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Performance Summary of Efficient Parallel Numerical Integration Program on a 2-D Mesh

A screenshot of a computer

Description automatically generated

This paper will provide in-depth analysis of the performance of the efficient parallel numerical integration program. The first output is the result of values 150 and 70 assigned to number of processes and number of points respectively. Likewise, the second output is given by the values 40 and 30 held by the aforementioned variables. We may appreciate that there are two substantial discrepancies in output and speedup between the two versions of the same program. First, Pi’s rightmost five digits, after the decimal, are completely different, moving from 3.141591561 in the version with 150 processes to 3.141564365 in the version with 40 processes. Second, the C\* simulator informs us that there is an acceleration of almost 36 times in the first run and a speedup of approximately 14 times in the second test, about less than half of the first.

The underlying reason for this major difference in performance is the communication delay in the 2-D mesh multicomputer topology. The higher the number of computers used, the lower the interprocessor communication delay. Because of the nature of the parallelized shared memory, the program is structured as to pass the globally declared variables as parameters inside function calls, allowing processors to carry out their instructions without interference, every time a process is created inside a for-loop. Thus, whenever processors communicate and shared data, the do so via streams, queue-like data structures that save data on a first-in, first-out basis, dramatically reducing the communication overhead in a multi-computer system. In conclusion, the more processors, as in computers, are employed in a multi-computer system with shared memory and organized communication structures, the lower the overall communication delay is.