HPC System Testing: Procedures, Acceptance, Regression Testing, and Automation

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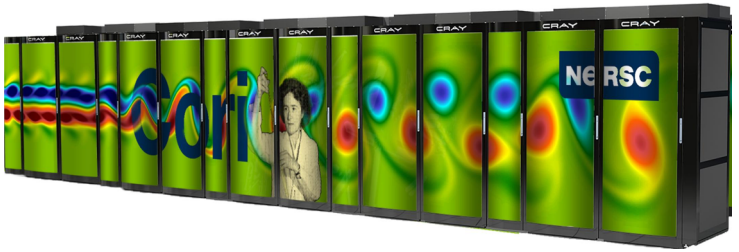
SC19

Cori

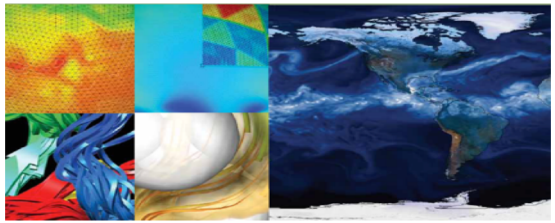


- **Cray XC System - heterogeneous compute architecture**
- **9600 Intel KNL compute nodes**
  - 68 cores, 4 HW treads/core, AVX-512, 16GB HBM, 96GB DRAM
- **>2000 Intel Haswell nodes**
- **Cray Aries Interconnect**
- **NVRAM Burst Buffer, 1.6PB and 1.7TB/sec**
- **Lustre file system 28 PB of disk, >700 GB/sec I/O**
- **Investments to support large scale data analysis**
  - High bandwidth external connectivity to experimental facilities from compute nodes
  - Virtualization capabilities (Shifter/Docker)
  - More login nodes for managing advanced workflows
  - Support for real time and high-throughput queues

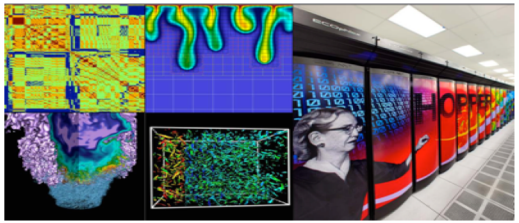
Mission HPC for DOE Office of Science

U.S. DEPARTMENT OF ENERGY | Office of Science

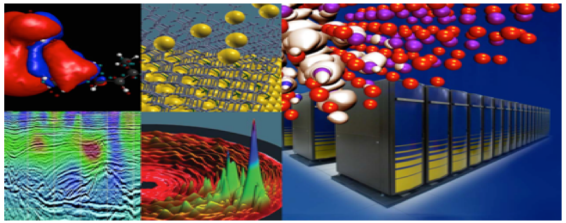
Largest funder of physical science research in the U.S. - $6.5B budget



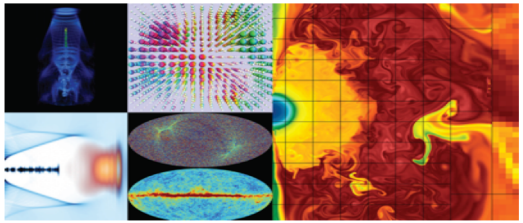
Bio Energy, Environment



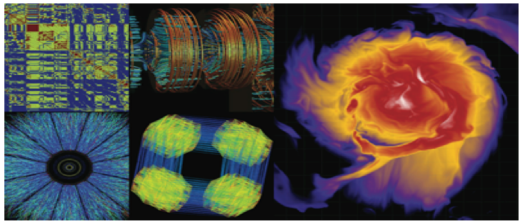
Computing



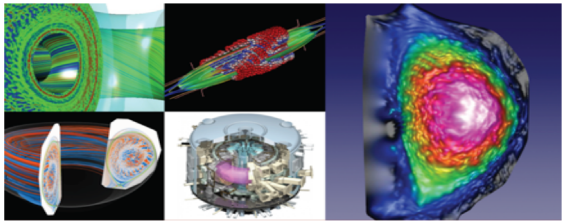
Materials, Chemistry, Geophysics



Particle Physics, Astrophysics



Nuclear Physics



Fusion Energy, Plasma Physics

7,000 users, 800 projects, 700 codes, 50 states, 40 countries, universities & national labs

Acceptance Testing

- SOW is critical
  - Defines the system and expected functionality
  - Covers the life of the system – parameters can change over time
  - Requires flexibility
- Acceptance tests
  - Functionality Tests
    - Regresson suite with additions for expected new functionality
    - System, application, and usability
  - Reliability Tests
    - Test ability of the system to run with degraded components or services
  - System Tests
  - Performance Tests
  - Availability Tests

Regression Testing

- Test systems
  - Ensure they look like a mini-version of the system
- Using ReFrame from CSCS
- Focus on expected functionality
- Allow users to provide tests for their critical functions
- Working to publish results
- Scale testing
  - After an upgrade add a user based workload across the system
  - Then stress specific components

Test examples on Cori

Functionality

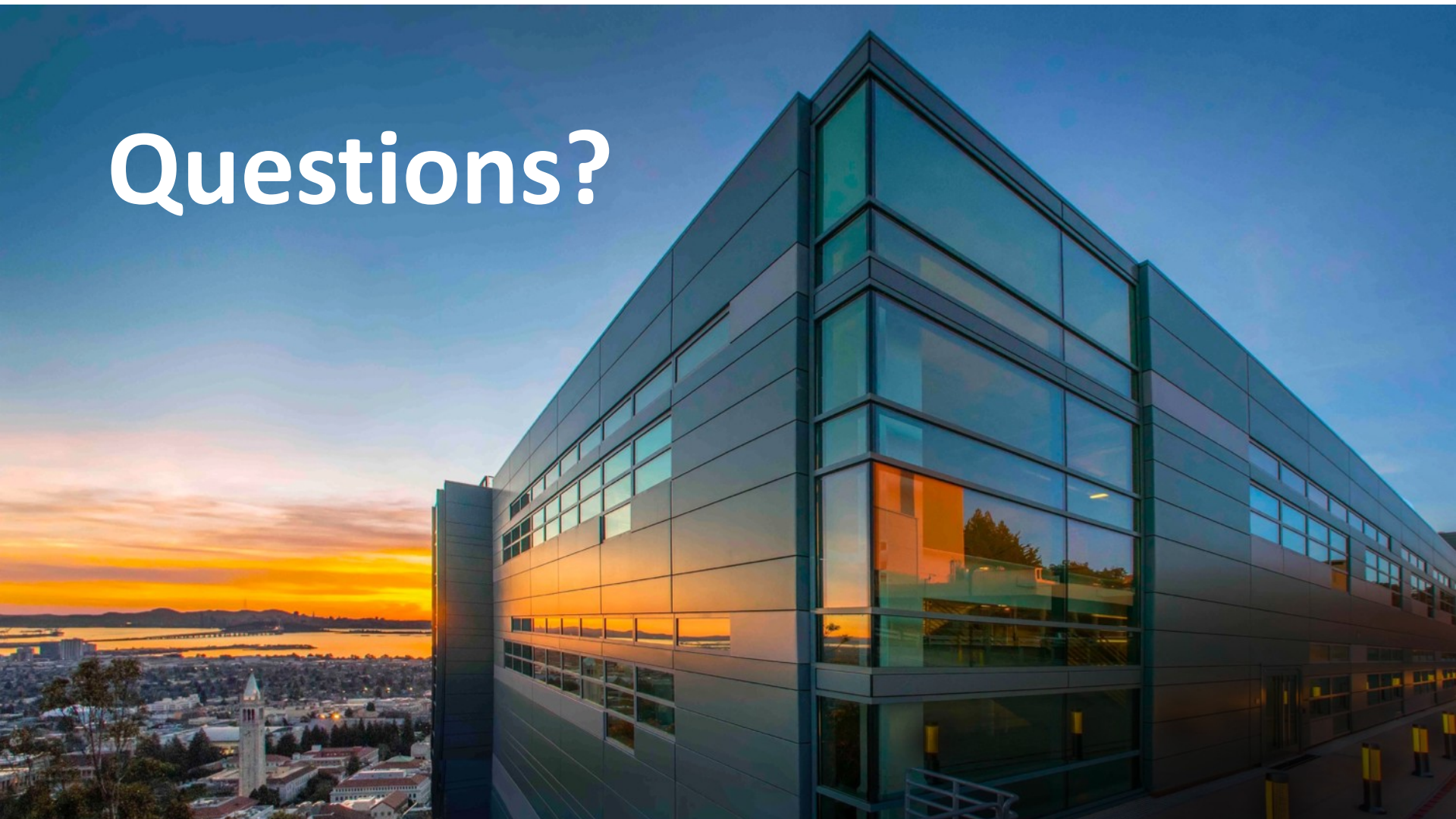
- DataWarp stage in/out
- Shifter (pull/execute)
- Jupyter
- IDL, Matlab
- TensorFlow/PyTorch
- Dynamic RDMA credentials
- hugepage allocation
- HPSS
- (many others)

Performance

- NERSC-8 procurement benchmarks
- IOR
- HPGMG, Graph500, HPCG
- NESAP apps
- (several others)

Conclusion

- Both acceptance and regression testing are important
- Scale testing is hard
  - How do you handle this at your site?
- Getting users involved in regression testing is important


Questions?