

Energy Efficient High Performance Computing Working Group 6/10/14 Meeting Report

INTRODUCTION

The EE HPC WG held a meeting on 6/10/14. This Working Group is composed of members representing major Federal departments and independent agencies, private sector representatives, and members of the academic community. More information can be found at the working group's website, <http://eehpcwg.lbl.gov>.

NEXT MEETING: August 12th, 9:00-10:00AM Pacific Time

NEXT WEBINAR: July 24th, 8:00-9:00AM Pacific Time. Alex Auweter, LRZ and Luigi Brochard, IBM will present on LRZ's power-aware job scheduling

Introductions and Announcements: *Natalie Bates, EE HPC WG & William Tschudi, LBNL*

- There is an extension of the Better Buildings Challenge for data centers that is open to anyone in the United States who is interested in improving their data center energy efficiency. <https://www4.eere.energy.gov/challenge/partners/data-centers>

Conferences Sub-group Update: *Anna Maria Bailey & Marriann Silveira, LLNL*

- **News on EE HPC WG participation in upcoming Conferences**
- **SC'14**
 - If you are attending SC14, please plan on participating in the 5th Annual EE HPC WG workshop all day Monday, November 17th.
 - The Demand Response team submitted a state of the practice paper that has been reviewed. The rebuttal period ended June 13th and acceptance notification should be early July.
 - BoF submissions are due at the end of July. There are several teams that are considering making submissions.
 - There are two panel submissions that may be of interest to the group. These include members of the EE HPC WG, but were not made by any of the teams. They are: "Energy Efficient Systems for HPC: Challenges and Trends" and "Challenges with Liquid Cooling"
- **ISC'14**
 - ISC'14 was held at the end of June in Leipzig, Germany.

- The Workload Power Measurement Methodology held a BoF.
- Axel Auweter from LRZ presented a paper on “A Case Study on Energy Aware Scheduling on SuperMUC”
- There was a panel and two other BoFs that may be of interest to the group.
 - o “Breaking Paradigms to Meet the Power Challenges” was a panel that explored “locating HPC centers in places like Iceland” as well as “using low-power embedded technologies for supercomputers”.
 - o “Energy Efficiency Benchmarks and Metrics at Exascale: The Application Perspective” was a BoF with speakers that included EE HPC WG members Natalie Bates, Simon McIntosh Smith and Marie Christine Swaley.
 - o “Embedded Technologies for Supercomputers” was another BoF with speakers that included EE HPC WG members John Shalf, David Donofrio and Alex Ramirez.

Update on EE HPC WG participation in recent Conferences

- Dale Sartor spoke at the Data Center Dynamics Conference that was held at the Santa Clara Convention Center on June 17th.
- NLIT 2014 – National Laboratories IT 2014 June 29th – July 2nd – San Francisco
- The EE HPC WG was invited to make a presentation on the EE HPC WG at the ASHRAE TC9.9 meeting that was held in Seattle in late June. They wanted to hear about the EE HPC WG goals, members, activities and collaborations with other groups. Bill Tschudi attended and presented.

The EE HPC WG website Links and Events page lists many upcoming Conferences and Workshops that have an HPC Energy Efficiency Focus

Future Conferences: (more details at <http://eehpcwg.lbl.gov/events-and-links>)

Infrastructure Sub-Group Update: *William Tschudi, LBNL & Dave Martinez, SNL*

LIQUID COOLED COMMISSIONING TEAM UPDATE: The Liquid Cooling Commissioning Team has collected and reviewed best practices and lessons learned for commissioning of liquid cooling infrastructure. The ultimate goal is to improve the commissioning process for delivering a liquid cooling infrastructure that works when the HPC system is installed.

The Team has written a document that is intended to provide some general guidance and recommendations for those who are writing commissioning plans. The Team has five ‘lessons learned’ documents that help to illustrate the general guidance and recommendations.

Bill Tschudi attended the ASHRAE TC9.9 meeting in late June. He presented on several topics, both related to LBNL and the EE HPC WG. In addition to presenting an overview of the EE HPC WG, he

found out more about how they'd like to get more directly involved in reviewing and enhancing the liquid cooling commissioning guidelines.

The Team has not yet decided whether or not to make an SC14 BoF submission. It partly depends upon whether or not there are additional lessons learned. The more lessons learned, the more likely we'll make a submission. **IF YOU ARE INTERESTED, PLEASE CONTACT NATALIE.**

CONTROLS TEAM: There are lessons learned and best practices evolving from implementing and operating supercomputer centers with complex infrastructure systems and the highly variable demands placed upon these systems with today's supercomputers. This team will focus on sharing designs, challenges and best practices for integrated control systems in order to determine if there are universal learnings.

The initial team output will be a short report documenting their findings and making recommendations for next steps.

The Team has been meeting regularly with strong participation. They have been sharing controls designs as well as issues and concerns. So far presentations have been made by LLNL, NCSA, ORNL and SNL. LANL and LRZ are also scheduled.

TUE TEAM: This Team has developed two new metrics; iTUE and TUE that account for infrastructure elements that are a part of the HPC system (like cooling and power distribution). TUE is an improvement over PUE as a metric that allows for inter-site comparison. iTUE is not only a metric that is necessary for calculating TUE, but stands on its own as a metric for a site to use for improving infrastructure energy efficiency.

There is on-going testing of these metrics by several sites, including LLNL, ORNL and LRZ. The Swiss National Supercomputing Center also intends to trial the metrics.

Anyone interested in participating on this team should contact Natalie.

ENERGY REUSE EFFECTIVENESS: The Energy Re-use Effectiveness Team in collaboration with The Green Grid has developed a standard metric for measuring the contribution of re-using heat generated by HPC systems for other useful purposes.

There is no new information to report on this activity. Anyone interested in sharing your experiences or testing the ERE metric should contact Natalie.

Systems Sub-group Update: *Natalie Bates, EE HPC WG*

SYSTEM WORKLOAD POWER MEASUREMENT METHODOLOGY: The EE HPC WG along with the Green500, Top500 and Green Grid have developed a standard methodology for measuring system power while running a workload. The team developed the methodology, refined it through both alpha and beta testing and collaborated with the Green500 List to ensure adoption as an enhancement to the Green500 run rules. The team is now developing outreach and other tools for broader adoption of the measurement methodology. The ultimate goal is to have broad use of the highest quality energy and

power measurement methodology for all of their system workload energy efficiency benchmarking activities.

This Team presented a paper in March that will be published as part of the SPEC/ACM International Conference on Performance Engineering. The paper explained the three quality levels of power measurement methodology and explored them with three case studies from LRZ, ANL and Calcul Quebec. The team is now focused on doing an analysis that quantifies the variation in measurement results between a L1, L2 and L3 measurement. Our hypothesis is that L1 and L2 variation is greater than L3. This has been suggested by analyses from LRZ and CSCS, but we are engaged in doing a more extensive analysis.

As mentioned in the Conferences update, this Team's ISC' 14 BoF submission was accepted. The organizers are Wu Feng, Green500 and Virginia Tech, Erich Strohmaier, Top500 and LBNL and Natalie Bates, EE HPC WG.

HPC AND GRID INTEGRATION: The Demand Response Team is investigating how HPC centers have, can and should engage more actively with the Grid electricity providers. The Team has collected information from 11 US-based SC sites that are on the Top100 list. This includes LLNL, LANL, ORNL, LBNL, ANL, Purdue, SDSC, NCSA, NOAA, Intel and WPAFB. This is an investigative activity with the ultimate goal of educating the HPC DOE Facility and Operations Managers about HPC and grid integration opportunities and challenges.

As mentioned in the Conferences update, this Team has submitting a paper to the State of the Practice track for SC'14.

The team is now focused on extending this work to European-based SC sites that are on the Top50 list. We have received feedback on a modified questionnaire from CEA and LRZ.

PROCUREMENT CONSIDERATIONS: The RFP Team has a whitepaper that recommends procurement document requirements that target more energy efficient HPC systems. The intention is to raise the bar and extend the requirements with a yearly update of the whitepaper. The 2013 focus is on measurement capabilities.

The Team has been honing the measurement capability requirements based on feedback from the vendor webinars as well as input at SC13. This process is complete and the final document is posted on the EE HPC WG website.

The Team has started to work on the 2014 update. We have a draft statement of 'time-stamping' requirements and have started to work on 'measurement uncertainty' as well as temperature sensors and measurements.

SW UPDATE

A solicitation to the EE HPC WG requested proposals for software teams. There were six respondents who made very thoughtful proposals. Some of the common themes are benchmarks, APIs, tools. We are meeting as a small team to review proposals, find synergies and discuss next steps.

PARTICIPANTS INCLUDED

Name	Organization
Randy Anderson	CGG
Anna Maria Bailey	LLNL
Natalie Bates	EE HPC WG
Sridutt Bhalachandra	University N. Carolina
Bill Brantley	AMD
Bob Conroy	OSIsoft
Garr Di Salvo	ARUP
Parks Fields	LANL
Jay Ford	Liquid Cool Solutions
Ted Kubaska	Independent Contractor
Detlef Labrenz	LRZ
Piotr Luszczek	University of Tennessee
Hoan Luu	SNL
Steve Martin	Cray
Kevin Peterson	Cray
Joey Sena	SNL
Marriann Silveira	LLNL
John Sines	LLNL
Jamel Tayeb	intel
Rob Taylor	UTC Aerospace Systems
Hinrich Tobaben	University of Hannover
Bill Tschudi	LBNL
David Walker	LANL
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