

**Energy Efficient High Performance Computing Working Group**  
**6/11/13 Meeting Report**

**INTRODUCTION**

The EE HPC WG held a meeting on 6/11/13. 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>.

Documents from the group can be found at

<https://docs.google.com/leaf?id=0BzyTVVVRdMKpNWVjNTI5YTEtMTIIZi00YTA5LTlkMTYtZmY3ZDIyZjJjZmMy&hl=en>.

***NEXT MEETING: August 13th, 9:00-10:00AM Pacific Time***

***NEXT Scheduled WEBINAR: 8AM July 23<sup>rd</sup>***

*Michael Patterson from Intel will re-present a paper that won the Gauss Award at ISC'13. This paper proposes two new metrics: ITUE (IT-power usage effectiveness), similar to PUE but "inside" the IT and TUE (total-power usage effectiveness), which combines the two for a total efficiency picture. We conclude with a demonstration of the method, and a case study of measurements at ORNL's Jaguar system. TUE provides a ratio of total energy, (internal and external support energy uses) and the specific energy used in the HPC. TUE can also be a means for comparing HPC site to HPC site.*

***Upcoming WEBINARS: Date TBD***

*Hubert Huber from LRZ & Ingmar Meijer from IBM Research will talk about LRZ's unique liquid cooling system. Herbert will also describe highlights of LRZ's energy management systems, including special energy and total cost of ownership considerations of the procurement process.*

**Introductions and Announcements: *Natalie Bates & Dale Sartor, LBNL***

- Membership continues to grow and at last count we were over 360 members.
- Aaron Anderson was the webinar speaker for May. He presented an update on early results for energy and power management at the NCAR-Wyoming Supercomputer Center with the Yellowstone system. The slides are posted on the website for those who didn't get a chance to attend the webinar.
- We had to reschedule the LRZ webinar, but expect to hold it in July. Herbert Huber and Ingmar Meijer will talk about LRZ's unique liquid cooling system. Herbert will also describe highlights of LRZ's energy management systems, including special energy and total cost of ownership considerations of the procurement process.
- At the last meeting, we presented the results of the membership survey. These results have been posted to the EE HPC WG website as an attachment on the "About" page.

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

The 9th High Performance Power Aware Computing Workshop was held on May20th in Boston. Several members of the EE HPC WG participated in the workshop. Dong Li from ORNL was a co-chair, Susan Coghlan from Argonne was a session moderator and Natalie Bates presented an EE HPC WG paper on Dashboard Recommendations.

### ➤ **News on EE HPC WG participation in upcoming Conferences**

- SC13 Supercomputing Conference will be held in Denver from November 17-22. The SC13 Workshop submission was accepted. We asked for 1.5 days- and got it! Last year we also asked for 1.5 days, but only received one day. This will be on Sunday and 1/2 day Monday.

### ➤ **Submissions that are planned or in the works.**

We submitted a paper to SC13 regarding the power measurement methodology. We will receive reviews on July 1st.

The SC13 BoF deadline is July 31st. We will probably submit at least one BoF, but won't decide until closer to the deadline.

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

- ❖ International Conference on Energy Aware High Performance Computing, September 2-3, 2013 Dresden, Germany. Paper submission: 26 April 2013
- ❖ Energy-Efficient High Performance Computing & Communication Workshop, September 17, 2013, Madrid, Spain.
- ❖ SC13, November 17-22, 2013 Denver, Colorado

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

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

Bill Tschudi announced that LBNL is engaged in two liquid cooling demonstrations. For more information, contact Bill Tschudi at LBNL; [510-495-2417](tel:510-495-2417); [wftschudi@lbl.gov](mailto:wftschudi@lbl.gov)

- Asetek demonstration: Asetek provides a liquid cooling solution where water is taken all the way to the processor inside servers. In the LBNL demonstration, this system was applied to a rack of Cisco servers with processors supplied by Intel. The energy benefit is expected to be in the ability to use higher temperature cooling water. In the LBNL demonstration, water temperatures will be varied and Linpack will be run with each temperature variant. This demonstration is in place and operating in LBNL's data center.
- Liquid immersion cooling: Intel, 3M, SGI, and Schneider Electric are teaming with LBNL to demonstrate liquid immersion cooling at the Navy Research Laboratory in Washington, DC. In this demonstration, the electronics are submerged in a bath of

dielectric fluid manufactured by 3M. The fluid boils off at the processor level and vapors rise in the bath. The vapors are condensed using water at relatively high temperature (up to 35 C). This water rejects its heat to atmosphere using a dry cooler with very low energy use. No compressor based cooling or evaporative cooling is needed. The demonstration should be operational in early 2014.

- **LIQUID COOLED COMMISSIONING TEAM UPDATE:** Tom Durbin drafted an outline for the commissioning guideline. The outline has three major sections: 1. System design description, 2. Commissioning plan and 3. System acceptance test procedure. The team is reviewing this draft outline.
- **DEMAND RESPONSE AND ELECTRIC GRID INTEGRATION TEAM UPDATE:** The demand response team has completed the problem definition phase. They recognize that HPC data centers can participate in grid-integrated energy management as well as affect and get affected by power quality. Their immediate output is to develop a whitepaper that provides a state of the practice survey of strategies for implementing HPC data center demand response. They target completion of the whitepaper by the end of October '13.
- **DASHBOARD TEAM UPDATE:** On behalf of the Dashboard team, Natalie Bates presented a paper on May 20<sup>th</sup> in Boston at the High Performance Power Aware Computing Workshop. A link to the paper will be posted on the EE HPC WG website, pending posting of the full conference/workshop proceedings by IEEE. Dale repeated this presentation for those who couldn't make the HPPAC Workshop (for a copy of this presentation, see <https://sites.google.com/a/lbl.gov/eehpcwg/infrastructure> ).
- **TUE TEAM:** The TUE paper will be presented by Mike Patterson at the International Supercomputing Conference (ISC'13). This conference will be held in Leipzig, Germany in mid-June. This paper will also be published as part of the IEEE Conference proceedings. **LATE BREAKING NEWS:** The TUE paper won the Gauss Best Paper Award at ISC!
- **ENERGY REUSE EFFECTIVENESS:** Still looking for a site that will help test the ERE metric. Please contact Natalie if you are interested.

#### **Compute System Sub-group Update: *Natalie Bates, LBNL***

- **POWER MEASUREMENT METHODOLOGY TEAM:** The Power Measurement Methodology Document was finalized and posted on the Green500 website on the submissions page. Green500 is soliciting submissions made with a higher quality power measurement methodology (Level 2 and Level 3 submissions)! We aren't yet certain how many L2/L3 submissions will get made for the June '13 lists, but the submission deadline is mid-June so we will know soon. We also aren't certain who will present at the ISC BoF on their submissions and testing of the methodology, but it should prove to be a productive and interesting session.
- **MEMORY WORKLOAD/BENCHMARK TEAM:** We still intend to kick off a new team to address the question of additional workloads that stress the other sub-systems - like memory, Storage and Communication.

- **RFP CONSIDERATIONS TEAM:** A draft of the RFP considerations whitepaper was circulated to the broader RFP team for their review and feedback. A small team has gone through all of the feedback and revised the document. It should be ready to be distributed to the entire WG by the end of June.

***PARTICIPANTS INCLUDED***

<b>Name</b>	<b>Organization</b>
Bailey, Anna Maria	LLNL
Bates, Natalie	LBNL
Bodas, Deva	Intel
Cocilova, Anita	LLNL
Coppola, Marcello	STMicroelectronics
Durbin, Thomas	NCSA
Ellsworth, Michael	IBM
Fields, Parks	LANL
Lam, Sunny	Intel Corporation
Loncaric, Josip	LANL
Mahdavi, Rod	LBNL
Martinez, Dave	LBNL
Nagappan, Ram	Intel Corporation
Rountree, Barry	LLNL
Sartor, Dale	LBNL
Siebold, Larry	Seibold Systems
Silveira, Marriann	LLNL
Symanski, Dennis	Electric Power Research Institute (EPRI)
Tschudi, Bill	LBNL
Wescott, Ralph	PNNL
Wilde, Torsten	Leibniz Supercomputing Ctr.
Zong, Ziliang	Texas State University