

Assignment 3 – Two level parallelism with MPI/OpenMP

Physics 7411 – Computational Physics: Computing for Petascale Systems

Due: April 14, 2009 at 6:00 p.m Central time

The purpose of this assignment is to add a second level of parallelism to a parallel MPI program using OpenMP. This structure matches will to today's multi-core based parallel Linux clusters which have 4-16 shared memory cores per node. You will start with a working parallel MPI code for a Conjugate Gradient Solver, cg.c.

1. Compile and run the gen-cg.c program and generate three data sets.
 - a. Small 100x100
 - b. Medium 1000x1000
 - c. Large 3500x3500
2. Compile and test cg.c with the small data set on a few processors.
3. Use gprof or pgprof to profile and identify the most time consuming portion of the cg.c program for the medium sized input.
4. Use OpenMP to add another level of parallelization in the part of the code taking the most time, test that the answer still matches that of the MPI only version
5. Measure the runtime of a) the MPI only version, and b) MPI/OpenMP version with OMP_NUM_THREADS set to 2 and 4 for the medium and large data sets
6. Write and submit a brief report which contains
 - a. the profile results from 3
 - b. a description of your additions and changes for 4
 - c. the timing results from 5
7. In addition submit your revised cg.c file

You may work individually or in groups of 2 on this assignment.

The code required for this project will be posted on the website with the handout soon.