TLP Project

May 6, 2009

Background Review

- Suppose your company wants to purchase some new computers.
  - Multiple single core systems that will be clustered
  - Quad-core systems.
- Suppose your budget is limited.
- Please write a report to a technical manager who needs to make purchase decisions with your suggestions about the best type of computers to purchase.

Project Overview

- Parallelize mandelbrot4.c or mandelbrot5.c
  - Make sure exec time works
  - Play with iterations param (longer run time)
- Part 1 - pthreads
  - Run algorithm with various numbers of pthreads.
- Part 2 - MPI
  - Run algorithm with various numbers of nodes
- Analyze to determine tradeoff of cluster vs. pthreads

Toolchain

- pthreads howto (http://www.yolinux.com/TUTORIALS/LinuxTutorialPosixThreads.html)
- MPI Documentation (http://heather.cs.ucdavis.edu/~matloff/MPI/NotesLAM.NM.html)
- General LAM MPI documentation (http://www.lam-mpi.org/tutorials/one-step/lam.php)

Sample Code

- mandelbrot4.c – Compute the Mandelbrot set and outputs a tga file.
- mandelbrot5.c – Do a dot product between two vectors using mpi
- Mandelbrot_parms – parameters for the Mandelbrot runs.
- Data move in mpi – Showing movement of data between master and slaves.
- vecsum.c – Showing MPI scatter and gather in action.
- dotprod.c.pthreads – Do a dot product between two vectors using pthreads
- dotprod.c.mpi – Do a dot product between two vectors using mpi

Other References

- Gather Web page – Web page illustrating MPI gather (http://mpi.deino.net/mpi_functions/MPI_Gather.html)

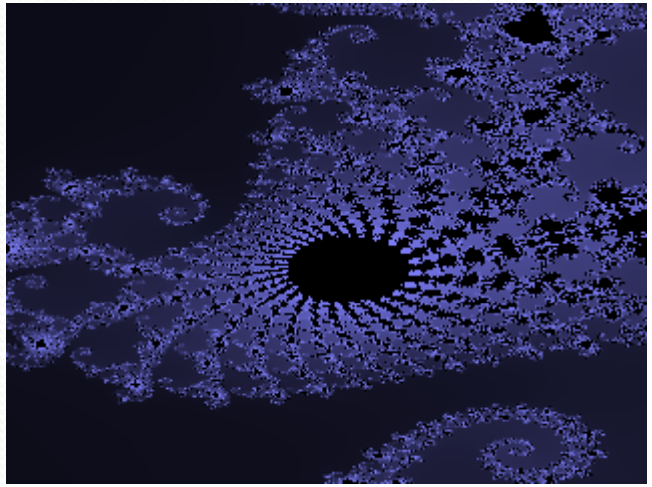
- Mandelbrot pictures – These pictures will match your output (http://www.maths.tcd.ie/~nryan/mandelbrot/seahorsezoom.html).

Before You Start

- **LAM setup**
  - First logon to one of the ECE unix systems.
  - 3 initial steps before you using MPI
    - $ setup lam
      $ vi .cshrc (add the following line:)
      setenv LAMRSH 'ssh -Y‘
      resoft (or open a new terminal window)
- **Compiling Mandelbrot samples**
  - *cc –lm –o mandelbrot5 mandelbrot5.c*

Parallelize mandelbrot[4/5].c

- Choose one version
  - Mandelbrot4.c – less colorful
  - Mandelbrot5.c – more colorful
- Outputs file in tga format (viewable with gimp)
- Works on 960 lines for 1280 x 960 image
  - Suggest splitting work by height
- Pthreads
  - Split up common memory / parms
- MPI
  - Send parms
  - Gather picture



pthread

- Make sure and get code working on ECE machines
- Test code with various thread configs
  - ECE single core machines
  - Tetra quad-core machine
- Record runing performance (program runtime in msecs).
- Record the processor speed information.
- Pthread capable code will be turned in.

MPI

- Run MPI version of code on various numbers of cluster members.
  - Suggest debugging on 2 cluster nodes to make sure your data is OK.
- How does performance per MPI node scale with more nodes?
- How does overall performance scale with more nodes?
- At what point does it not make sense to add more nodes?
- Handin MPI version of code.

Report

- Briefly explain strategy to parallelize code.
- Show performance as threads are varied
- Show performance as cluster members are varied
- Correlate MPI with threads performance
  - Raw CPU power?
- Discuss trade-off of running on MPI vs. threads
  - Machine expense?

DUE DATE: Friday 5/15 at 5PM.