

T-Question 9.1: Segmentation

- a. What is the benefit of using virtual addresses instead of working directly on physical addresses?

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Solution:

That allows the operating system to freely organize the physical address space (e.g., move the memory of processes) and to protect itself from processes as well as isolating processes from each other, by configuring the virtual-to-physical mapping appropriately. Added the same mapping to more than one process also allows for convenient and fast sharing of memory.

- b. How does the MMU determine where the segment table is located in memory?

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Solution:

The MMU has two registers: one that contains the physical address of the segment table and one that specifies the size of the table (either in bytes or elements, depending on the architecture).

- c. Assume a system with 16-bit virtual addresses that supports four different segments, which uses the following segment table:

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Segment Number	Base	Limit
0	0x1000	0x15f3
1	0x43ab	0x0300
2	0x25f3	0x1000
3	0x8000	0x00FF

Complete the following table and explain briefly how you derived your solution for each row in the table.

Virtual Address	Segment Number	Offset	Valid?	Physical Address
0xA019				
	1	0x0200		
0xC0DE			yes	0x25f3

Solution:

Virtual Address	Segment Number	Offset	Valid?	Physical Address
<i>0xA019</i>	<i>2</i>	<i>0x2019</i>	<i>no</i>	—
<i>0x4200</i>	<i>1</i>	<i>0x0200</i>	<i>yes</i>	$0x43ab + 0x0200 = 0x45ab$
<i>0xC0DE</i>	<i>3</i>	<i>0x00DE</i>	<i>yes</i>	$0x8000 + 0x00DE = 0x80DE$
<i>0x8000</i>	<i>2</i>	<i>0x0000</i>	<i>yes</i>	<i>0x25f3</i>

**Total:
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