



# **FREE TUTORIAL WORKSHOP**

## **Introduction to Parallel Programming & Cluster Computing**

*Preference will be given to NSF EPSCoR Track 1 (Climate Change) and Track 2 (Cyberinfrastructure) participants from Idaho, Nevada, and New Mexico, but others are encouraged to apply.*

**Sunday June 26 - Friday July 1 2011**  
**Idaho State University (Pocatello)**

**Jointly presented via videoconferencing with the University of Washington (Seattle)**

**Includes FREE housing and FREE meals for the week**

(You or your institution will need to pay your travel costs to get to and from Pocatello.)

This summer tutorial workshop is being sponsored by the National Computational Science Institute (NCSI) with support from TeraGrid, Blue Waters, the SC 2011 conference's Education Program, and the Tri-States EPSCoR Consortium (Idaho, Nevada and New Mexico EPSCoR).

Prerequisites:

- at least one semester of programming experience in C, C++ and/or Fortran, recently;
- at least one semester of experience with any Unix-like operating system (including but not limited to Linux), recently.

**Apply to attend at:**

<http://www.computationalscience.org/>

This tutorial workshop covers not only how to do parallel computing, but also how to teach it, and how to use parallel computing in your teaching, not only in teaching Computer Science but also in teaching domain Science, Technology, Engineering and Mathematics (STEM) disciplines.

The tutorial workshop will require a **\$150 FULLY REFUNDABLE DEPOSIT**. To get your refund, you'll need to attend the workshop EVERY SINGLE DAY, and submit the daily surveys EVERY SINGLE DAY, plus the pre-survey and the post-survey.

**Questions about the workshop and/or venue?**

Contact Keith Weber ([webekeit@isu.edu](mailto:webekeit@isu.edu)) or Nancy Glenn ([glennanc@isu.edu](mailto:glennanc@isu.edu)).

**Questions about travel arrangements?** Contact your state liaison:

- Idaho – Michele Mattoon ([mmattoon@uidaho.edu](mailto:mmattoon@uidaho.edu))
- Nevada – Pam Levins ([Pam\\_Levins@nshe.nevada.edu](mailto:Pam_Levins@nshe.nevada.edu))
- New Mexico – Mary Jo Daniel ([mjdaniel@unm.edu](mailto:mjdaniel@unm.edu))

*Women, persons with disabilities, and members of underrepresented groups are especially encouraged to apply. NSF defines underrepresented groups as Native Americans, African Americans, Pacific Islanders, and Hispanics.*

## Tentative Agenda (subject to change without notice)

Sunday June 26

- Evening
  - Welcome and workshop series overview
  - HPC Overview (jigsaw puzzle)

Monday June 27

- Early Morning
  - Time to Science: Drop of Water Example
  - MPI Programming Model: Desert Islands Analogy
  - What is a Cluster?
  - Intro to MPI: the first six routines
- Late Morning
  - First experience running on a cluster
  - Lab: MPI Hello World
  - Lab: Greetings
- Early Afternoon
  - Storage Hierarchy
  - More MPI (communicators, tags, etc)
  - Group exercise in MPI coding
- Late Afternoon: Lab: Area under a curve

Tuesday June 28

- Early Morning
  - Project Guidelines
  - Dependency Analysis
- Late Morning
  - MPI Collective Communications
  - Applications and Types of Parallelism

Tuesday June 28 (continued)

- Early Afternoon: Lab: N-body
- Late Afternoon
  - MPI Blocking vs Nonblocking Communication
  - Lab: Deadlock

Wednesday June 29

- Early Morning
  - Bootable Cluster CD
  - OpenMP
- Late Morning: Lab: OpenMP
- Early Afternoon: Parallel debuggers
- Late Afternoon: Lab: Game of Life (analogy for transport codes, e.g. finite difference)

Thursday June 30

- Early Morning: Breakout mini-sessions
- Late Morning: Breakout mini-sessions
- Early Afternoon: Live Demo: Fire (Monte Carlo)
- Late Afternoon: GPGPU

Friday July 1

- Early Morning: Breakout mini-sessions
- Late Morning: Breakout mini-sessions
- Afternoon: Project presentations

### Example Mini-session Topics

- LittleFe: A Cluster in a Suitcase
- Benchmarking and Tuning Parallel Software
- MPI Lab: Practicing Send/Recv
- MPI Lab: Collective Communications
- Visualizing Science via the ScienceSim Metaverse
- Computational Science Education Reference Desk
- Building a Cluster: Software, Libraries, User Administration, Funding, Infrastructure
- Instruction Level Parallelism
- Compilers and Dependency Analysis
- Applications and Parallel Paradigms
- Multicore
- High Throughput Computing (e.g., Condor)

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