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Tools Discussion

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SNL

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Tools installed and in use at SNL

- vTune
  - Most used by code developers; More usage as we go to hybrid codes; not optimal for MPI and at scale
- CrayPat
  - We have lot of experience with it
  - Stresses our SIERRA apps; for large scale runs/trace
- Allinea DDT & Map
- OpenSpeedShop
  - Dynamic instrumentation; easy to use as no mods to the executable
- HPCToolkit
  - Worked with Prof Mellor Crummy to improve use with OpenMP; Nice features not in other tools.
- mpiP & memP
  - Easy to use and low overhead; used frequently;
- Totalview
  - Most used debugger; DDT is getting more exposure
- Intel's new Vector Advisor (looking to participate in the Alpha program);
  - Looks like a powerful tool ; complements Cray's Reveal

Requirements

- Ease of use; users often discouraged by steep learning curve
- The real challenge: go from generating large amount of data to insights for tuning
- Need training with vectorization tools
  - Reveal
  - Vector Advisor
- Working with Intel local team to set up compilers & tools training to the larger SNL code development teams in early 2015
- SIERRA/SD teams feedback
  - Tools for memory utilization; need thread based memory counter
  - Tools to help identify non-thrad-safe code
- It's been a while since we have had a training on Cray's Program development environment – Need to set up soon!
  - Cray's PrgEnv
  - CrayPat and Apprentice
  - Reveal

Some SNL user experience with Intel Inspector

Program FDEM calculates a 3D finite-difference solution of the six coupled first-order electromagnetic partial differential equations (the "EH system") appropriate for isotropic electromagnetic media. Numerical solution methodology is explicit, time-domain, finite-differencing with O(2,N) FD operators on staggered spatial and temporal grids.

- Program: FDEM
  - Version: 2.1 - memory efficient
  - Primary Developer: D.F. Aldridge
  - Secondary Developer: K.A. Schramm
  - Last Revision Date: 13 March 2014
- User threading of FDEM Fortran code with OpenMP
- After ~50 Cycles and –O3 NaNs occurred
- Intel inspector identified several race conditions and uninitialized variables
- It's a nice tool for use in the porting process
- Easy to show the user how to use it
- This is very important because user won't use complicated tools

Inspector used to locate threading errors in FEDM