Section 7: Virtual Memory

CS 152
Spring 2009

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Problem 1: VM Basics
What are the 3 main motivations for Virtual Memory?

Problem 2: TLB Design
After analyzing your system's performance you realize you are getting lots of TLB misses. Making the TLB bigger will make the hit time too slow and you can't change the page size. What else could you do?

Problem 3: SW Issues
Running your GEMM (matrix multiply) code on large matrices you find out that you are getting lots of TLB misses. What can software changes can you do to fix it?

Problem 4: Page Table Size
Your system has a 40-bit virtual address with a 32-bit physical address and 16KB pages. Your PTE's use 6 status bits and your disk is addressed by 42 bits. All addresses are byte addressed, word aligned. A program is launched that only allocates one page.

a) How many bytes is your page table?

b) If you use a 2-level hierarchical page table, with 4K top level pages, how big is your page table now?

c) If you are trying to design your page table to be as small as possible with only 1 page allocated, how many top level pages should there be?

On the back is p. 328 from H & P. Look at it to see a modern memory system.