Introduction:
Migrating Cori to Perlmutter Training

Helen He and Rebecca Hartman-Baker
User Engagement Group
December 1, 2022
### Some Logistics

- Users are muted upon joining Zoom due to large number of attendees
- Please change your name in Zoom session 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-dec2022/](https://www.nersc.gov/users/training/events/migrating-from-cori-to-perlmutter-training-dec2022/)
- Please ask your questions in GDoc (preferred over Zoom chat)
  - [https://tinyurl.com/bdf8ezfb](https://tinyurl.com/bdf8ezfb)
  - NERSC staff standing by to answer questions
<table>
<thead>
<tr>
<th>Time (PDT)</th>
<th>Topic</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 - 9:10 am</td>
<td>Introduction: Migrating from Cori to Perlmutter Training</td>
<td>Helen He, Rebecca Hartman-Baker</td>
</tr>
<tr>
<td>9:10 - 9:50 am</td>
<td>Intro to Perlmutter and GPUs</td>
<td>Jack Deslippe</td>
</tr>
<tr>
<td>9:50 - 10:35 am</td>
<td>Migrating from Cori to Perlmutter: CPU Codes</td>
<td>Erik Palmer, Helen He</td>
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<tr>
<td>10:35 - 10:55 am</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>10:55 - 11:40 am</td>
<td>Migrating from Cori to Perlmutter: GPU Codes</td>
<td>Muaaz Awan, Steve Leak, Helen He</td>
</tr>
<tr>
<td>11:40 am -12:15 pm</td>
<td>Hands-on and help with users’ own codes</td>
<td>All</td>
</tr>
<tr>
<td>12:15 - 13:00 pm</td>
<td>Lunch Break</td>
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<tr>
<td>13:00 - 3:00 pm</td>
<td>Hands-on and help with users’ own codes (cont’d)</td>
<td>All</td>
</tr>
</tbody>
</table>
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, 10:00 - 15:00:
  - CPU:  `#SBATCH --reservation=pm_cpu_dec1 -A ntrain2 -C cpu`
  - GPU:  `#SBATCH --reservation=pm_gpu_dec1 -A ntrain2 -C gpu`
  - Existing NERSC users are added to the ntrain2 project to access node reservations
Cori Will Be Retired in March 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 to transition from Cori to Perlmutter
- Cori will be retired in March 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-Jan**: Cori to Perlmutter transition training focus & office hours
- **Late Jan or early Feb**: Announce final date (T) for decommissioning
- **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.)

### Shared CPU Node

<table>
<thead>
<tr>
<th>Resource</th>
<th>Perlmutter</th>
<th>Cori</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources</td>
<td>Use a node shared with other users’ notebooks but outside the batch queues.</td>
<td>Use your own node within a job allocation using defaults.</td>
</tr>
<tr>
<td>Use Cases</td>
<td>Visualization and analytics that are not memory intensive and can run on just a few cores.</td>
<td>Visualization, analytics, machine learning that is compute or memory intensive but can be done on a single node.</td>
</tr>
</tbody>
</table>

### Exclusive CPU Node

<table>
<thead>
<tr>
<th>Pool</th>
<th>Start</th>
</tr>
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<tbody>
<tr>
<td>perlmutter</td>
<td>start</td>
</tr>
<tr>
<td>cori</td>
<td>start</td>
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</tbody>
</table>

### Exclusive GPU Node

<table>
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<th>Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>perlmutter</td>
<td>start</td>
</tr>
<tr>
<td>cori</td>
<td>start</td>
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</tbody>
</table>

### Configurable GPU

<table>
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</thead>
<tbody>
<tr>
<td>perlmutter</td>
<td>start</td>
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<tr>
<td>cori</td>
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Jupyter will have a brief maintenance Wednesday, November 30 starting at 10 AM PST. See the NERSC MOTD for status updates.
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 (no plans to support)
Some Existing Training Materials

- NERSC Training Events and Archives (slides, recordings): [https://www.nersc.gov/users/training/events/](https://www.nersc.gov/users/training/events/)
  - Using Perlmutter Training, Jan 2022
  - New User Training, Sept 2022
  - GPUs for Science Day 2022, Oct 2022
  - Data Day 2022, Oct 2022
  - OpenMP Offload Training, Aug-Sep 2022
  - 9-part CUDA Training Series, Jan 2020 - Oct 2021
  - 3-part OpenACC Training Series, Apr - Jun 2020
  - SYCL Training, Mar 2022
  - Codee Training, Apr 2022
  - Nvidia HPC SDK Training, Jan 2022
More Training Opportunities

- **Cori to Perlmutter Transition Office Hours**
  - We’ve held 3 office hours this month, met with 50+ users
  - Additional Office Hours scheduled for
    - Fri, Dec 2 (tomorrow!); Thur, Dec 8; Fri, Dec 16
    - Fri, Jan 6; Thur, Jan 12

- Codee training (under planning)
  - A developer tool to help inserting OpenMP and OpenACC directives

- N-Ways for GPU Programming Bootcamp (under planning)
  - OpenMP Offload, OpenACC, CUDA, Standard Language Parallelization, etc.