Welcome to Codee Training, Apr 2023

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Apr 25-26, 2023
Introduction

● Codee (previously known as Parallelware Analyzer)
  ○ A programming development tool for C/C++/Fortran parallel codes on multicore CPUs and GPUs using OpenMP and OpenACC
  ○ Can automatically insert OpenMP or OpenACC directives in codes
  ○ Produces performance optimization report with recommended actions
    ■ Open catalog of performance optimization best practices by Codee
      https://www.codee.com/knowledge/

● Hands-on training provided by Appentra
  ○ Thanks Manuel Arenaz (Founder and CEO), Ulises Costi, Fani Garcia in Spain
  ○ A very rich collection of demos and step-by-step guides for selected benchmark kernel codes and real scientific application codes
Schedule, Day 1

Part 1, Tue, Apr 25
9:00 am - 12:30 pm PDT

**Codeee: Automated code inspection for performance**

- Codeee command-line tools
- Open catalog of C/C++/Fortran performance optimization best practices for CPU and GPU
- Challenges of PI, MATMUL, HEAT, LULESHmk, ATMUX
- Development of parallel codes with best practice recommendations

**Format:** Remote demos, hands-on, and homework exercises
## Schedule, Day 2

### Part 2, Wed, Apr 26

**Accelerating MBedTLS and Guided Parallelization of ZPIC and NUCCOR with Codee**

- Putting it all together in real codes through Codee automation
- MBedTLS: cryptographic codes
- ZPIC code: Particle-in-Cell (PIC) code
- NUCCOR Fortran code
- Bring your own applications

**Format:** Remote demos and hands-on
Some Logistics (1)

- Muted upon joining Zoom due to large number of attendees
- Please change your name in Zoom session as “first_name last_name”
  - Click “Participants”, then “More” next to your name to rename
- Live “Captions” and “View Full Transcripts” are enabled
- Q&A: use Google Doc (preferred) instead of Zoom chat
  - https://tinyurl.com/mu3fwayy
- Slides/exercises are uploaded to the event web page, videos afterwards
- NERSC Office Appointments for Codee will be available later
- Please help us with answering the survey after the training
  - https://tinyurl.com/codee-survey-apr2023
Some Logistics (2)

- Users are added to the ntrain8 project for hands-on
  - Training accounts are valid through May 3
- Perlmutter GPU nodes are reserved during the training
  - Apr 25: 9 am - 12:30 pm, `#SBATCH --reservation=codee_day1_xx -A ntrain8`
  - Apr 26: 9 am - 12:30 pm, `#SBATCH --reservation=codee_day2_xx -A ntrain8`
    where xx is cpu, gpu
  - Use `#SBATCH -A <your_project>` outside of reservation hours
- Hands on materials
  - Use your NERSC login or training account on Perlmutter
  - `% ssh perlmutter-p1.nersc.gov` (or ssh saul1-p1.nersc.gov)
  - `% cd $SCRATCH`
  - `% cp -r /global/cfs/cdirs/training/2023/Codee_Apr2023 .` (notice the dot)
- Perlmutter documentation
  - [https://docs.nersc.gov/systems/perlmutter/](https://docs.nersc.gov/systems/perlmutter/)
Using codee at NERSC

- % module load codee  (default version is 2023.1)
- % pwreport <options> or % pwdirectives <options> or % pwloops <options>
  - help menu: “pwreport --help”, “pwdirectives --help”
  - docs and examples directories in codee installation on Perlmutter
    - cd $CODEE_DIR

- Can use login node for most of development work above for GPU
- Can use any compiler, such as gcc or nvidia compiler, for own applications
- Can then submit batch jobs to run the generated/improved OpenMP offload or OpenACC codes on GPU nodes, and multithreaded or vectorized codes on CPU nodes.
Thank you!