

# **16.317: Microprocessor Systems Design I**

Summer 2013

## Lecture 7: Key Questions July 30, 2013

1. What are the major differences between real mode and protected mode?
2. What are the benefits offered by protected mode operation on the 80386?

3. Describe the difference between global and local memory.

4. Explain the purpose and general organization of descriptors.

5. Explain the general memory address calculation used in protected mode.

6. Explain the purpose and format of selectors.

7. Describe the descriptor tables used in the x86 architecture.

8. Describe the global descriptor table register (GDTR).

9. GDTR questions:

a. What is the GDT base address and limit if

- GDTR = 123400000FFH?
  
  
  
  
  
  
  
  
  
  
- GDTR = FEDC1AB20007H?
  
  
  
  
  
  
  
  
  
  
- GDTR = AABBB11221F0FH?

b. What is the size of the GDT and number of descriptors it holds in each of the examples above?

c. What is the maximum GDT size and number of descriptors?

10. Show how selectors and the GDTR are used to access global memory.

11. Describe how the LDTR is used to determine the location of the current LDT. Where are the values in the LDTR loaded from? At what point does the LDTR change? And what is the purpose of the LDTR cache?

12. Show the process used for local memory accesses on x86 processors.



13. Describe the interrupt descriptor table and its purpose.

14. Describe the process of task switching and the structures used in task switching on x86 processors.

**Practice problems:** Assume an x86 processor is running in protected mode with the state given below (all values in hex); note that each memory location shown contains a descriptor about a particular segment:

GDTR = 00200000001F  
LDTR = 000B

DS = 0017  
SS = 0018  
ESI = 00001000  
EBX = 0001120

Memory	Address
Base = 030010F0 Limit = 020F	00200000
Base = 00200020 Limit = 0017	00200008
Base = 00200038 Limit = 0010	00200010
Base = 1200C000 Limit = FFFF	00200018
Base = 12340000 Limit = 00FF	00200020

Memory	Address
Base = 01000010 Limit = 1127	00200028
Base = 03170200 Limit = 03F7	00200030
Base = 1A000000 Limit = 01FF	00200038
Base = 06B01000 Limit = 0F07	00200040
Base = 05000120 Limit = 000F	00200048

- What is the base address and limit of the global descriptor table? How many descriptors does this table contain?
- What is the base address and limit of the current local descriptor table? How many descriptors does this table contain?
- What are the starting and ending addresses for the current data and stack segments?
- What address is accessed by each of the following instructions?
  - MOV AX, [0100H]
  - ADD DX, [SI]
  - MOV AX, SS:[SI+EF00]
  - SUB SS:[A200], CX
  - MOV DX, [BX+SI]
  - MOV CX, [BX+SI+1EH]

**Space to answer questions**

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