

Energy Efficient High Performance Computing Working Group  
**September 13, 2011 Meeting Report**

## **INTRODUCTION**

The EE HPC WG held a meeting on September 13, 2011. This Working Group is composed of members representing Federal 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 October 11th, 2011 9:00-10:00AM Pacific Time***

***NEXT Webinar – Also October 11<sup>th</sup>, 2011 10:00-11:00 Pacific Time  
Alan Yoder, NetApp to speak on Green Storage for HPC***

### **Introductions and Announcements: *Natalie Bates***

There is an EE HPC WG workshop planned for Super Computing 11 (SC11). It will be from 8:30-5:00 on Monday, November 13<sup>th</sup>.

The EE HPC WG website has been updated to include regular progress reports.

### **Infrastructure Sub-Group Update: *William Tschudi and Henry Coles***

The infrastructure subgroup has been working on liquid cooling temperature guidelines. The goal was to get a temperature guideline high enough that any national lab could be cooled without using compressors. A more ambitious goal was to make this possible with dry coolers. The recommendations standardize at 32 C for cooling towers and 45 C for dry cooler applications.

ASHRAE is finalizing a white paper which will have liquid cooling guidelines; it is in the voting process. The subgroup expects that the paper will be available in its final version shortly.

Henry Coles with support from many others recently wrote a paper describing the liquid cooling recommendation rational, which has been posted on the infrastructure page of the website.

Mike Patterson has written a paper on the subject of waste heat metrics.

The infrastructure sub-group's next activity will be to develop metrics for the shifting of loads from IT components to infrastructure components and vice versa. This will

include, for example, taking fans out of servers and internal versus external power supplies. The Green Grid and will be engaged in the project once it progresses.

The use of DC Pro is included in DOE's sustainability plans. DOE data centers will be required to use DC pro as well as have someone take the data center certified energy practitioner training.

Bill Tschudi presented a paper at the summer ASHRAE conference on a technology developed by Clustered Systems, which uses conduction and a refrigerant to remove heat from servers.

A Data Center Programming Guide will be made available within the next couple months. It will tell data center managers how to consider ASHRAE 90.1 in data centers. It will show federal agencies how to plan their data centers and how they're expected to meet the requirements.

LBL completed a study about corrosion in data centers. Data Centers located near volcanoes or sources of air pollution are concerned with corrosion. The report polls contaminate levels from several U.S. cities and concludes that corrosion will not be a problem in U.S. data centers. One data center in Santa Clara had high contaminate readings, but still reported no problems. The report is on the LBNL website.

### **Conferences Sub-group Update: *Natalie Bates for Anna Maria Bailey***

#### **SC'11**

The EE HPC WG has two birds of a feather and one state of the practices session coming up at SC'11 in Seattle.

*Workshop: "Towards and Beyond Energy Efficiency: HPC System and Datacenters" Monday, 8:30AM - 5:00PM*

Speakers include Satoshi Matsuoka/TIT, Ingmar Meijer/IBM, Anna-Maria Bailey/LLNL, Michael Patterson/Intel, William Tschudi/LBNL and Alan Yoder/NetApp. They are well known leaders in energy efficiency for supercomputing and promise a lively and informative session.

*Birds of Feather: "Setting Trends for Energy Efficiency" Tuesday, 12:15-1:15PM*

ABSTRACT: This BoF reviews an effort to drive a commonly adopted set of methodologies, workloads and metrics for measuring energy efficiency of supercomputing architectures. This is a collaborative effort between the Green500, the Top500, The Green Grid and the Energy Efficient HPC Working Group. It is intended for those involved in the supercomputer system architecture design and procurement decision-making process including users, data center and facilities designers/managers. This community effort seeks to characterize the energy efficiency of supercomputer architectures rather than the operational efficiency of supercomputers or data centers. A pragmatic decision was taken to select readily available, broadly adopted and well defined workloads that exercise

the HPC system or subsystem to the fullest capability possible. An immediate focus of this community is to improve the methodology for measuring the energy and/or power consumed while running workloads, such as HPL.

*Birds of Feather: "'Hot' for Warm Water Cooling" Tuesday, 5:30-7:00PM*

ABSTRACT: About half of an air-cooled data-center's energy consumption is wasted on powering the cooling systems that keep the computer system from overheating. Furthermore, the amount of heat dissipated by future supercomputers limits the practicality of air-cooling. Liquid-cooling is key to reducing cooling energy consumption for future supercomputers because the heat capacity and transfer efficiency of liquids is orders of magnitude greater than that of air. The transition from air to liquid-cooling is a technology inflection point providing an opportunity to set guidelines for energy efficiency of liquid-cooled facilities and systems. Substituting vapor-compression refrigeration systems with cooling towers or dry coolers that provide warmer water to supercomputers is the natural progression towards energy conservation. The U.S. Department of Energy (DOE) Supercomputing Laboratories are working collaboratively with industry representatives to develop guidelines for warmer liquid-cooling temperatures to guide future supercomputer procurements, and to facilitate the design of warmer temperature cooling systems.

*State of the Practice: "'Hot' for Warm Water Cooling" Wednesday 4:00-4:30PM*

ABSTRACT: Liquid-cooling is key to reducing energy consumption for this generation of supercomputers and remains on the roadmap for the foreseeable future. This is because the heat capacity of liquids is orders of magnitude larger than that of air and once heat has been transferred to a liquid, it can be removed from the datacenter efficiently. The transition from air to liquid-cooling is an inflection point providing an opportunity to work collectively to set standards for facilitating the energy and cost efficiency of liquid-cooled HPC facilities and systems. The vision is to use non-chilled water, to facilitate heat re-use and to build solutions that are more energy-efficient, more carbon-neutral and more cost-effective than their air-cooled predecessors. The Energy Efficient HPC Working Group is developing guidelines for warmer liquid-cooling temperatures in order to assist with procurement specifications, to design warmer temperature cooling systems and facility cooling systems. This report describes those guidelines.

There are also many other sessions at the conference that will deal with energy-efficiency issues. Natalie has included a full list on the EE HPC WG conferences website <http://eehpcwg.lbl.gov/conferences>.

More information on upcoming events can be found at:

<http://eehpcwg.lbl.gov/events-and-links>

**Compute System Metrics Sub-group Update: *Craig Steffen***

The compute systems metrics group is working on a power measurement methodology document. They have the document set up as a google doc. They are now sending it out to slightly larger audiences for comments. There will be another round of edits before SC 11.

## ***PARTICIPANTS***

<b>Name</b>	<b>Organization</b>
Natalie Bates	EE HPC WG
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