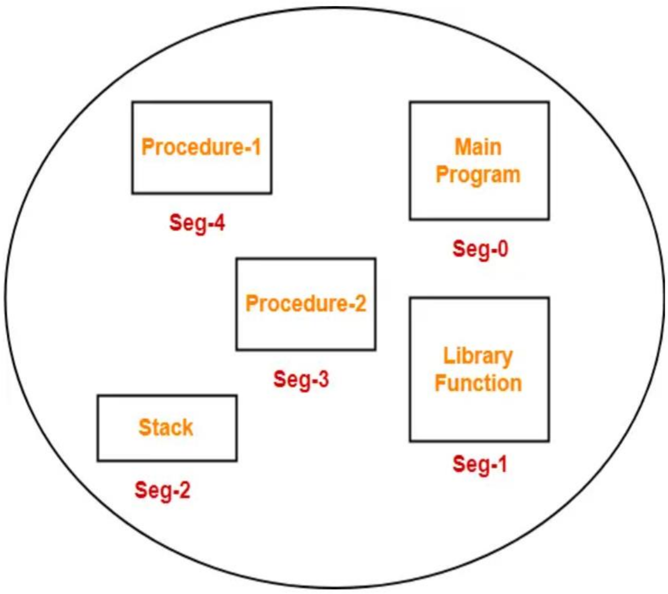
Unit-IV

Topic 5: Segmentation

Like Paging, Segmentation is another non-contiguous memory allocation technique. In Paging, the process was divided into equal-sized pages irrespective of the fact that what is inside the pages. It also divides some relative parts of a process into different pages which should be loaded on the same page. It decreases the efficiency of the system and doesn't give the user's view of a process. In Segmentation, similar modules are loaded in the same segments. It gives the user's view of a process and also increases the efficiency of the system as compared to Paging.

Basic Method

A Program is basically a collection of segments. And a segment is a logical unit such as: main program, procedure, function, method, object, local variable and global variables, symbol table, common block, stack and arrays. A computer system that is using segmentation has a logical address space that can be viewed as multiple segments.



And the size of the segment is of the variable that is it may grow or shrink. As we had already told you that during the execution each segment has a name and length. And the address mainly specifies both thing name of the segment and the displacement within the segment. Therefore the user specifies each address with the help of two quantities: segment name and offset.For simplified Implementation segments are numbered; thus referred to as segment number rather than segment name.Thus the logical address consists of two tuples:**<segment-number,offset>** where,

Segment Number(s):

Segment Number is used to represent the number of bits that are required to represent the segment.

Offset(d)

Segment offset is used to represent the number of bits that are required to represent the size of the segment.

Hardware

The details about each segment are stored in a table called a segment table. Segment table is stored in one (or many) of the segments.In the segment table each entry has :

Segment Base/base address:

The segment base mainly contain**s** the starting physical address where the segments reside in the memory.

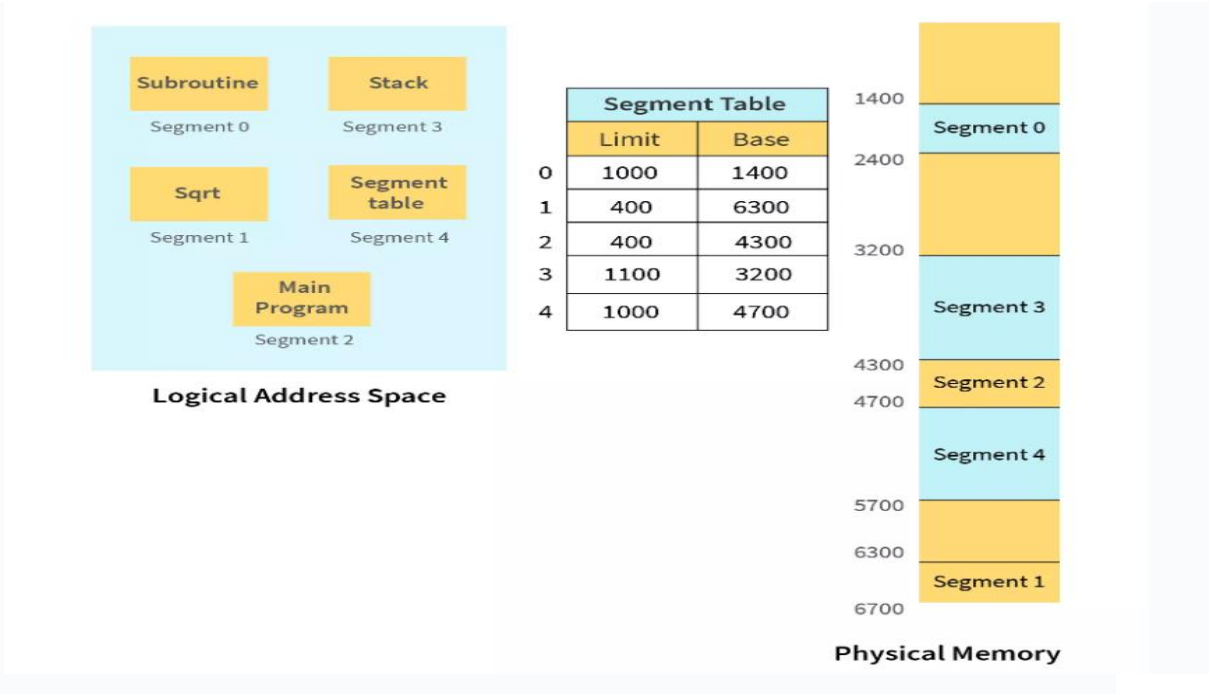
Segment Limit:

The segment limit is mainly used to specify the length of the segment.

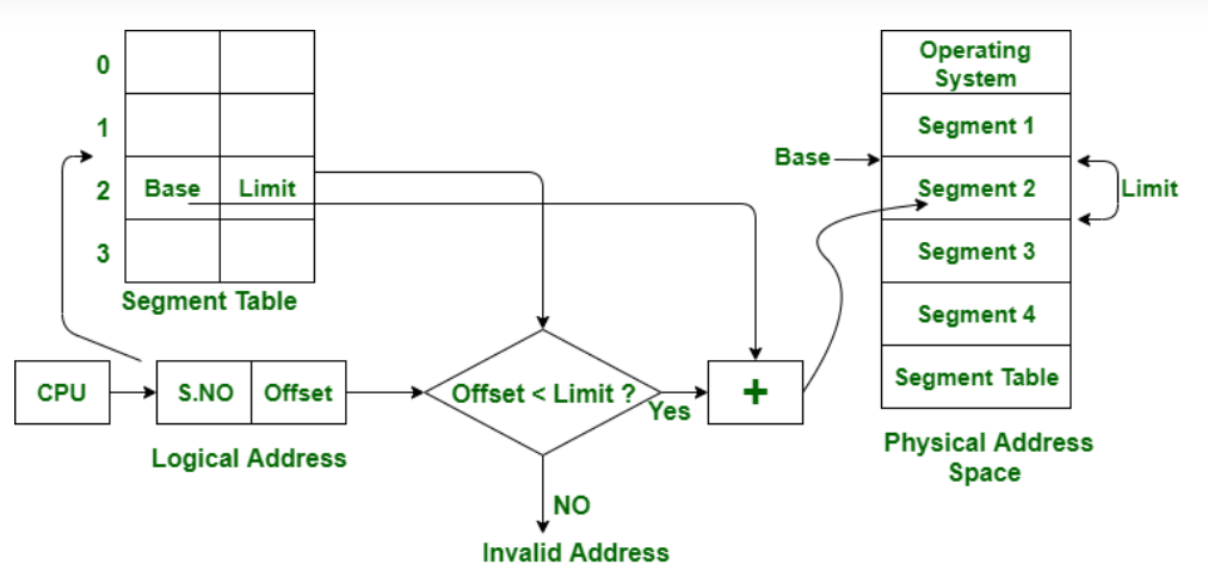
Let's take the example of segmentation to understand how it works.

Let us assume we have five segments namely: Segment-0, Segment-1, Segment-2, Segment-3, and Segment-4. Initially, before the execution of the process, all the segments of the process are stored in the physical memory space. We have a segment table as well. The segment table contains the beginning entry address of each segment (denoted by **base**). The segment table also contains the length of each of the segments (denoted by **limit**).

As shown in the image below, the base address of Segment-0 is 1400 and its length is 1000, the base address of Segment-1 is 6300 and its length is 400, the base address of Segment-2 is 4300 and its length is 400, and so on.The pictorial representation of the above segmentation with its segment table is shown below.



With the help of segment table and hardware assistance, the operating system can easily translate a logical address into physical address on execution of a program. The **Segment number** is mapped to the segment table. The limit of the respective segment is compared with the offset. If the offset is less than the limit then the address is valid otherwise it throws an error as the address is invalid. In the case of valid addresses, the base address of the segment is added to the offset to get the physical address of the actual word in the main memory.



Advantages of Segmentation

1. No internal fragmentation
2. Average Segment Size is larger than the actual page size.
3. Less overhead
4. It is easier to relocate segments than entire address space.
5. The segment table is of lesser size as compared to the page table in paging.

Disadvantages

1. It can have external fragmentation.
2. it is difficult to allocate contiguous memory to variable sized partition.
3. Costly memory management algorithms.

Paging Vs Segmentation

Paging	Segmentation
A page is a physical unit of information.	A segment is a logical unit of information.
Frames on main memory are required	No frames are required
The page is of the fixed block size	The page is of the variable block size
It leads to internal fragmentation	It leads to external fragmentation
The page size is decided by hardware in paging	Segment size is decided by the user in segmentation
It does not allow logical partitioning and protection of application components	It allows logical partitioning and protection of application components
Paging involves a page table that contains the base address of each page	Segmentation involves the segment table that contains the segment number and offset