Simulation and Scientific Computing
Assignment 2

Openmp code for solving elliptic PDE

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Performance Plots:

Following curves i.e. Speed up Vs Number of threads and Parallel efficiency Vs Number of threads are plotted with number of threads on X axis as logscale base 2 and performance characteristics on Y axis for various cases.

a) nx = 32; ny = 32.

b) nx = 33; ny = 33.

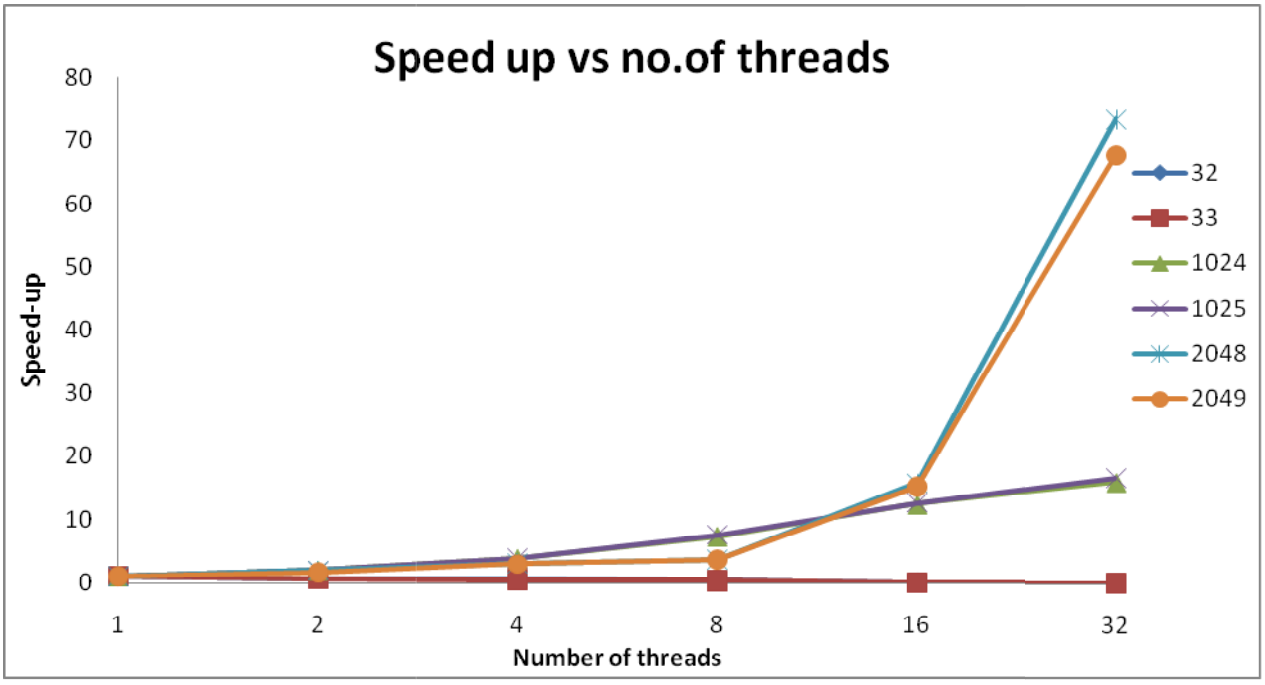
c) nx = 1024; ny = 1024.

d) nx = 1025; ny = 1025.

e) nx = 2048; ny = 2048.

f) nx = 2049; ny = 2049.

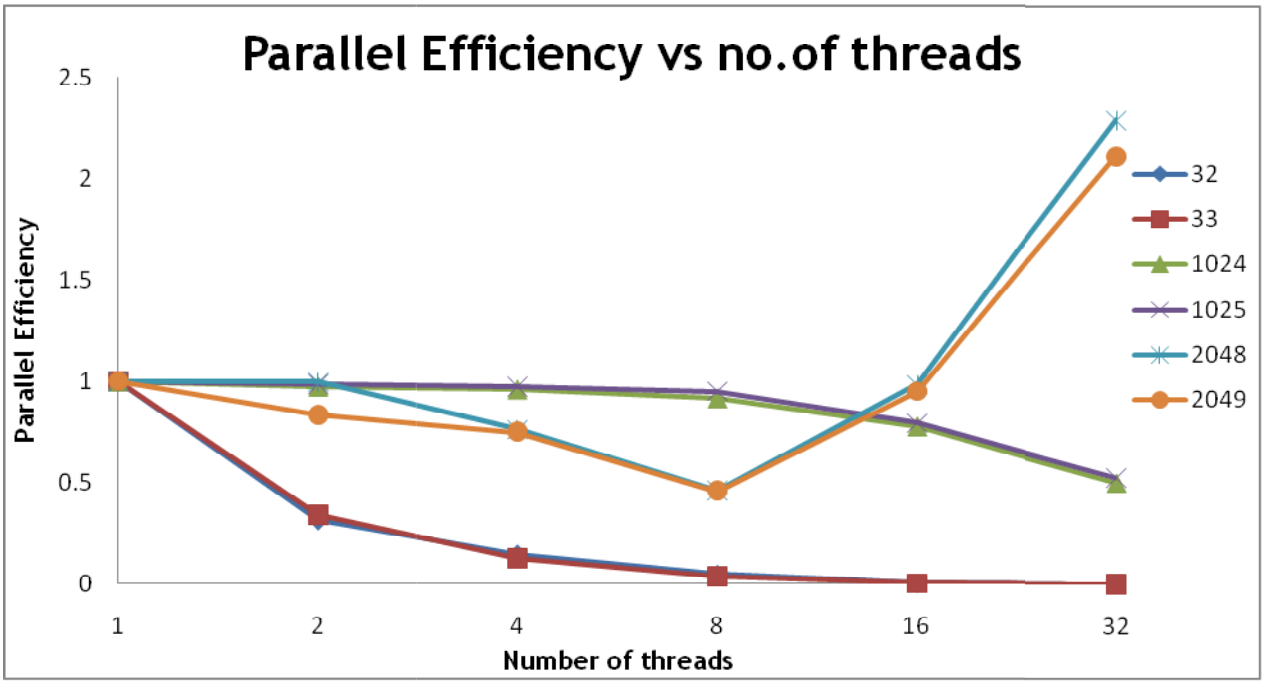
1) Speed up Vs Number of threads:



It can be observed from the curve that for smaller grids the speedup is not significant due to insufficient data but as we jump to the case for nx and ny greater than and equal to 2048 the code is scaling as the parallel resources increases. Scaling for 2048 shows a saturating trend till 8 threads which could be associated

with memory bandwidth saturation, but it starts scaling exponentially as we increase threads to 16 and 32.

2) Parallel efficiency Vs Number of threads:



Parallel efficiency shows a decreasing trend for grid sizes less than 1025, as the parallel resources are not getting utilized efficiently due to insufficient data. For the grid sizes 2048 and 2049, parallel efficiency decreases till 8 threads because of the bandwidth limitation of a single ccNUMA domain. But as we increase to 16 and 32 threads the efficiency scales exponentially ,which is the same trend as speed-up.

In order to achieve proper scaling and to ensure golden touch rule , thread pinning was implemented.