Introduction: Migrating Cori to Perlmutter Training

Helen He and Rebecca Hartman-Baker
User Engagement Group

Mar 10, 2023
Some Logistics

- Please change your name in Zoom as “first_name last_name (nersc_user_name)”, such as “Helen He (yunhe)”
  - Click “Participants”, then “More” next to your name to rename.
- You can click the CC button to toggle captions and view full transcript
- Slides to be uploaded soon. Videos available in a few days after split/trim
  - https://www.nersc.gov/users/training/events/migrating-from-cori-to-perlmutter-training-march2023/
- We do Q&As in GDoc (preferred over Zoom chat)
  - https://tinyurl.com/3yted8ek
  - NERSC staff standing by to answer questions
- Please help us with Survey afterwards
  - https://tinyurl.com/2t9jnnzk
About This Training

- This is a rerun of the Dec 1, 2022 migration training, with some updates
- It covers
  - Perlmutter architectures
  - Recommended programming models
  - Performance tips
  - Programming environment
  - Building and running jobs on CPUs and GPUs
  - Focus on differences between Cori and Perlmutter
- It does not cover
  - Teaching coding and optimization of using CPU and GPU programming models
  - Data analytics software and workflow usages
## Agenda

<table>
<thead>
<tr>
<th>Time (PST)</th>
<th>Topic</th>
<th>Presenters</th>
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<tbody>
<tr>
<td>9:00 - 9:15 am</td>
<td>Introduction: Migrating from Cori to Perlmutter Training</td>
<td>Helen He, Rebecca Hartman-Baker</td>
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<tr>
<td>9:15 - 10:00 am</td>
<td>Intro to Perlmutter and GPUs</td>
<td>Jack Deslippe</td>
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<td>10:00 - 10:50 am</td>
<td>Migrating from Cori to Perlmutter: CPU Codes</td>
<td>Erik Palmer, Helen He</td>
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<td>10:50 - 11:10 am</td>
<td>Break</td>
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<tr>
<td>11:10 - 11:50 am</td>
<td>Migrating from Cori to Perlmutter: GPU Codes</td>
<td>Muaaz Awan, Steve Leak, Helen He</td>
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<tr>
<td>11:50 am - 12:20 pm</td>
<td>More Q&amp;A and start Hands-on</td>
<td>All</td>
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<td>12:20 - 1:00 pm</td>
<td>Lunch Break</td>
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<td>1:00 - 2:30 pm</td>
<td>Hands-on and help with users’ own codes (cont’d)</td>
<td>All</td>
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Hands-on Exercises

- Feel free to use some NERSC prepared CPU and GPU examples at [https://github.com/NERSC/Migrate-to-Perlmutter](https://github.com/NERSC/Migrate-to-Perlmutter)
or bring your own applications codes today.

- Perlmutter Compute node reservations today, 11:30 - 14:30:
  - CPU: `#SBATCH --reservation=pm_cpu_mar10 -A ntrain8 -C cpu`
  - GPU: `#SBATCH --reservation=pm_gpu_mar10 -A ntrain8 -C gpu`
  - Existing NERSC users are added to the ntrain8 project to access node reservations
Cori Will Be Retired in Apr 2023

- Cori was installed in 2015, and at 6+ years may be NERSC’s longest lasting system
- AY2023 allocations are based on Perlmutter’s capability, and NERSC hours allocated can be used on Cori
- We will give users more time and help to transition from Cori to Perlmutter
- Cori will be retired in end of Apr 2023 (as T in next slide)
Cori Retirement Timeline

- **Oct 2022**: Software freeze (no new user-facing software installed by NERSC)
- **AY 2023**: All allocations based on Perlmutter’s capacity only
- **Nov-Mar**: Cori to Perlmutter transition training focus & office hours
- **Jan 2023**: Announced final date (T), end of April for decommissioning
  - Note: Cori GPU and Cori large memory nodes retire end of March
  - Cori Haswell and KNL nodes expire end of April
- **T - 1 week**: Implement reservation, preventing new jobs from running effective T
- **T**: Delete all jobs from queue, no new jobs can be submitted; continue to allow login to retrieve files from Cori scratch
- **T + 1 week**: Close login nodes permanently
- **T + 1 month**: Disassembly begins
Access Perlmutter via SSH

- `ssh elvis@perlmutter-p1.nersc.gov`
  or `ssh elvis@saul-p1.nersc.gov`
  (substituting your username for `elvis`)
- Use **MFA** (password + one-time password) in same way as Cori
  - Can use `sshproxy` to reduce frequency of authentication
Access Perlmutter via JupyterHub

Can open a “terminal” as well as choosing many other JupyterHub kernels (such as Python, PyTorch, etc.)
File Systems and Data Considerations

- Files/data in your **global home and CFS directories** on Cori are **available** on Perlmutter
  - The old symlink `/global/project/projectdirs` to CFS on Cori **does not exist** on Perlmutter; be sure to remove this from old scripts!
- Files/data on **Cori scratch not accessible** on Perlmutter
  - Perlmutter has its own scratch file system
  - Cori scratch will be retired with Cori
  - Can migrate Cori scratch data onto CFS or HPSS via Globus or `scp` first, then access on Perlmutter ([details](#))
Cori / Perlmutter Comparison: Similarities

- Cray user environment
  - Compiler wrappers (cc, CC, ftn)
  - PrgEnv modules
- Slurm
  - Similar queues set up (regular, premium, overrun, shared, etc.)
- CPU nodes
  - AMD instead of Intel, but standard CPU architecture with no major surprises
  - Similar to Haswell in clock speed, similar to KNL in number of cores per node
Cori / Perlmutter Comparison: Differences

- **Lmod vs modules**
  - Many similarities, but some major differences
  - Modules may not be initially visible due to dependencies; using `module spider` will find hidden modules

- **GPU nodes**
  - Substantially different programming models required to exploit GPU nodes
  - Codes may have different GPU-compatible and CPU-only versions

- **Compiler/PrgEnv versions**
  - No Intel compiler
Data Analytics Documentations on Perlmutter

- Jupyter
- Using Python on Perlmutter
- Preparing Python for Perlmutter GPU
- Julia
- Shifter
- Workflow Tools
- Analytics
- Machine Learning
Some Existing Training Materials

- NERSC Training Events and Archives (slides, recordings): https://www.nersc.gov/users/training/events/
  - + Using Perlmutter Training, Jan 2022
  - + New User Training, Sept 2022
  - + Data Day 2022, Oct 2022
  - GPUs for Science Day 2022, Oct 2022
  - OpenMP Offload Training, Aug-Sep 2022
  - + AI for Science Bootcamp, Aug 2022
  - 3-part OpenACC Training Series, Apr - Jun 2020
  - SYCL Training, Mar 2022
  - Codee Training, Apr 2022
  - Nvidia HPC SDK Training, Jan 2022
  - Migrating from Cori to Perlmutter Training, Dec 2022

+: events covers Data related topics
More Info and Training Opportunities

- **Migrating from Cori to Perlmutter documentation**
  - [https://docs.nersc.gov/systems/cori/migrate_to_perlmutter/](https://docs.nersc.gov/systems/cori/migrate_to_perlmutter/)

- **Cori to Perlmutter Transition Office Hours**
  - Held 10 office hours since Nov, met with 150+ users
  - More scheduled: Wed, Mar 15; Fri, Mar 31

- **N-Ways for GPU Programming Bootcamp (Apr 5-6)**
  - OpenMP Offload, OpenACC, CUDA, Standard Language Parallelization, etc. Application deadline Mar 22

- **DOE Cross-facility Workflows training (April 12)**
  - GNU Parallel, Parsl, FireWorks, and Balsam. Deadline Apr 5

- **Codee training (Apr 25-26)**
  - A developer tool to help inserting OpenMP and OpenACC directives
Thanks for your attention!

More questions? Need help?...
http://help.nersc.gov/