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

Codee: Automated code inspection for performance

- Codee 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

9:00 am - 12:30 pm PST

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/

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.

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Thank you!