First Touch Awareness Implementations for Parallel Jacobi Method

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1   Overview

This algorithm is programmed in C++ using OpenMP. The goal is to determine the execution time for various numbers of threads and matrix sizes. The project features one executable (`jacobi`). Additionally, a shell script was used to collect and output the data, and Python scripts using Matplotlib were used to create organized visualizations. Output text files used for the visualizations have been saved in this repository.

2   Implementations

In the previous Jacobi assignment, `times_3.txt` was recorded just before the implementation of first touch awareness. `times_4.txt` was recorded afterwards, and `times_5.txt` was recorded after scheduling was added to the pragma statement. In general, there is not much timing difference between 3 and 4 at lower sizes, suggesting that communication across the memory network is not expensive for this scale. However, after the implementation of first-touch, there is somewhat more time delay for low-thread-count execution times at larger sizes (see Figure 2). This could be caused by the higher caches associated with each thread not having enough memory to store the larger matrices. This then results in overhead with no real benefit, as the thread would have to pull from lower/shared/main memory regardless.
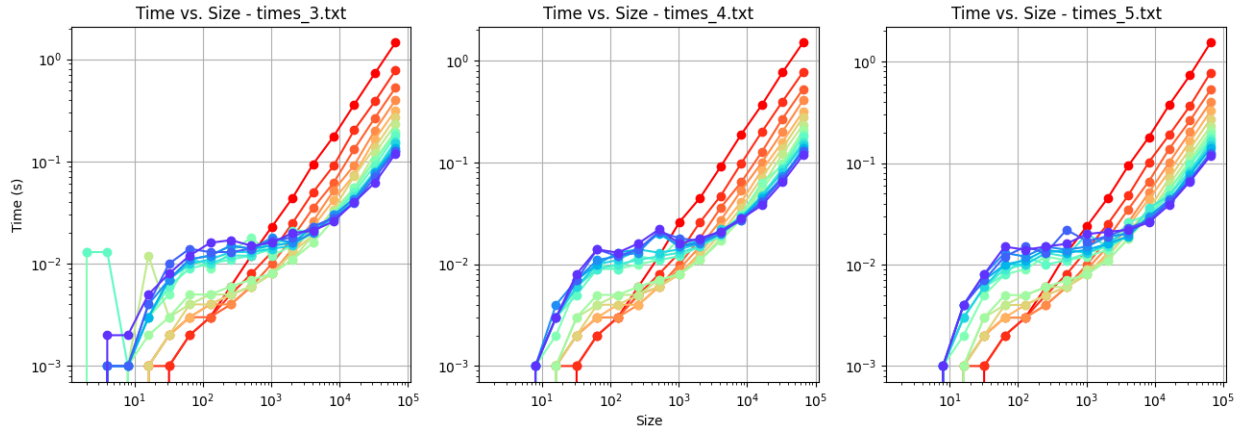
Figure 1: Thread Counts on Execution Time vs. Matrix Size for Pre-Implementation, Post-Implementation, and Scheduled Implementation of First Touch Awareness
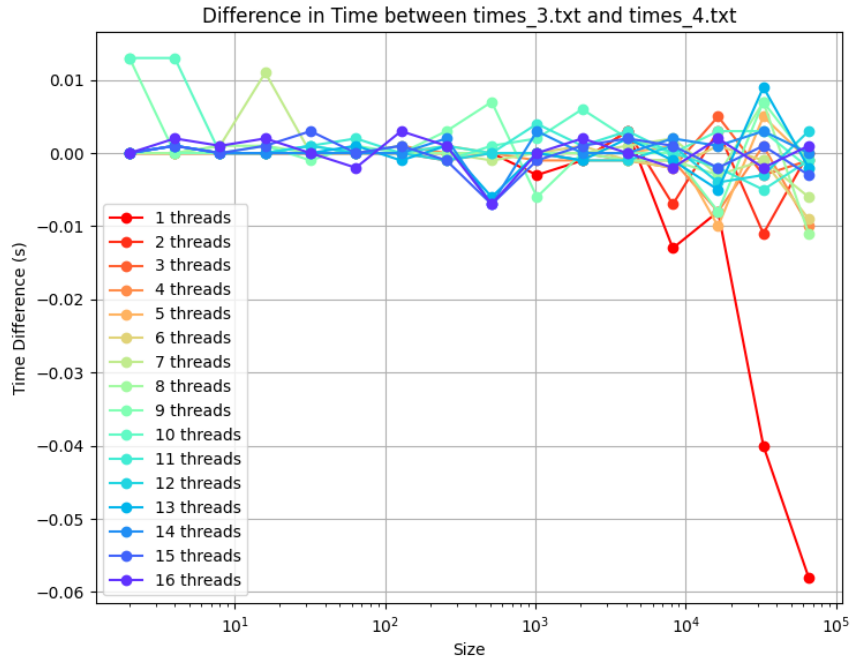

Figure 2: Thread Counts on Signed Difference in Execution Time between Pre-Implementation and Post-Implementation of First Touch Awareness