

Energy Efficient High Performance Computing Working Group 10/11/16 Meeting Report

INTRODUCTION

The EE HPC WG held a meeting on 10/11/16. 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, <https://eehpcwg.llnl.gov/>.

NEXT MEETING: Tuesday December 13th, 9:00-10:00AM Pacific Time

Introductions and Announcements: *Natalie Bates, EE HPC WG & Anna Maria Bailey, LLNL*

- The EE HPC WG website has a new look with a new logo and slogan. “Sustainably Supporting Science through committed community action”

Conferences Sub-group Update: *Torsten Wilde, Leibniz Supercomputing Centre (LRZ, Germany) & Michael Patterson, Intel*

SC16

- The annual SC16 EE HPC WG workshop was held on Sunday, November 13th. The following day (Monday the 14th) was the Energy Efficient Supercomputing (E2SC) Workshop. These two complimented each other with an infrastructure focus in the EE HPC WG and an application focus in the E2SC.
 - The keynote speaker for the workshop was Thomas Schulthess, director of the Swiss National Supercomputing Centre (also known as CSCS). He studied physics and earned his Ph.D. degree at ETH Zurich. As CSCS director, he is also professor of computational physics at ETH. Prior to this, Thomas worked for twelve years at the Oak Ridge National Laboratory (ORNL) in Tennessee.
 - The agenda for the workshop included the following topics:
 - State of the EE HPC WG
 - Future-proofing your HPC Data Center design
 - Energy-efficiency economics
 - Architectural roadmap and impacts
 - System software: Controlling energy across the stack
 - There were lunch-time discussion groups. The list included:
 - Power API/Redfish/GEO
 - Liquid Cooling (possibly including liquid cooling standardization)
 - Metrics, with a focus on Total Cost of Ownership (TCO)
 - Energy and Power Aware Job Scheduling and Resource Management

- The EE HPC WG organized a panel on Emerging Realities and New Protocols for Power Distribution: High Voltage and dc. This was moderated by Anna Maria Bailey- Lawrence Livermore National Laboratory and included panelists: Dan Stanzione- Texas Advanced Computing Center, Gary New- NCAR, Keiichi Hirose- Nippon Telegraph and Telephone Corporation, Mike Patterson- Intel.
- The EE HPC WG had a booth on the Exhibition Floor of the Conference. There was information about the EE HPC WG. It also served as a place to meet and make new contacts as well as catch-up with current colleagues.
- Five submissions were made and two Birds of Feathers were accepted.

1. Energy Efficiency Considerations and HPC Procurement

ABSTRACT: The predominant goal for procurement of HPC systems is to identify the optimal solution to both technical and financial targets that maximizes the contribution of that system to the organization’s mission. Beyond the acquisition cost of the system, it is also important to consider the total costs of ownership, including the improvements necessary to host the system, the infrastructure that supports its operation, and the significant operational costs associated with that new HPC system. In this BoF, HPC leaders will discuss and debate key procurement requirements and lessons learned that can contribute to greater energy efficiency and reduced operational costs.

This BoF will be organized as a panel with Ladina Gilley as moderator. Each panelist will be asked to present a unique perspective with different procurements.

2. The Green500: Trends for Energy-Efficient Supercomputing

ABSTRACT: With power a first-order design constraint on par with performance, it is important to measure and analyze trends for energy-efficient supercomputing. This BoF will discuss trends across the Green500 and highlights from the latest Green500 list. The Green500 and TOP500, in collaboration with the Energy-Efficient HPC WG, have a newly integrated submission process designed to streamline future submissions and to provide a consistent set of data for the historical record. It will also provide a forum for community review of the integrated submission process. The BoF will close with an awards presentation, recognizing the most energy-efficient supercomputers in the world.

This BoF will continue to highlight the alignment in power measurement methodology between the Top500 and the Green500 that was done in collaboration with the EE HPC WG.

Other Conferences:

The EE HPC WG website has a links and events page with many other conferences and workshops listed that have an HPC energy efficiency focus.

<https://eehpcwg.llnl.gov/pages/events.htm>

Infrastructure Sub-Group Update: *David Grant, ORNL and Dave Martinez, SNL*

LIQUID COOLING CONTROLS TEAM:

David Grant made a presentation on dynamic cooling controls for Summit, ORNL’s next leadership class supercomputer. He made the presentation at the August HPC Power Management Workshop. He talked about the procurement process as well as defining the requirements and design for Summit cooling controls. The control system for Summit will be designed using industrial grade programmable logic.

This presentation was repeated for the Liquid Cooling Controls Team and it generated a lot of interesting discussion. All of the presentations from the HPM Workshop can be found at <http://hpm.ornl.gov/agenda.html>

Moving forward, this Team will be revisiting a list that they've developed of telemetry requirements required for dynamic control of liquid cooled systems and infrastructure. It is possible that this list will be included in the next revision of the EE HPC WG HPC Procurement Considerations Document.

We had a poster on this topic at the SC16 EE HPC WG booth.

DASHBOARD TEAM:

The Dashboard Team has provided a list of energy efficiency data and metrics that could be included on a dashboard. The initial list of elements was generated with input from a small group of EE HPC WG members. This list was presented at an SC15 BoF and feedback gathered from a broader group of community members. There were only minor changes suggested as a result of this review. The team has now transitioned to understanding how often (if at all) sites are actually using energy efficiency data and metrics. A survey was designed to collect this information and 12 sites have already responded. Further information about the dashboard effort can be found in two publications that are listed on the EE HPC WG website. Both of them were published in the High Performance Power Aware Computing Workshop.

TUE TEAM:

There isn't any news from the TUE Team.

LIQUID COOLED COMMISSIONING TEAM:

There isn't any news from the Liquid Cooled Commissioning Team.

If you are interested in participating more actively in any of these efforts or on any of these teams, please contact David Grant, Dave Martinez or Natalie.

High Voltage and DC- Potential New Team:

We are exploring whether or not a new team on High Voltage and DC makes sense for the EE HPC WG. There are some interesting questions:

- Alternating current (ac) is ubiquitous, but is direct current (dc) more efficient, reliable and less expensive?
 - Will this trend accelerate with use of renewables?
 - The implications for these new power distribution systems demand major shifts for both the infrastructure and operations of the data-center. Are we prepared for this shift?
 - Will dc be compelling enough to drive the eco-system?
 - What needs to be done to bridge the gap and ease the transition?
 - Many high-performance-computers use high-voltage dc internally; why not in the data center?
- These will be discussed in a panel session planned for SC16 with Anna Maria as the moderator. We will also have a poster on this topic in the SC16 EE HPC WG booth.

Heat Re-use and Recovery – Potential New Team:

Another possible team is on heat re-use and recovery. There are several sites that have efforts in this area. These include the supercomputing centers at the National Renewable Energy Lab and Lawrence Berkeley National Lab in the United States and, in Europe, there is the Leibniz Supercomputing Center, KTH in Sweden and UNINETT in Norway.

We had a poster on heat re-use and recovery in the EE HPC WG Booth.

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

SYSTEM WORKLOAD POWER MEASUREMENT METHODOLOGY:

We have a joint Green500, Top500 and EE HPC WG Birds of Feather for SC16. As part of this BoF, the EE HPC WG will encourage submissions made with higher quality power measurement methodology. There are 3 quality levels, with increasing accuracy of measurement technique. The Swiss National Supercomputing Center (CSCS) and Los Alamos National Laboratory both made a high quality (level 3) submission and will be presenting on their experience at this BoF.

HPC AND GRID INTEGRATION:

This team is analyzing data from major supercomputing centers in Europe and the United States about their electricity contracts and relationships with their electricity service providers. The goal of this study is to determine the structure of the contracts that exist between supercomputing centers and electricity service providers. The team is identifying the influence that this interaction (contractual interaction) may have on demand response participation. This information is used to understand the degree to which supercomputing centers have, and manage, flexibility toward grid operation. The information will be further used to identify barriers and opportunities in a demand response-participation context.

ENERGY AND POWER AWARE JOB SCHEDULING AND RESOURCE MANAGEMENT:

This team has kicked off in high-gear with both great participation as well as immediate work commencing on the initial goal of writing a whitepaper capturing the inventory of sites that are using energy and power aware job scheduling and resource management tools with large-scale implementations in a production and/or pre-production (technology development) environment. The team has sent surveys and will be interviewing ~ 10 sites.

RFP CONSIDERATIONS:

The EE HPC WG held a webinar in August that provided a kick-off for bringing the RFP Team out of its current dormant state. What do we need to do next? What needs to be improved, added?

An SC16 Birds of Feather is planned to solicit further feedback on the document and where we should take it. The BoF will be organized as a panel. It will include panelists from major supercomputing centers who have included energy efficiency considerations in recent RFP documents. It will also include vendor perspectives from Cray and IBM.

PARTICIPANTS INCLUDED

Name	Organization
Anna Maria Bailey	LLNL
Natalie Bates	EE HPC WG
Anita Cocilova	LLNL
David Grant	ORNL
Lennart Johnsson	KTH University, Sweden
Sharan Kalwani	Michigan State University
Detlef Labrenz	LRZ
Rodney Martin	NASA
Steven Martin	CRAY
Alexander Moskovsky	RSC Group
Kevin Pedretti	Sandia National Laboratories
Ben Radhakrishnan	National University
Dale Sartor	LBNL
Larry Seibold	Seibold Systems
Torsten Wilde	Leibniz Supercomputing Centre (LRZ, Germany)