

Energy Efficient High Performance Computing Working Group
12/11/12 Meeting Report

INTRODUCTION

The EE HPC WG held a meeting on 12/11/12. 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 February 12th, 9:00-10:00AM Pacific Time

NEXT WEBINAR December 19th 9:00-10:00AM Pacific Time

"Foundations for an Energy Efficient HPC Data Center"

Presented By: Bill Tschudi (LBNL) & David Martinez (SNL)

Introductions and Announcements: *Dale Sartor, LBNL*

- ~30 new members have been added since the October meeting, mostly as a result of SC12 Workshop. We have now topped 300 members.
- The EE HPC WG organized two technical sessions for SC12 and both of them were well presented and attended. We will hear more about these sessions from the Conferences, Infrastructure and Compute System Teams.
- The kick-off meetings for the Liquid Cooling Commissioning Team and the Demand Response Team will be held in January. Anyone who is interested in joining should contact Natalie.
- Since there were a lot of people who were not able to attend SC12, we have decided to repeat the workshop presentations as webinars. A webinar will be held next week, Wednesday December 19th at 9AM Pacific Time. Bill Tschudi and Dave Martinez will present "Foundations for an Energy Efficient Data Center". In January, Nic Dube and Steve Hammond will present on NREL and the Net Zero Data Center.

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

- The EE HPC WG organized two technical sessions for SC12 and both of them were well presented and attended.
- A Workshop entitled "Third Annual Workshop on Energy Efficient High Performance Computing - Redefining System Architecture and Data Centers" had ~150 participants total, with over 100 in the room at any one time. Presenters included:
 - Opening Remarks, by Robin Goldstone/LLNL

- Foundations for an Energy Efficient Data Center, by Bill Tschudi/LBNL and Dave Martinez/SNL
- Metrics Overview and Update, by Michael Patterson/Intel
- Analysis of Application Requirements and Impact on Energy Use, by John Shalf/LBNL
- Case Study: GPUs TSUBAME, by Satoshi Matsuoka/Tokyo Institute of Technology
- New ASHRAE Thermal Guidelines for Air and Water Cooling, by Michael Ellsworth/IBM
- Case Study: LRZ Liquid Cooling, Energy Management and Contract Specialties, by Herbert Huber/LRZ and Ingmar Meijer/IBM
- Case Study: NREL and the Net-Zero Data Center, Steve Hammond/NREL and Nic Dube/HP
- Closing Remarks, by Jim Rogers/ORNL
- *These presentations are also posted on the EE HPC WG website under the Documents Page.*

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

- ❖ Eighth IEEE Workshop on High-Performance, Power-Aware Computing (HP-PAC), May 20, 2013 Boston, Massachusetts USA
Paper submission: 14 January 2013
- ❖ International Supercomputing Center, June 16-20, Leipzig, Germany
Paper submission: 27 January 2013
- ❖ BoF, Tutorial, Poster submission: 10 February 2013
- ❖ Fourth International Green Computing Conference, June 26-29, 2013 Arlington, Virginia USA
Paper submission: 15 January 2013
Workshop, Tutorial submission: TBD
- ❖ International Conference on Energy Aware High Performance Computing, September 2-3, 2013 Dresden, Germany
Paper submission: 26 April 2013
- ❖ SC13, November 17-22, 2013 Denver, Colorado
Workshop submission: 31 January 2013 Tutorials: 25 March 2013

Infrastructure Sub-Group Update: *William Tschudi, LBNL*

- The Infrastructure Sub-Group is soliciting participation in the following current and new teams. Please contact Natalie Bates if you are interested in participating in one or more of these teams.
- **LIQUID COOLED COMMISSIONING GUIDELINE.** Scheduled weekly on Thursday at 9AM starting January 10th. 10 team members signed up. There are lessons learned and best practices evolving from commissioning data centers with liquid cooled HPC systems. This team will focus on writing a commissioning guideline with a focus on energy efficiency for HPC data centers that are deploying liquid cooled systems. David Martinez from Sandia National Laboratory will provide technical leadership for this team. He will draw upon the commissioning plan developed for use by the National Renewable Energy Laboratory as the initial basis for the guideline. This team is especially looking for members who have had experience with commissioning data centers for HPC liquid cooled data centers.
- **DEMAND RESPONSE AND ELECTRIC GRID INTEGRATION.** Schedule TBD. Start in January. 7 Team Members signed up. Data centers with petascale systems for high-performance computing (HPC) are realizing the large impact they will be putting on their electricity service providers as they bring on (and perhaps turnoff or idle) megawatt scale (soon double digit) super

computers. There is interest in discussing demand response and electric grid integration of data centers across a wide range of opportunities and issues (e.g. better energy management of the IT equipment as not to shock the grid or impact the data center operations). With initial guidance from Girish (Rish) Ghatikar, who works in the Demand Response Research Center at Lawrence Berkeley National Laboratory, we will host a discussion on whether there is a clear problem statement and desirable outcome that would benefit from the collective action of the EE HPC WG. Rish will draw upon his and the team experience leading a study that examined data center characteristics, loads, control systems, and technologies to identify demand response (DR) and automated DR (Open Auto-DR) opportunities and challenges. For more information, please see <http://drrc.lbl.gov/projects/dc>

- **DASHBOARD TEAM.** Recap of recent steps: Sent "HPC Dashboard Guide - WG Document Final V01 23Sep12" to the entire EE HPC WG. Reviewed and disposed feedback with the larger Dashboard team, incorporating changes in "HPC Dashboard Guide - WG Document Final V04 06Nov12". Current status: "HPC Dashboard Guide - WG Document Final V04 06Nov12" posted on the EE HPC WG website. <http://eehpcwg.lbl.gov/documents>
- **TUE TEAM.** Planning on making a submission to ISC. Possible ORNL review/trial.

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

POWER MEASUREMENT METHODOLOGY:

In October, we finished revising, reviewing and approving the beta version of the Power Measurement Methodology. This version incorporated changes that resulted from the alpha testing phase. There were three major changes; 1) tightening the system boundary definition, 2) specifying the power measurement point (which addressed a concern about AC-DC power losses) and 3) added the reporting of temperature as an environmental variable.

In November, we completed beta testing with ORNL, University of Tennessee, Argonne, LRZ, and University of Jaume. These included systems from Cray, Appro (now Cray), IBM- both BG/Q and Dataplex and Bull. This was an improvement in vendor coverage from the alpha testing with the addition of Appro and Bull. No show stoppers were identified as a result of the beta testing. There are, however, several major change requests that are a carryover from the alpha testing. The top one being whether or not to include an idle power measurement as part of the 'workload'.

Jack Dongarra's team changed the High Performance Linpack workload as a result of our efforts. They have included a start/stop time in the HPL code that demarcates the part of the run that is the most computational intensive- and has a consistently high power draw. An interview with Jack Dongarra and Dona Crawford, Associate Director of Computation at LLNL was done by The Register at SC12 and will run sometime in the next couple of weeks.

We held a successful BoF to review the beta test results at SC12. There were ~ 100 people in attendance. Craig Steffen also gave a presentation on our efforts at the Green500 BoF. Finally, at yet another BoF, Paul Coteus announced that the IBM BG/Q had made a change to its firmware that addressed our requirement for measuring AC-DC power losses. He said that the firmware change would be incorporated in their standard product.

BEYOND HPL

We will be kicking off a new team in January to address the question of additional workloads that stress the other sub-systems - like memory, Storage and Communication.

RFP GUIDELINES

On-going work in generating a guideline for RFP/RFI's that will address- among other things- the power measurement and management capabilities desired of HPC systems.

PARTICIPANTS

Name	Organization
Bailey, Anna Maria	LLNL
Bates, Natalie	LBNL
Chung-Hsing, Hsu	ORNL
Cocilova, Anita	LLNL
Harrington, Steve	Flometrics
Kubaska, Ted	Independent Contractor
Lam, Sunny	Intel
Lopez, Cacheiro Javier	Supercomputing Center of Galicia
Mahdavi, Rod	LBNL
Nomine, Jean-Philippe	CEA
Patterson, Michael	Intel
Peterson, John	HP
Sartor, Dale	LBNL
Singh, Shalini	Stanford University
Silveira, Marriann	LLNL
Tomlinson, Robert	LANL
Tschudi, Bill	LBNL
Walters, Adam	FNAL
Wescott, Ralph	PNNL