EEHPC
The Electric Grid and HPC

Supercomputing 2013

November 17, 2013

Anna Maria Bailey, LLNL
Jim Rogers, ORNL
Josip Loncaric, LANL
Bob Conroy, OSI Soft

Lawrence Livermore National Laboratory

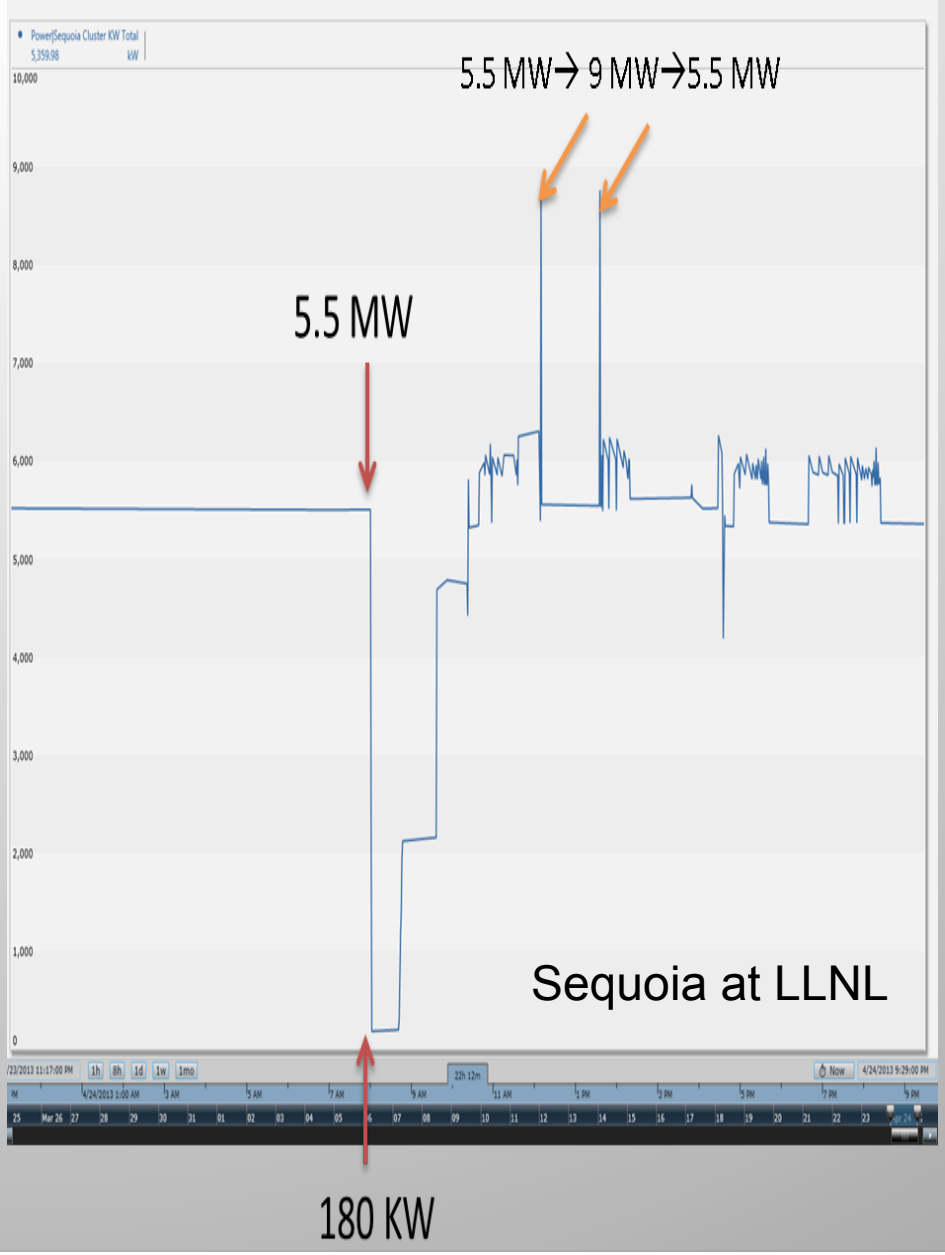
LLNL-PRES-760781
This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC

EE HPC Working Group Team
The Electric Grid and HPC

- Problem statement:
  - HPC centers are large kilowatt to megawatt energy consumers
  - Can benefit from improved energy efficiency
  - May benefit from participating in the electric grid-level energy management
  - May impact and/or get impacted by the electricity power quality and renewable generation
- Investigative effort:
  - Review of current research and practice
  - Top100 US sites questionnaire
  - Team output – report
    - LLNL, LANL, ORNL, ANL, LBNL, NCSA, WPAFB, NOAA, Purdue, SDSC, Intel
- Please contact Natalie Bates if you are interested in joining this team.

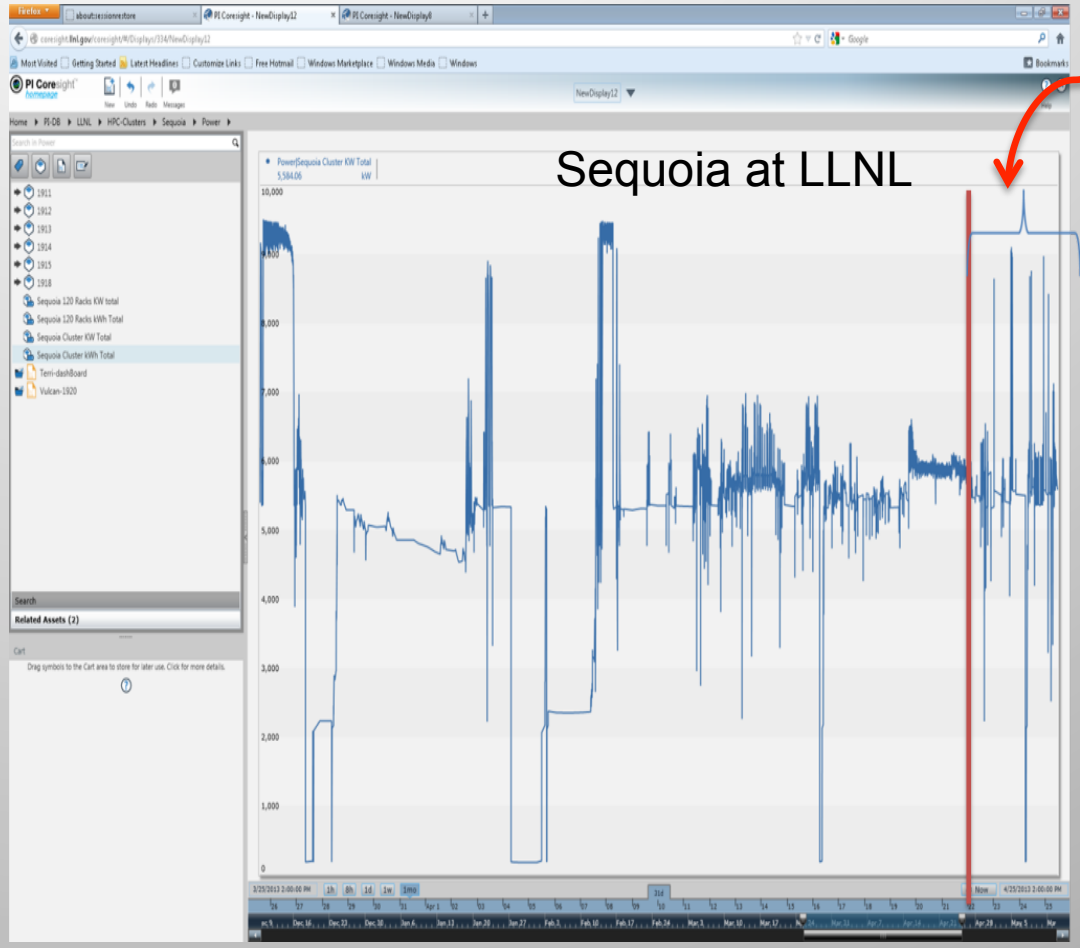
Challenge

- Recent installed HPC systems have raised concerns with some utilities
- Requires modeling power consumption and quality of large HPC computational block loads
- Requires the need to address operational cost increases with larger load
- Requires the ability to know what to monitor
  - Continually log events of HPC workload to include scheduled maintenance, unscheduled power interruptions, power glitches, etc. to gain broader knowledge



Amplified Bursty Behavior Due to Magnitude of Computer

- Scheduled maintenance can result in 5 MW load swings to the grid in a short period of time
- Bursty behavior of real workload indicated that real power fluctuations can be more abrupt



Addressing the Concerns and Challenges of HPC to the Grid

- Jim Rogers – ORNL
  - Discuss grid modeling of the TVA electrical grid at ORNL and how large computational block loads relate to the TVA
- Josip Loncaric – LANL
  - Discuss the challenge of variable power demand typical for HPC workloads, and the importance of working with the utility to minimize power costs
- Bob Conroy – OSI Soft
  - Discuss the benefits of benchmarking and metrics of large block loads. "You cannot improve what you do not measure".