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1 Introduction

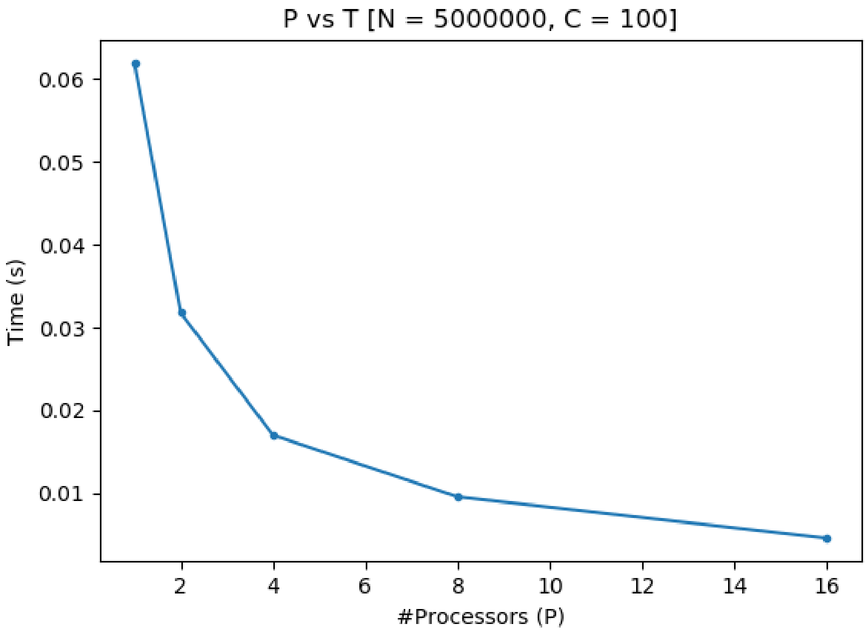
The following results were obtained by running on a single node with 28 processors on the PACE-ICE cluster.

We note the runtime and efficiency of the parallel sum algorithm from class as -

$$\text{Theoretical runtime T(N,P)} = \Theta(\frac{N}{P} + \log P)$$

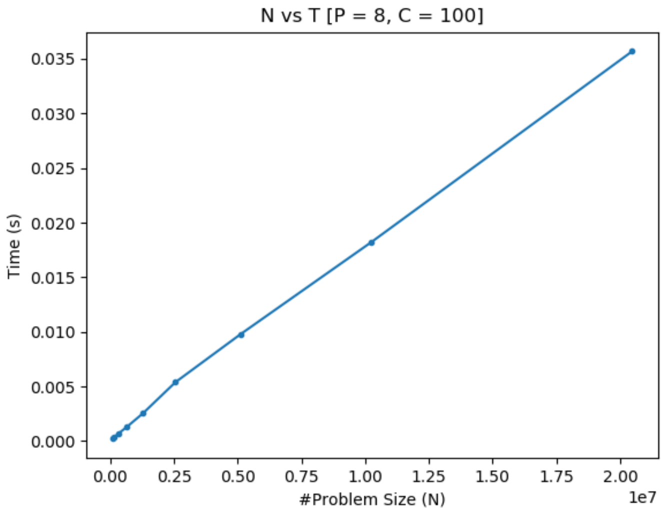
$$\text{Efficiency} = \Theta(\frac{N}{N + P\log P})$$

P vs T

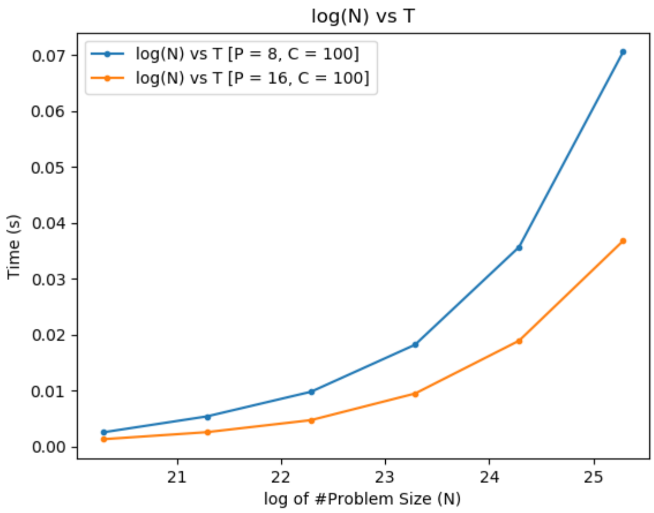


We see from the above plot that the runtime of the algorithm decreases with increase in the number of processors. This is as expected from the theoretical runtime because the term $\frac{N}{P}$ decreases much faster than the increase of $\log P$. As the number of processors doubles, we expect that the runtime should nearly half because $\log P$ is insignificant compared to $\frac{N}{P}$ for these input values. This means that the product $T * P$ should be approximately constant and this can be observed from the plot which seems similar to a $y = \frac{1}{x}$ plot.

N vs T



From the theoretical runtime expression, we expect that the runtime increases nearly linearly with N as long as N is large. We made the N vs T plot but it was hard to infer anything from it because the smaller values of N were nearly indistinguishable because of the scale of the graph owing to the exponential increase of N.



So, we decided to plot log N vs T instead. Since, N vs T was expected to be linear, log N vs T is expected to be exponential. This is supported by the graph. For large N, the local computation time dominates the communication time but as N decreases, the communication time has more of an effect on the runtime.