COSC 310

OPERATING SYSTEMS

Lab 3, Soobin Rho

Aim: To investigate how the number of processes affects the running time in Fork and how the number of threads affects the running time in OpenMP and POSIX Threads.

Method: I ran numerical computations on 50 million numbers. I used the c programs written by Professor Steinwand: `num3.c`, `num3omp.c`, and `num3pthread.c`. Each program had to be run 18 times. In total, it took my computer 7 and a half hours to run these.

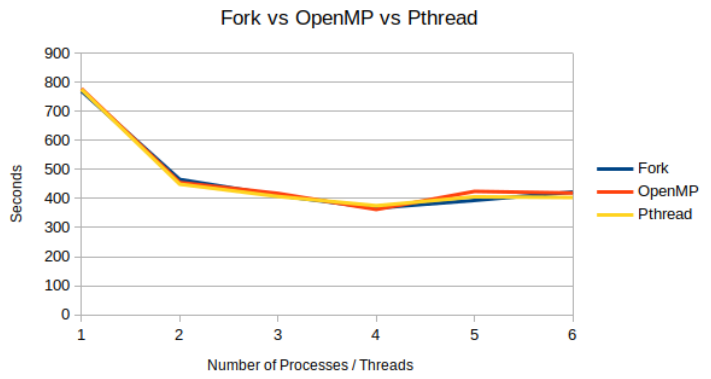
Since I needed to run these programs a total number of 54 times, I wrote a Bash script to do that. I didn't know anything about Bash scripting before, but I always wanted to. So, this lab was a perfect opportunity to start learning about Bash scripting. I read "The Linux Command Line" (William Shotts) to write the script. It basically accepts the filename of the program to run, as well as their parameters, in the form of a standard input, and then runs them for the specified amount of iterations. All outputs of the programs were redirected as files, which I named as follows:

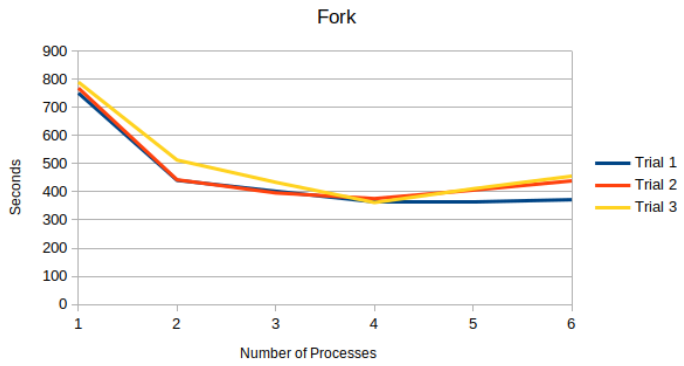
2023-02-26-131509-num3fork_1.txt
2023-02-26-131509-num3fork_2.txt
…
2023-02-26-131509-num3omp_1.txt
2023-02-26-131509-num3omp_2.txt
…
2023-02-26-131509-num3pthread_1.txt
2023-02-26-131509-num3pthread_2.txt
…

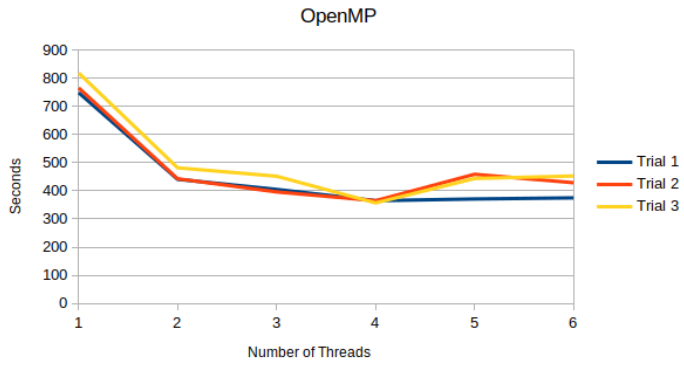
My Computer:

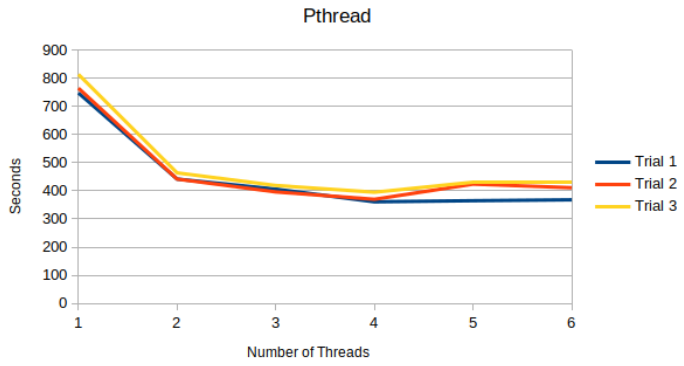
- ThinkPad T440, Fedora 37 KDE
- Intel i7-4600U 3.3GHz. It has 4 cores.
- 12GB Ram

Results:









Note that Trial 2 and Trial 3 have higher runtimes than Trial 1 because I was doing other homework at the same time I was doing Trial 2 and Trial 3. Unlikes 2 and 3, Trial 1 was not competing with any other process.

Conclusion: The run time decreased by half when the number of processes or threads increased from 1 to 2. When the number increased from 2 to 3 and so on, the runtime improvement was not as great as 50% as the first increment, but still had around 10% gain in performance.

What surprised me the most was that increasing the number of processes or threads beyond the number of cores on my CPU either has no positive effect at all or even hurts the performance. On all Fork, OpenMP, and Pthreads, the most optimal number of processes or threads was 4, which also happens to be the number of cores on my CPU.