Supercomputing for Everyone Series: Performance Tuning Summer School

X1: First steps

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Socratic questionnaire: who are you?

- your expectations?
- feedback during the class
- interactive exercises
- anonymous

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Room: PTUNE15
Goal

- access “BlueWaters” as a leadership computing resource
- compile serial, OpenMP, MPI and GPU programs
- run the sample programs

https://bluewaters.ncsa.illinois.edu/getting-started
Access to Blue Waters

- every participant receives a training account

- use your ssh client and login using traXXX account into bwbay.ncsa.illinois.edu

- create two ssh client sessions (ssh keys do not work on Blue Waters!)
  Unix: ssh -C -X <traXXX>@bwbay.ncsa.illinois.edu

- it will ask for your name and email and connect you to Blue Waters

- note: you cannot scp data onto Blue Waters, you can only push/pull data from the login node
Grab and unpack this exercise on Blue Waters

- pull the exercise material from the IU website
  wget http://pages.iu.edu/~hbrunst/ptune15/material/x01.tar.gz

- unpack the material
  tar xvzf x01.tar.gz
Did you download and unpack the exercise?

Please, put your answer on

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Get interactive compute allocation

- create interactive session
  `qsub -I -l nodes=1:ppn=16:xe -l walltime=01:30:00`
  Job submitted to account: gjs
  `qsub: waiting for job 2093872.nid11293 to start`
  `qsub: job 2093872.nid11293 ready`

- go to directory “x01”
  `cd x01`
Monte Carlo simulation of Pi

- produce random points
- count points within unit circle
- $\pi = \frac{\text{inside points}}{\text{total points}}$
Run serial sample program

- switch programming environment to gnu
  (needs to be done for every new shell or interactive job!!!)

  module switch PrgEnv-cray PrgEnv-gnu

- compile the sample program

  cc -O3 pi-serial.c -o pi-serial

- run and time the sample program

  time aprun ./pi-serial
How much time did it take to run pi-serial?

Please, put your answer on

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Run OpenMP parallel program

- compile the sample OpenMP program
  \[ \text{cc -O3 -fopenmp pi-omp.c -o pi-omp} \]
- run the sample program on one process with 16 threads (in an interactive job submitted by qsub, see above)
  \[ \text{time aprun -n 1 -d 16 ./pi-omp} \]
How much time did it take to run pi-omp?

Please, put your answer on

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Run MPI parallel program

- compile the sample MPI program
  ```
  cc -O3 pi-mpi.c -o pi-mpi
  ```
- run the sample program on 16 MPI processes
  ```
  time aprun -n 16 ./pi-mpi
  ```
How much time did it take to run pi-mpi?

Please, put your answer on

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Run CUDA parallel program

- create interactive GPU session (might not work for everyone at the same time)
  
  qsub -I -l nodes=1:ppn=16:xk -l walltime=01:30:00

- load CUDA toolkit
  
  cd x01
  module switch PrgEnv-cray PrgEnv-gnu
  module load cudatoolkit

- compile the sample program
  
  nvcc -arch=sm_35 -lcurand pi-cuda.cu -o pi-cuda

- run the sample program
  
  time aprun -n 1 ./pi-cuda
How much time did it take to run pi-cuda?

Please, put your answer on

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QUESTIONS?

https://connect.iu.edu/ptune15