Chapter 10: Virtual Memory

Lesson 07:

Segmentation and Partitioning of virtual address space into segment and page addresses

Objective

- Understand how the segmentation helps
- Learn Partitioning of virtual address space into segment and page addresses
- Learn Segmentation concepts, use of segment address at first step and use of page displacement bits at next step

Use of TLBs along with the page tables

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- TLBs is that the amount of data referenced by programs is growing quickly over time, but the size of pages is growing fairly slowly
- Trade-off between the number of page table and TLB entries required, which decreases as page size increases, and the amount of memory wasted because fractions of a page cannot be assigned to a program, which increases as the page size increases

Insufficient of TLB of a given size

- The number of pages of data referenced by a program is growing over time
- A TLB of a given size able to contain translations for less and less of the data referenced by a program, reducing the TLB hit rate

Example

- A processor with 128 TLB entries and 4 kB pages can cache translations for 512 kB of data in the TLB
- If the system containing the processor has 128 MB of main memory, the translations in the TLB cover less than 0.5 percent of the main memory

Segments (superpages or page blocks)

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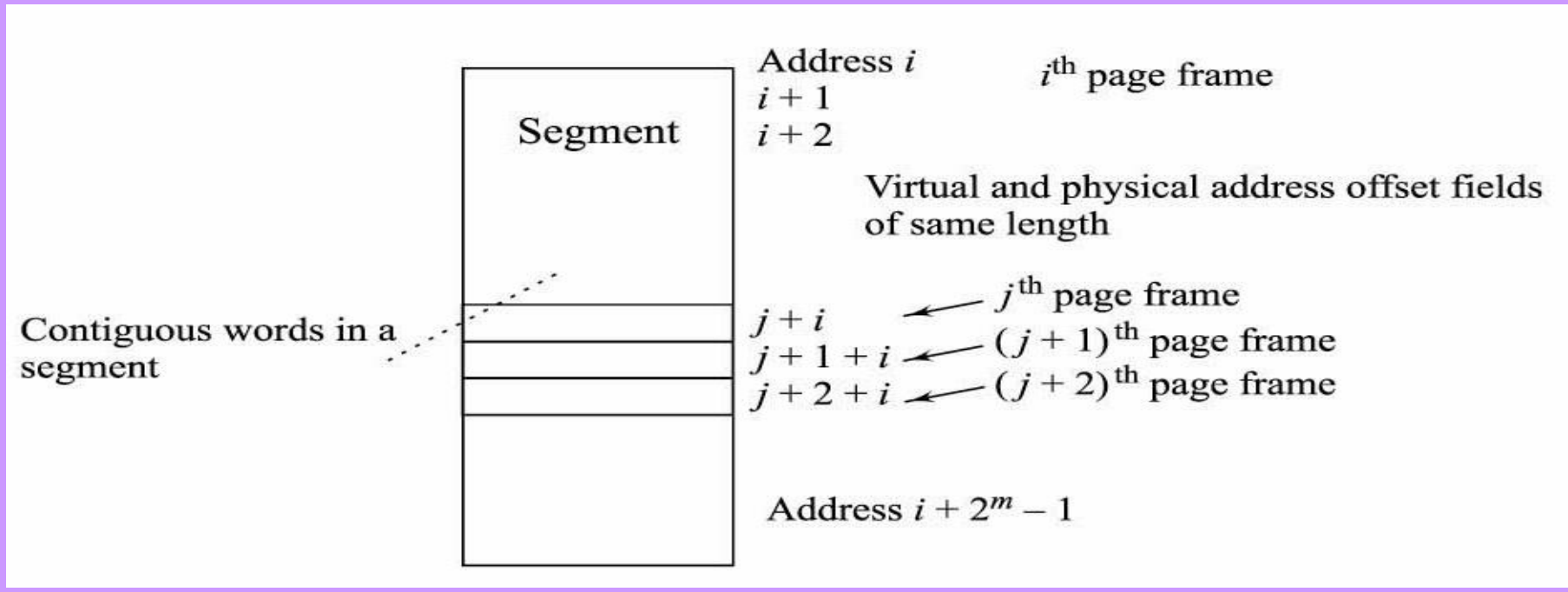
- Some processors provide the ability to map larger blocks of data, called segments *(superpages or page blocks*), in each TLB entry

A segment of 2^m words



Segments (superpages or page blocks)

- Some systems allow only each TLB entry to contain the translation for a variable-sized block of data, while others provide two sizes—one equal to the page size and one much larger, often more than a MB in size
- When an application references large block of contiguous data, these improvements can greatly increase the TLB hit rate

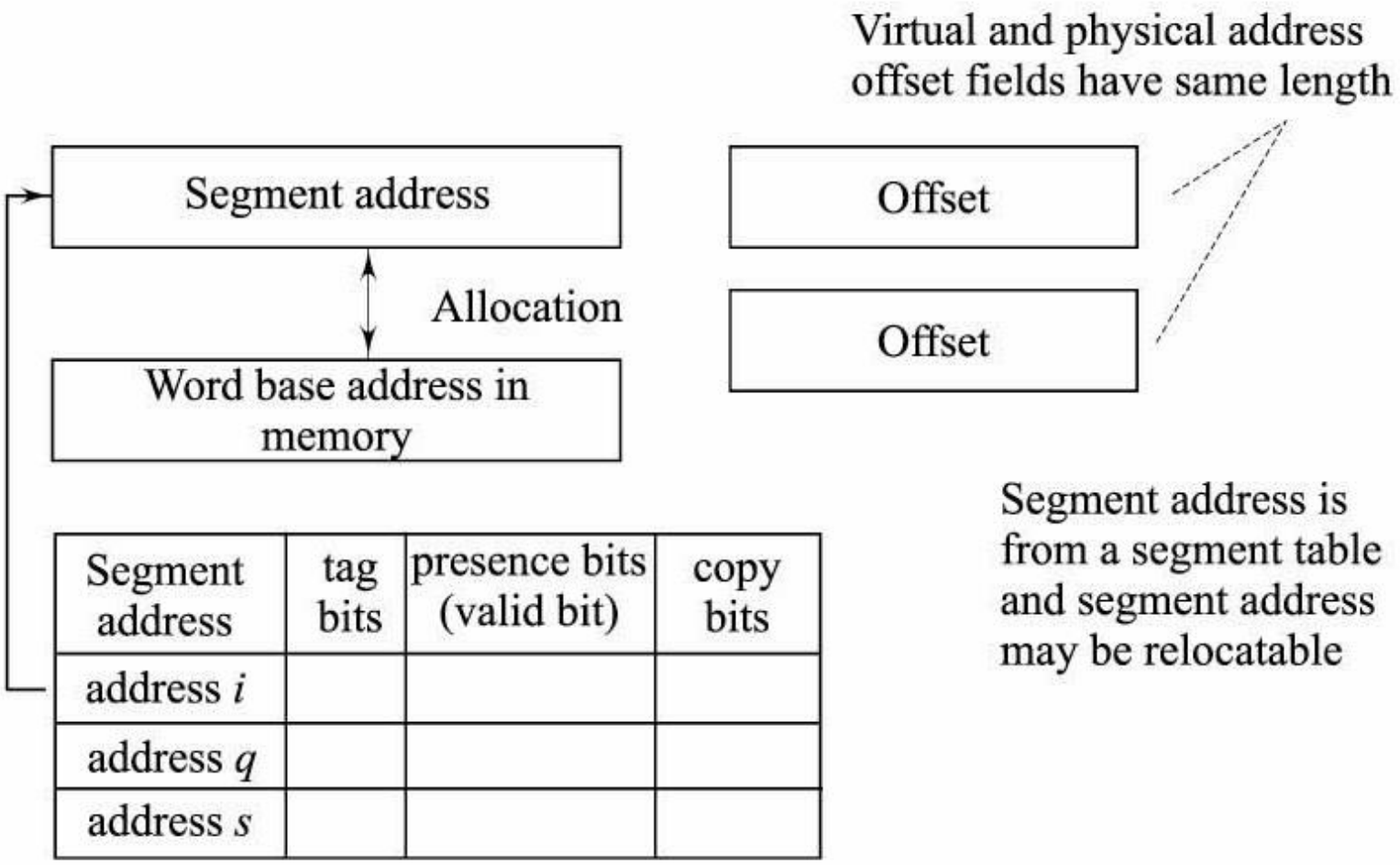
Segment

- A block having contiguous words
- For example: a code segment containing a program module or data segment containing a table for data

Segment

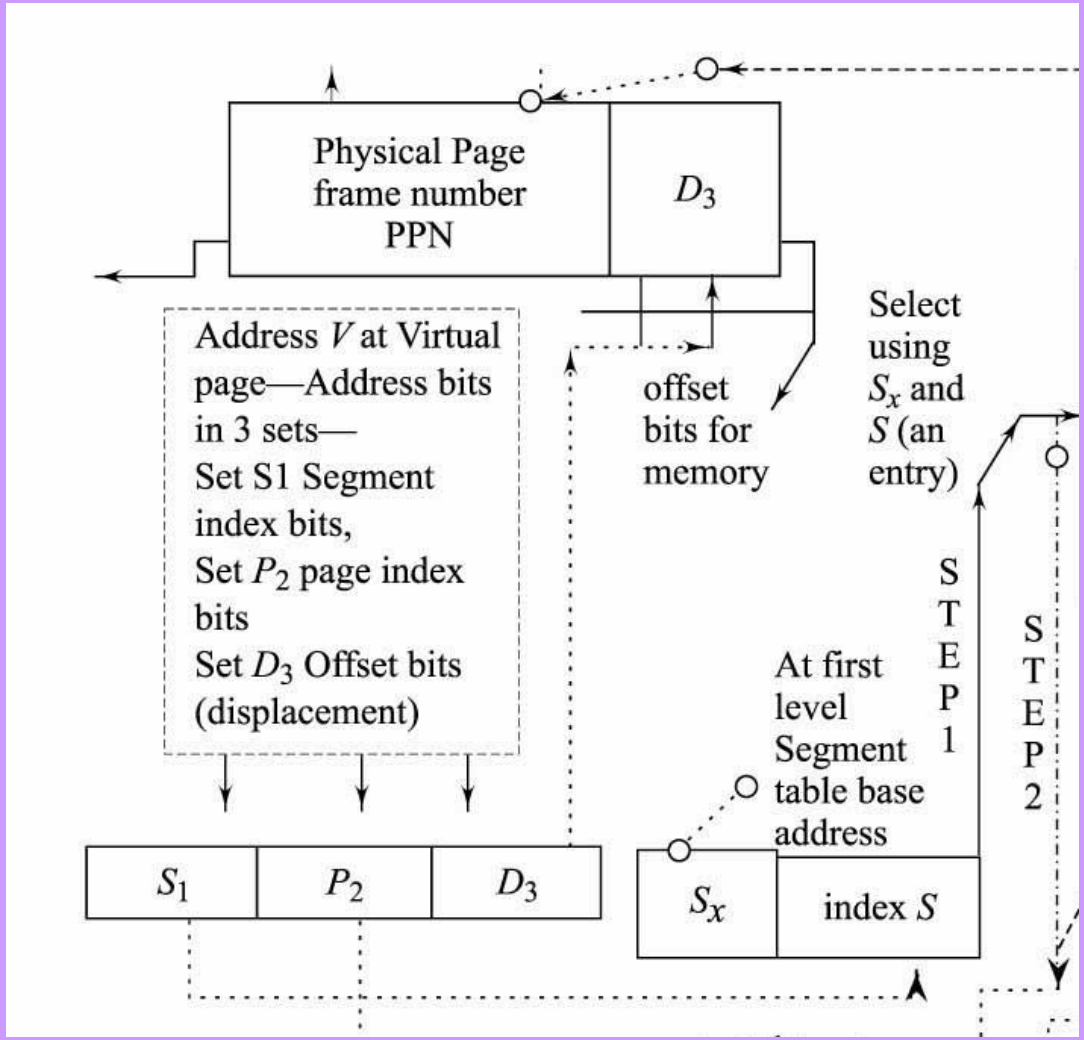
- A word in a segment is accessed by the segment address (base address, which means the address of the first word) and an offset (displacement value, which means the relative location in memory with respect to the base)
- A segment can have many pages such that each page is contiguously located

Segment word and segment table entries

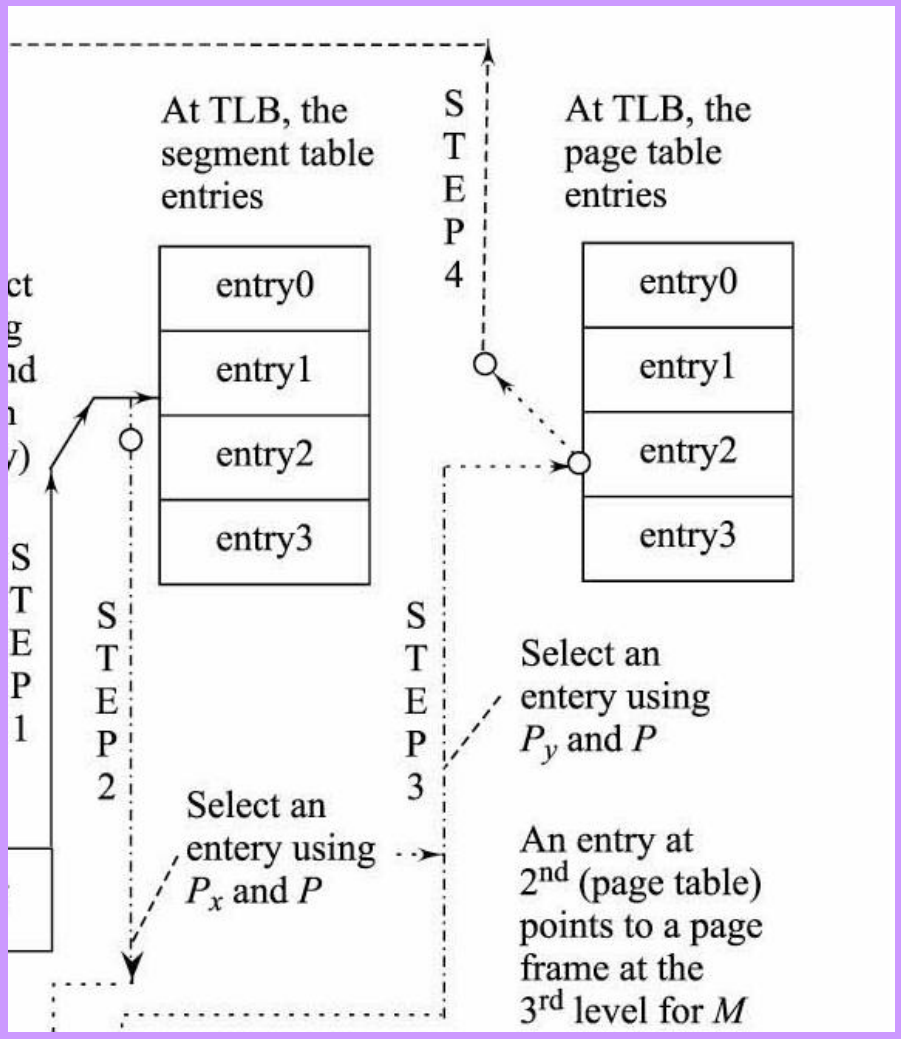


Use of Segments (superpages or page blocks) and page tables

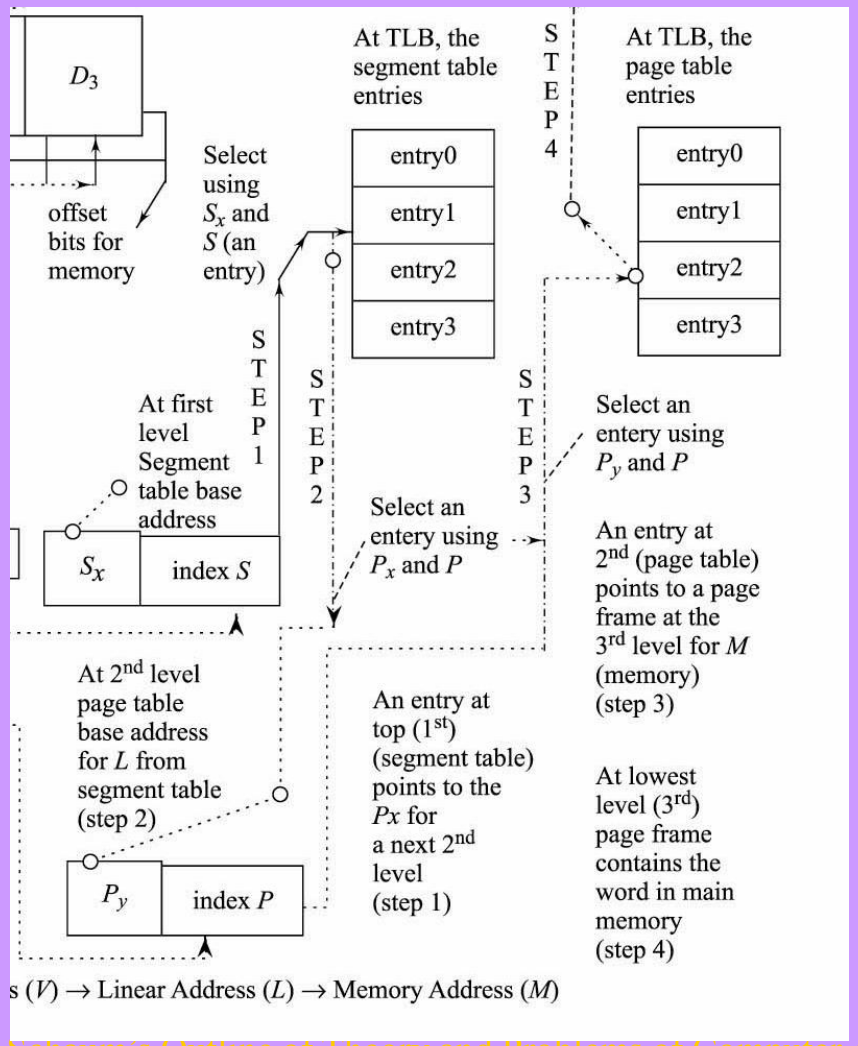
Address translation process using segment table at first step and page table at second step



Address translation process using segment table at first step and page table at second step



Address translation process using segment table at first step and page table at second step



Use of Segments (superpages or page blocks) at first level and page displacement and other bits for second level

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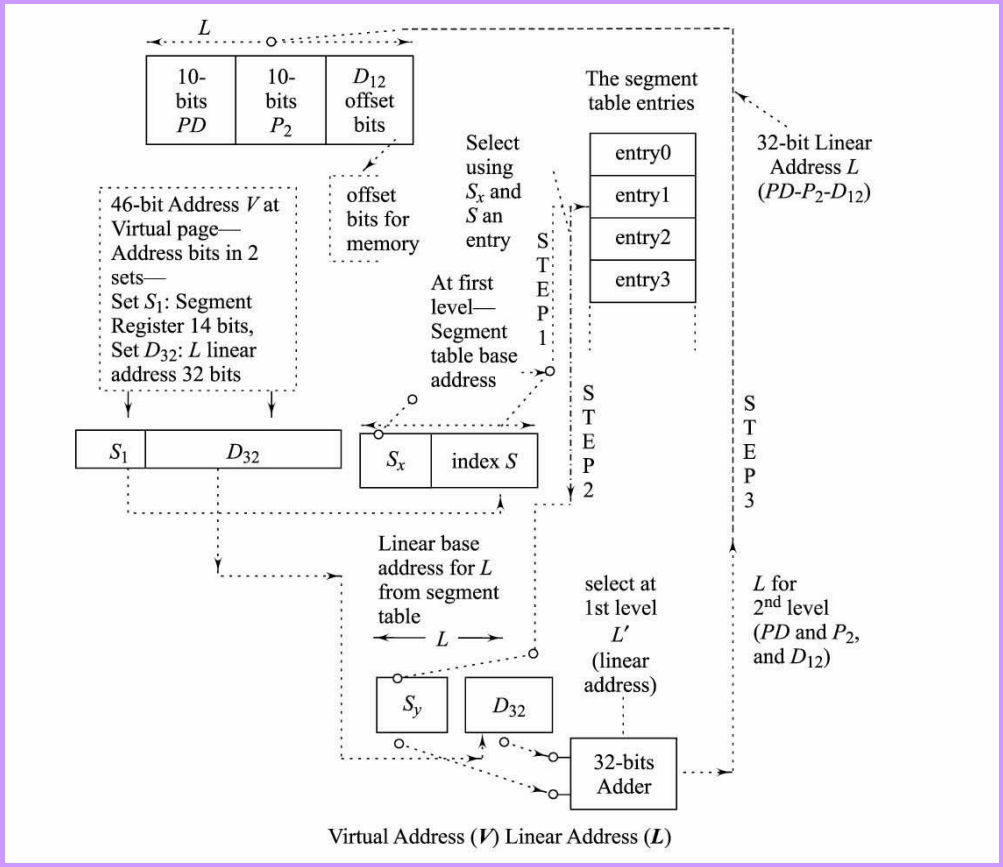

Summary

We learnt

- Segmentation concepts
- Use of segment address at first step
- Use of page displacement bits at next step
- Use of linear address and offset at last step

End of Lesson 07 on

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