

Welcome to Codee Training, Sept 2024



Helen He, Woo-Sun Yang
Sept 5-6, 2024

Introduction to Codee

- Developed by Appentra Solutions
- 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
- Can **automatically rewrite Fortran code to enforce Fortran modernization** best practices
- **Identifies opportunities for improvement** and provides detailed guidance on how to effectively exploit them
 - Open Catalog of Best Practices for Modernization and Optimization
<https://github.com/codee-com/open-catalog>

Hands-on Training

- Thanks **Manuel Arenaz (Founder and CEO), Álvaro Dieste, Ulises Costi** of Appentra in Spain
- A very rich collection of demos and step-by-step guides for selected benchmark kernel codes and real scientific application codes
- Organizers
 - NERSC: Helen He, Woo-Sun Yang, Rebecca Hartman-Baker, Madelyn Blair
 - OLCF: Suzanne Parete-Koon

Schedule, Day 1

Part 1, Thur, Sept 5

Codee: Automated Code Inspection for Modernization and Optimization

9:00 am - 12:30 pm PDT

- Lecture:
 - Codee's command-line tool
 - Open Catalog of Best Practices for Fortran/C/C++ Modernization and Optimization for CPU and GPU
- Demo using Fortran:
 - HIMENO modernization
 - HIMENO optimization through CPU & GPU parallelism
- Demo using C/C++:
 - COULOMB optimization through CPU & GPU parallelism
- Hands-on: PI, MATMUL, COULOMB, HIMENO

Format: Remote lecture, demos, and hands-on

Schedule, Day 2

Part 2, Fri, Sept 6

9:00 am - 12:30 pm PDT

Codee: Automated Analysis of Large-Scale Fortran/C/C++ Codes

- Lecture:
 - Codee's command-line tool using compilation databases
 - Automated testing of large codes using Codee on Perlmutter
 - Use case: Optimizing the Weather Research and Forecasting Model (WRF) with OpenMP Offload and Codee
- Demo using Fortran:
 - Putting it all together with HYCOM
- Demo using C/C++:
 - Putting it all together with MBedTLS
- Hands-on: NUCCOR, ATMUX, HEAT, LULESHmk, MBedTLS
- Bring your own applications!

Format: Remote lecture, 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/bdeeckww>
- Slides/exercises are uploaded to the event web page, videos afterwards
- Please help us with answering the **survey** after the training
 - <https://tinyurl.com/codee-survey-sept2024>

Some Logistics (2)

- NERSC users are added to the **ntrain6** project for hands-on
 - Training accounts are valid through Sept 13
- Perlmutter GPU nodes are reserved during the training
 - Sept 5: 9 am - 1:30 pm Pacific Daylight Time
`#SBATCH --reservation=codee_day1 -A ntrain6 -C gpu -q shared -c 32 -G 1`
 - Sept 6: 9 am - 1:30 pm Pacific Daylight Time
`#SBATCH --reservation=codee_day2 -A ntrain6 -C gpu -q shared -c 32 -G 1`
 - Use `#SBATCH -A <your_project>` outside of reservation hours
 - Use `#SBATCH -N 1 -C gpu -A <your_project> -q regular` or an exclusive GPU node
- Hands on materials
 - Use your NERSC login or training account on Perlmutter
 - `% ssh perlmutter.nersc.gov` (or `ssh saul.nersc.gov`)
 - `% cd $SCRATCH`
 - `git clone https://github.com/codee-com/codee-demos.git`

Using codee at NERSC

- Load a newer codee module for today:

```
% module load codee/2024.3.1
```

```
% codee <options>
```

- **help menu**: “codee --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.

NERSC Code of Conduct

As NERSC collaborators, we are all bound by the Code of Conduct:

Team Science

Service

Trust

Innovation

Respect



■ We agree to **work together professionally and productively** towards our shared goals while respecting each other's differences and ideas.

■ We should all feel free to speak up to maintain this environment and remember there are resources available to **report violations** to foster an inclusive, collaborative environment.

Email nersc-training@lbl.gov for any concerns

<https://www.nersc.gov/nersc-code-of-conduct> or search “NERSC Code of Conduct”

Thank you!

