Programme	: S. Y. B. Sc.	
Subject	: Computer Science	
Semester	: IV	
Paper Code	: CSC 104	
Paper Title	: Computer Organization and Operating systems	
Unit 8	: Memory Management	
Module Name	: Segmentation	

Module Number : 32

Segmentation

- Segmentation is a non-contiguous memory allocation technique.
- In segmentation, process is not divided blindly into fixed size pages.
- The process is divided into modules(segments).
- Segmentation is a variable size partitioning scheme.
- In segmentation, secondary memory and main memory are divided into partitions of unequal size.
- The size of partitions depend on the length of modules.
- The partitions of secondary memory are called as segments.

Example

• Consider a program is divided into 5 segments as shown below :



Fig: Programmers view of a program

Segment Table

- Segment table is a table that stores the information about each segment of the process.
- It has two columns.
 - First column stores the base address or starting address of the segment in the main memory.
 - Second column stores the size or length of the segment.
- Segment table is stored as a separate segment in the main memory.
- Segment table base register (STBR) stores the base address of the segment table.

	Base	Limit
Seg-0	1400	1000
Seg-1	6300	400
Seg-2	4300	400
Seg-3	3200	1100
Seg-4	4700	1000

For illustration, consider the below segment table

The segments are stored in the main memory as shown below :



Translating Logical Address into Physical Address

Following steps are followed to translate logical address into physical address-

<u>Step-01:</u>

- CPU generates a logical address consisting of two parts-
 - 1. Segment Number
 - 2. Segment Offset
- Segment Number specifies the specific segment of the process from which CPU wants to read the data.
- Segment Offset specifies the specific word in the segment that CPU wants to read.

Step-02:

- For the generated segment number, corresponding entry is located in the segment table.
- Then, segment offset is compared with the limit (size) of the segment.

Case-01: Segment Offset >= Limit

• If segment offset is found to be greater than or equal to the limit, a trap is generated.

Case-02: Segment Offset < Limit

- If segment offset is found to be smaller than the limit, then request is treated as a valid request.
- The segment offset must always lie in the range [0, limit-1], Then, segment offset is added with the base address of the segment.
- The result obtained after addition is the address of the memory location storing the required word.



Fig : Segmentation hardware.

Advantages

The advantages of segmentation are-

- It allows to divide the program into modules which provides better visualization.
- Segment table consumes less space as compared to Page Table in paging.
- It solves the problem of internal fragmentation.

Disadvantages

The disadvantages of segmentation are-

- There is an overhead of maintaining a segment table for each process.
- The time taken to fetch the instruction increases since now two memory accesses are required.
- Segments of unequal size are not suited for swapping.
- It suffers from external fragmentation as the free space gets broken down into smaller pieces with the processes being loaded and removed from the main memory.

Example of Segmentation:



- Segment 2 is 400 bytes long and begins at location 4300. Thus in this case a reference to byte 53 of segment 2 is mapped onto the location 4300 (4300+53=4353).
- A reference to byte 1222 of segment 0 would result in the trap to the OS, as the length of this segment is 1000 bytes.