`CST 334 (Operating Systems)

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# Lab: Translation Lookaside Buffers (TLBs)

Could you figure out the size of the TLB on your machine by writing some C code and seeing how long it takes to run?

Here is an idea:

* Write some C code that accesses a value on one page, then a value on the next page, then a value on a third page, and then repeats the process many times. Should this code run quickly?
* What if the code accesses 10 consecutive pages in a loop instead of 3? Should this code run just as quickly?
* What if the code accesses 1000 consecutive pages in a loop instead of 10? Should this code run just as quickly?

The code in the first example should run quickly because the VPN associated with the first page will be stored in the TLB. When the code refers to that page over and over, there will be a cache hit, and the memory accesses should be very fast.

The code in the last example will probably run more slowly because by the time we access the first page again, the VPN associated with the first page will have been cleared from the TLB.

The author has written C code to run these experiments. Let's try the code for different values of "number of consecutive pages".

1. Copy and compile the file tlb.c that can be found at:

/home/CLASSES/brunsglenn/cst334/labs/TLB/tlb.c

You can compile it on mlc104 like this:

$ gcc -pthread -o tlb tlb.c

(For details on the code, refer to the beginning of the Homework section in OSTEP Chapter 19, and the code itself.)

The program takes 2 command line parameters: the first is the number of pages the program will loop over, and the second is the number of trials it will run (in each trial it will loop over the number of pages a bunch of times).

The program outputs the average time it took to run each trial. For example, you could run the code like this:

$ ./tlb 100 10000

This says: loop over 100 pages bunch of times, and find the average time over 10,000 trials.

1. Following question 3 in OSTEP, write bash code to run the program repeatedly with different values for the number of pages. Use a bash for loop.
2. What do your results tell you about the size of the TLB on mlc104?
3. Do you know any method to plot your results as shown in Figure 19.5 of OSTEP?
4. If you have time, try to address questions 5 and 6 in OSTEP. For 5, look into system call ‘pthread\_set\_affinity’.