of vehicles on the sides of streets where the one who manages to enter will get the space. Two vehicles can leave a space between them that cannot be used by any vehicle. This means that whenever a process needs memory, a search for the space needed by it, is done. If contiguous space is available to accommodate that process, then the process is loaded into memory.

External Fragmentation

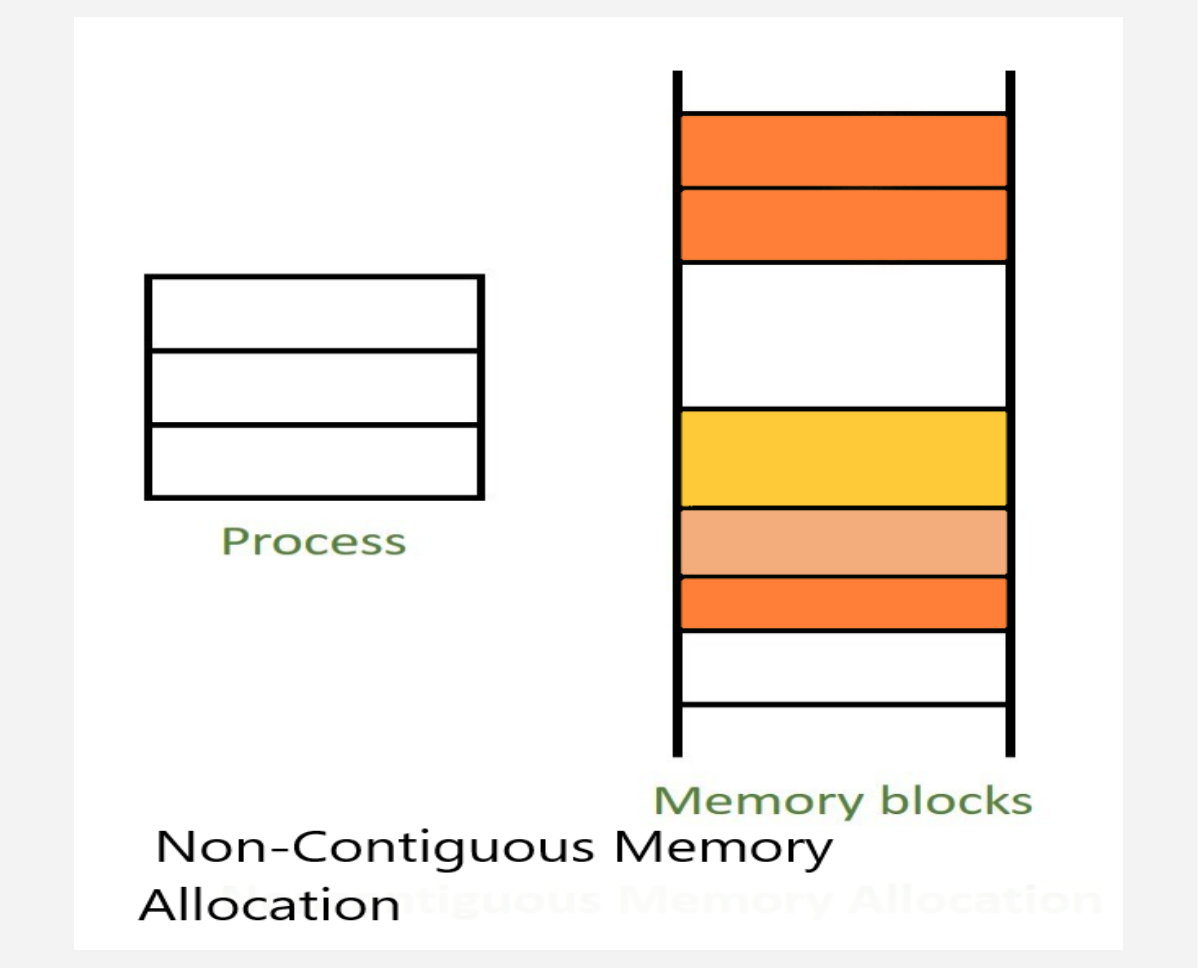
This phenomenon of entering and leaving the memory can cause the formation of unusable memory holes (like the unused space between two vehicles). This is known as External Fragmentation.

Non-contiguous Storage Allocation

To resolve the problem of external fragmentation and to enhance the degree of multiprogramming to a greater extent, it was decided to sacrifice the simplicity of allocating contiguous memory to every process. It was decided to have a non-contiguous physical address space of a process so that a process could be allocated memory wherever it was available.

There are 2 techniques for non-contiguous allocation:

1. Paging
2. Segmentation



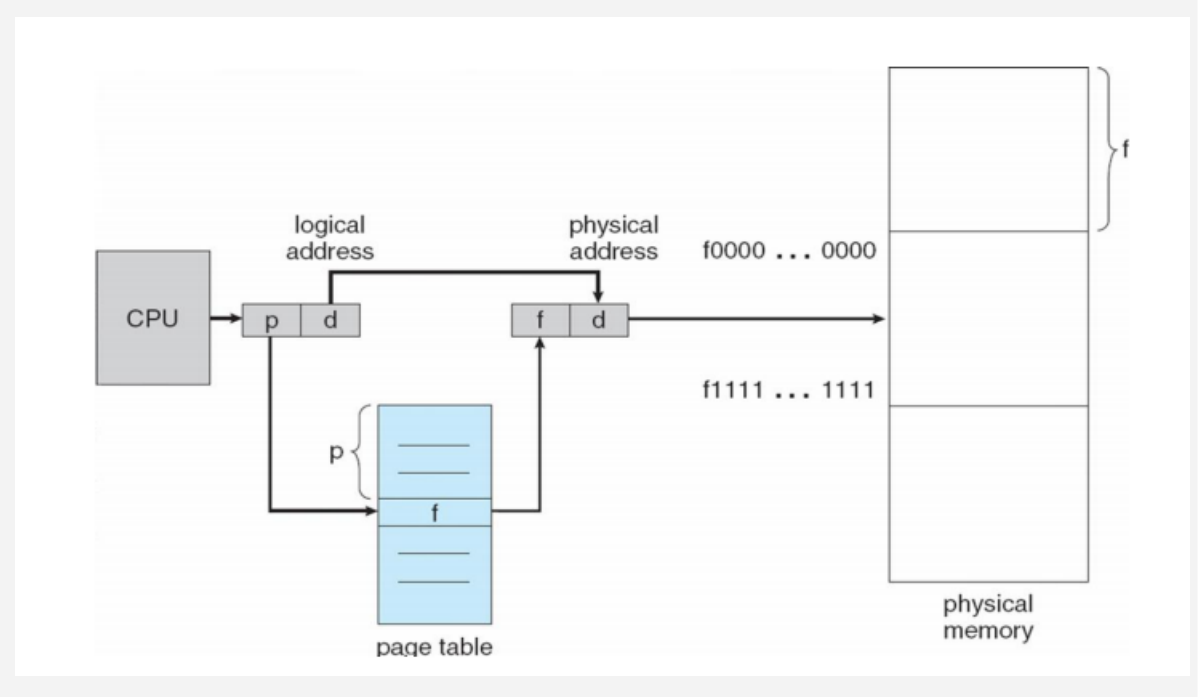
Paging

In paging, physical memory is divided into fixed-size blocks called frames and the logical memory is divided into the fixed-sized blocks called pages.

The size of a page is the same as that of a frame. The key idea of this method is to place the pages of a process into the available frames of memory, whenever, this process is to be executed. The address mapping is done by Page table.

Physical memory is divided into fixed size- blocks called FRAMES. (size is power of 2, for example 512 bytes)

Logical memory is divided into blocks of the same size called PAGES.



Example

Suppose, if the main memory size is 16 KB and Frame size is 1 KB. Here, the main memory will be divided into the collection of 16 frames of 1 KB each.

Advantages and Disadvantages of paging

Advantages :

no external fragmentation.
Simply memory management algorithm.
Swapping is easy(equal sized pages and page frame).

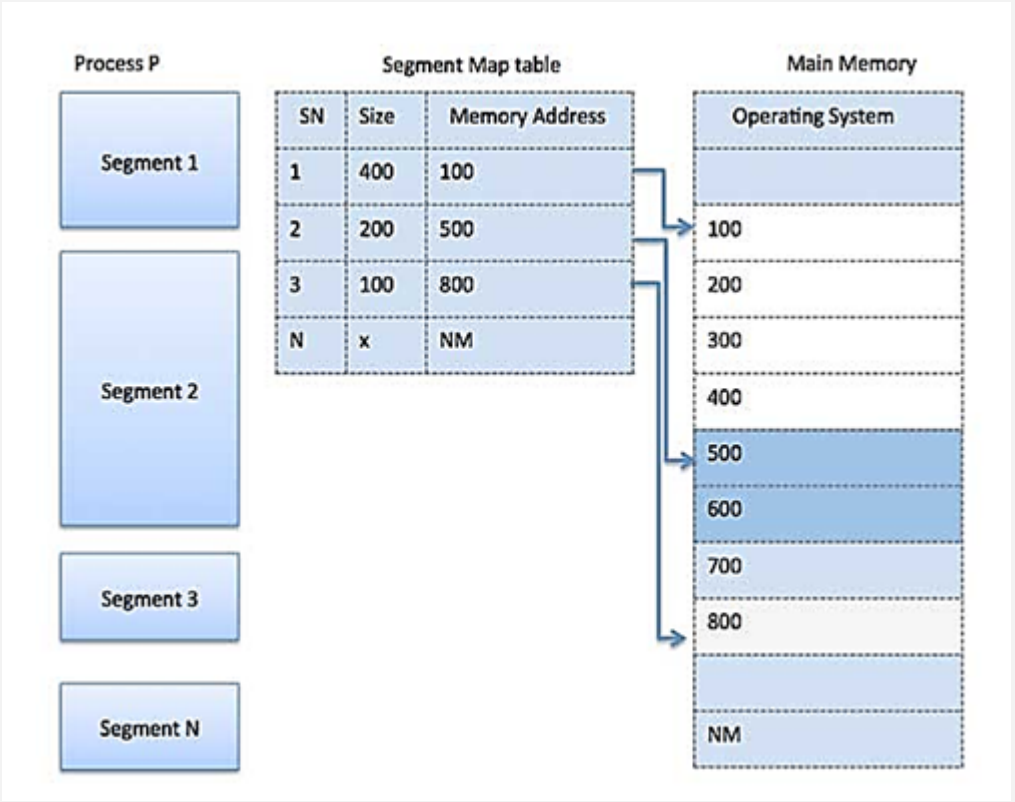
Disadvantages:

Internal fragmentation.
Page tables may consume more memory.

Segmentation

segmentation is another technique for the noncontiguous storage allocation. It is different from paging as it supports users' view of his program.

For a programmer it might be more relevant to divide the logical address space of his program into variable sized segments (with respect to his view of main program, subroutines, data, etc.) than to divide it into fixed size pages. Such variable sized segments, which are a collection of logically related information, are the basis of segmentation technique.



segmentation

For each segment, the table stores the starting address of the segment and the length of the segment. A reference to a memory location includes a value that identifies a segment and an offset.

Advantages and disadvantages of segmentation

Advantages :

no internal fragmentation.

Segment tables consume less memory than pages.
Lends itself to sharing data among processes.
Lends itself to protection.

Disadvantages: Costly memory management algorithm.