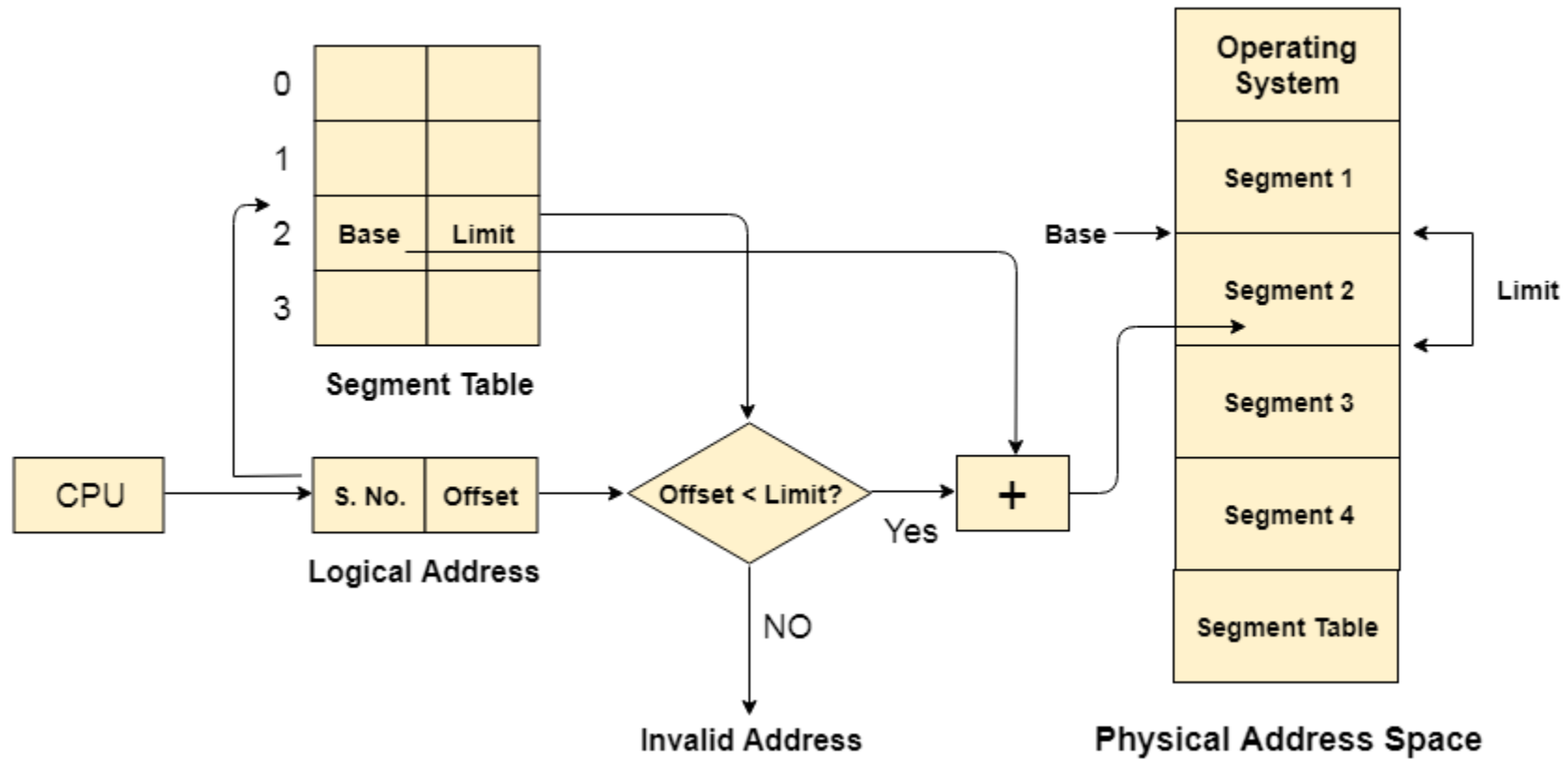# Segmentation :-

- In Operating Systems, Segmentation is a memory management technique in which, the memory is divided into the variable size parts. Each part is known as segment which can be allocated to a process.

- The details about each segment are stored in a table called as segment table. Segment table is stored in one (or many) of the segments.

- Segment table contains mainly two information about segment:

- 1.Base: It is the base address of the segment

- 2.Limit: It is the length of the segment.

Why Segmentation is required?

- Till now, we were using Paging as our main memory management technique. Paging is more close to Operating system rather than the User. It divides all the process into the form of pages regardless of the fact that a process can have some relative parts of functions which needs to be loaded in the same page.

- Operating system doesn't care about the User's view of the process. It may divide the same function into different pages and those pages may or may not be loaded at the same time into the memory. It decreases the efficiency of the system.

- It is better to have segmentation which divides the process into the segments. Each segment contain same type of functions such as main function can be included in one segment and the library functions can be included in the other segment,

Translation of Logical address into physical address by segment table:-

- CPU generates a logical address which contains two parts:

- 1.Segment Number

- 2.Offset

- 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 address, the base address of the segment is added to the offset to get the physical address of actual word in the main memory.

	Base	Limit
0		
1		
2	Base	Limit
3		

Segment Table

CPU

S. No.	Offset

Logical Address

Offset < Limit?

Yes

+

NO

Invalid Address

Base →

Limit

Operating System

Segment 1

Segment 2

Segment 3

Segment 4

Segment Table

Physical Address Space
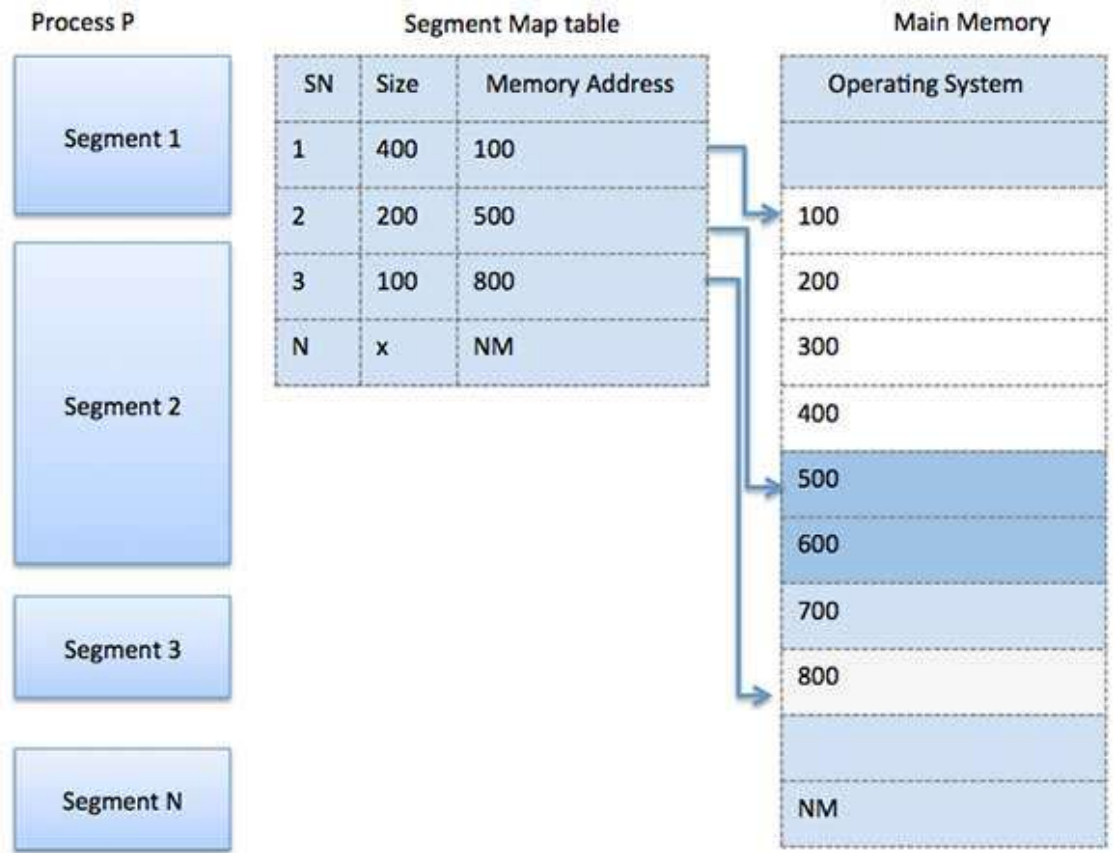
Advantages of Segmentation:-

- 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 compare 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.

- Segmentation is a memory management technique in which each job is divided into several segments of different sizes, one for each module that contains pieces that perform related functions. Each segment is actually a different logical address space of the program.

- When a process is to be executed, its corresponding segmentation are loaded into non-contiguous memory though every segment is loaded into a contiguous block of available memory.

- Segmentation memory management works very similar to paging but here segments are of variable-length where as in paging pages are of fixed size.

- A program segment contains the program's main function, utility functions, data structures, and so on.

- The operating system maintains a **segment map table** for every process and a list of free memory blocks along with segment numbers, their size and corresponding memory locations in main memory.

- 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.

Process P

Segment 1

Segment 2

Segment 3

Segment N

Segment Map table

SN	Size	Memory Address
1	400	100
2	200	500
3	100	800
N	x	NM

Main Memory

Operating System
100
200
300
400
500
600
700
800
NM

2.)Hardware support for segmentation:-

- In the program, the user refers to objects by a two-dimensional address, the actual physical memory is still, of course, a one-dimensional sequence of bytes. Thus we have to define an implementation to map two-dimensional user-defined addresses into one-dimensional physical addresses.

- This mapping is affected by a segment table. In the segment table, each entry has a segment base and a segment limit.

- Segment Base : it contain the starting physical address where the segment keep in memory.

- Segment limit : it specifies the length of the segment.

The use of the segment table illustrated in this figure:-
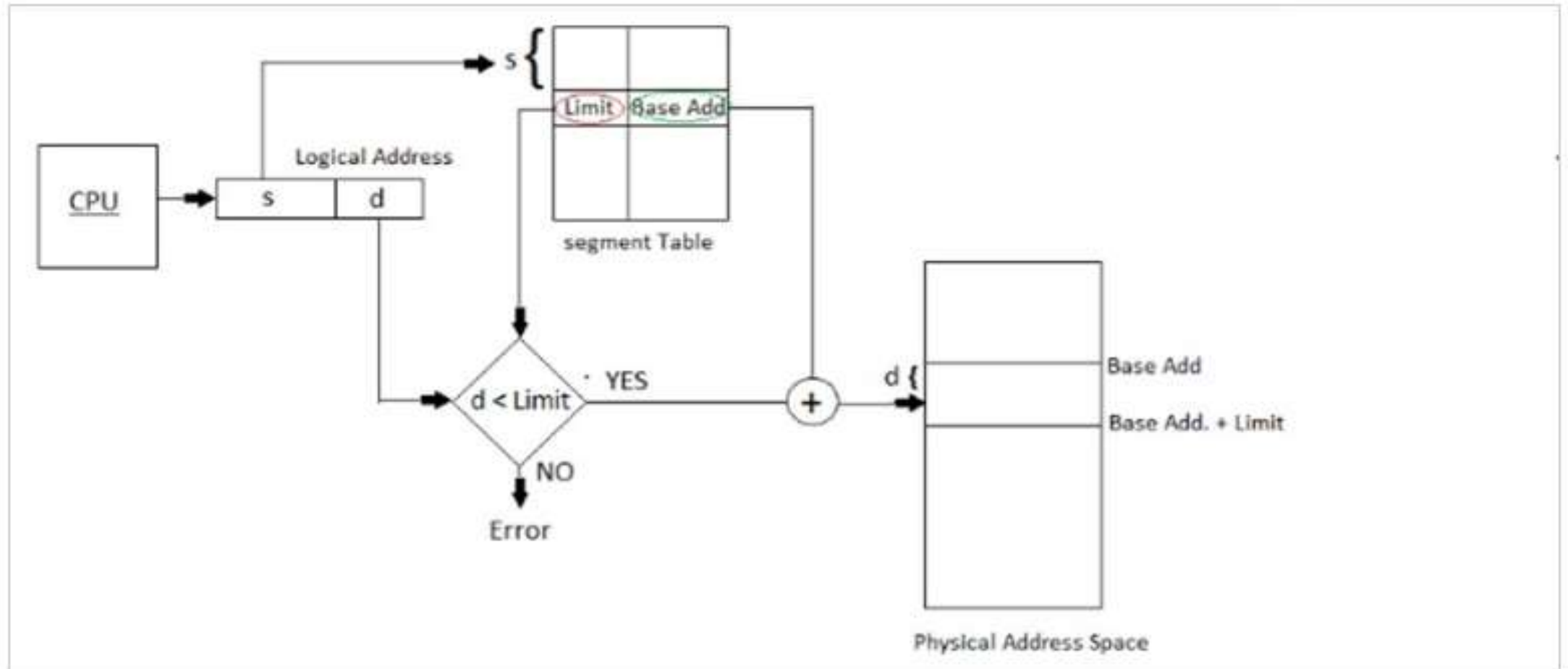
Segmentation Hardware

- The logical address consists of two parts: a segment number (s) and an offset (d) into that segment.
- The segment number used as an index into the segment table.
- The offset d of the logical address must be between 0 and the segment limit.
- If offset is beyond the end of the segment, we trap the Operating System.
- If offset is in the limit, then it is combined with the segment base to produce the address in physical memory, hence the segment table is an array of base limit and register pairs.