Experiments on Scalability

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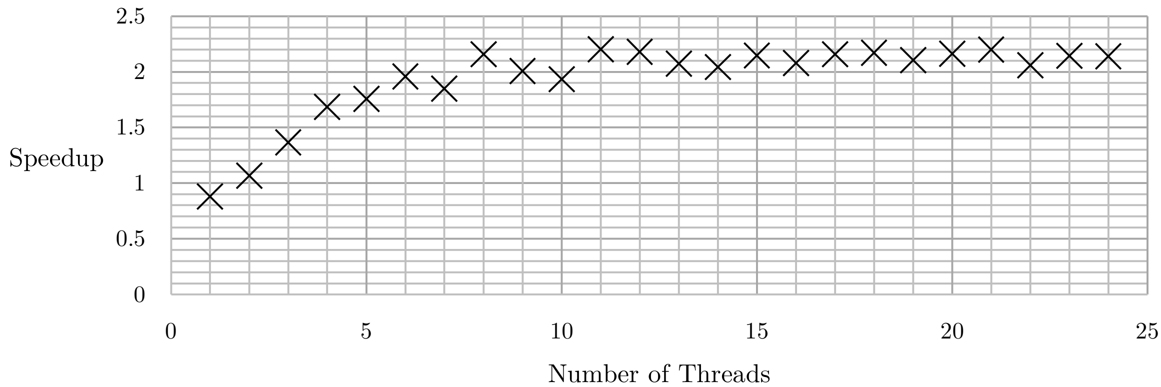
I performed the following experiments on Hamilton – Durham University's 24-core supercomputer. All results are the average of five repetitions of the experiments.

Strong Scaling

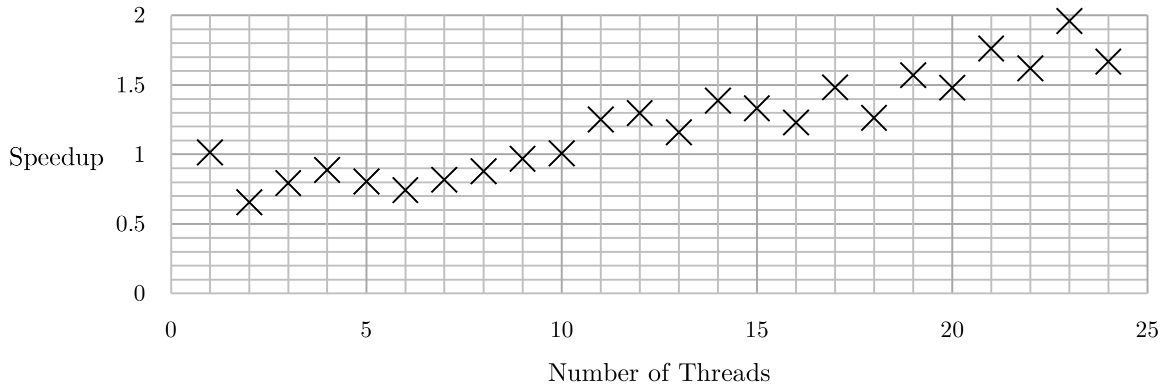
In this experiment, I ran the parallel implementation of the program on a constant input of 216 bodies, varying the number of threads available and measuring the runtime. The speedup was calculated by dividing the time for serial execution by the parallel times. Below is the plot of speedup against number of threads:



This graph clearly shows the logarithmic trend that is common in most plots of Amdahl's Law.

Weak Scaling

In this experiment I ran the sequential and parallel code, varying the input size by a factor of the square root of the number of threads available to the parallel implementation. Below is the plot of speedup against number of threads in this weak scaling model:



This graph shows the linear trend laid out by Gustafson's Law.

Comparison

For small processes with low numbers of bodies, strong scaling is the more appropriate model as the process could be run feasibly in serial but sped up to a limit in parallel. However, larger processes with thousands of bodies, processing serially is much less feasible, therefore the weak scaling model is more appropriate, as the machine's available resources are assumed to be saturated.