A Brief Introduction to NERSC Resources and Allocations

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Facility for DOE Office of Science Research

Largest funder of physical science research in U.S.

- Bio Energy, Environment
- Computing
- Materials, Chemistry, Geophysics

- Particle Physics, Astrophysics
- Nuclear Physics
- Fusion Energy, Plasma Physics
NERSC Mission and Strategic Areas

• **NERSC Mission**: To accelerate scientific discovery at the DOE Office of Science (SC) through high performance computing and data analysis

• **Strategic Objectives**: Meet the ever-growing computing and data needs of our users by
  – Providing usable exascale computing and storage systems
  – Transitioning DOE SC codes to execute effectively on manycore architectures
  – Influencing the computer industry to ensure that future systems meet the mission needs of DOE SC

• **Enables our users to tackle some of the most computationally challenging scientific problems today**
Focus on Science
• A word-class resource to support world-class science.
• 1,500 refereed journal publications per year
• Supports Nobel-prize winning projects: Chemistry 2013, Physics 2011, Peace 2007

Large diverse user community
• 5,000 users, 700 projects
• From 48 states, 65% from universities
• Many large international collaborations

Science-driven systems and services
• Designed to support science
• Optimized for scientific productivity at cutting-edge scale
Some Characteristics of NERSC

- Large, state-of-the-art computing and data systems
- Consulting, system admin, 24x7 operations support
- Well maintained software environment, prebuilt optimized applications & libraries
- Designed for massive parallelism, but supports all scales
- Easily share data and codes
- Easy to use account management
- Large permanent archival data storage
- Ongoing technology refreshes
- Word-class cybersecurity
- Open science environment
- Web-based science /data gateways
NERSC Demographics

5,000 users from 48 U.S. states

642 international users
NERSC 2013 Allocations
By DOE Office

ASCR: Advanced Scientific Computing Research
BER: Biological & Environmental Research
BES: Basic Energy Sciences
FES: Fusion Energy Sciences
HEP: High Energy Physics
NP: Nuclear Physics
NERSC Supports Jobs of all Kinds and Sizes

High Throughput: Statistics, Systematics, Analysis, UQ

Larger Physical Systems, Higher Fidelity
NERSC Systems Today

**Edison: 2.57PF, 357 TB RAM**
- Cray XC30 5,576 nodes, 134K Cores
- 7.6 PB Local Scratch 163 GB/s
- 16 x QDR IB
- 80 GB/s

**Hopper: 1.3PF, 212 TB RAM**
- Cray XE6 6,384 nodes 150K Cores
- 2.2 PB Local Scratch 70 GB/s
- 16 x FDR IB
- 50 GB/s

**Production Clusters**
- Carver, PDSF, JGI, KBASE, HEP
- 14x QDR

**Vis & Analytics**
- Data Transfer Nodes
- Adv. Arch. Testbeds
- Science Gateways

**Ethernet & IB Fabric**
- Science Friendly Security
- Production Monitoring
- Power Efficiency
- WAN

**Global Scratch**
- 3.6 PB
- 5 x SFA12KE

**/project**
- 5 PB
- DDN9900 & NexSAN

**/home**
- 250 TB
- NetApp 5460

**HPSS**
- 50 PB stored, 240 PB capacity, 20 years of community data

**2 x 10 Gb**

**1 x 100 Gb**
- Software Defined Networking
NERSC Allocations

• In essence, an allocation is a grant; Not of money, but of access to:
  – NERSC compute resources (specific quantity of CPU time)
  – NERSC storage resources (live and archival)
  – Extensive user support (Consulting, 24x7 Operations, etc.)

• Eligibility: All work done at NERSC must be within the DOE Office of Science mission
  – Many projects are directly funded by the main Office of Science program areas (ASCR, BES, BER, FES, HEP, NP)
  – Others are chosen because they are compatible with and of interest to the program area missions
**NERSC Allocations (Cont’d)**

- **Different allocation types are available**
  - **DOE Production**: Awards made directly by DOE program managers (the way most NERSC users get time)
    - Mid-sized to large allocations; Yearly
  - **ALCC**: ASCR Leadership Computing Challenge
    - Large allocations; Yearly
  - **DDR**: Director’s Discretionary Reserve
    - Strategic allocation awards
  - **Startup**: Awarded at NERSC’s discretion
    - Small (up to 50k hours); Rolling

- **If moving up from an institutional cluster environment, a startup is likely the right way to go**

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<table>
<thead>
<tr>
<th>Allocation Type</th>
<th>% Time</th>
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<tbody>
<tr>
<td>DOE Production</td>
<td>80 %</td>
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<tr>
<td>ALCC</td>
<td>10 %</td>
</tr>
<tr>
<td>DDR</td>
<td>10 %</td>
</tr>
<tr>
<td>Startup / Education</td>
<td>N/A</td>
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Startup allocations

• Apply any time of year
  – Decisions typically made within three weeks

• Must be able to demonstrate how your project fits within the specific Office of Science mission areas

• A startup allocation is not the end goal; Instead, it’s an opportunity to:
  – Get your codes up and running on NERSC resources while also being scientifically productive
  – Perform detailed tuning and performance characterization to support a new DOE Production, ALCC, etc. application

• Covered in detail on the web:
  – http://www.nersc.gov/users/accounts/allocations/first-allocation/
Thank you.