Energy Efficient High Performance Computing Working Group
10/9/12 Meeting Report

INTRODUCTION

The EE HPC WG held a meeting on 10/9/12. 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=0BzyTVVVRdMKpNWVjNTI5YTEtMTllZi00YTA5LTlkMTYtZmY3ZDIyZjJjZmMy&hl=en.

NEXT MEETING December 11th, 9:00-10:00AM Pacific Time

Introductions and Announcements: ***Dale Sartor, LBNL***

- Membership is up to 250 individuals from 18 different countries.
- November Webinar (11/6/12 @ 9:00AM Pacific Time). Alex Ramirez, Associated Professor at UPC and Task Leader at the Barcelona Supercomputing Center will talk about Mont-Blanc, an exascale proto-type that will rely on energy-efficient ARM processors, also used in embedded and mobile devices. It is expected to achieve from 4 to 10 times increase in energy-efficiency compared with current technologies.
- An upcoming webinar with a date to be determined will be Jim Rogers, ORNL on GPU/Jaguar experience.
- We are kicking off two new teams; one on Liquid Cooling Commissioning and the other on Demand Response. Everyone should have received an invitation to join these teams and the other ones that we already have underway.
- We also have a workshop and BoF scheduled for SC12. Peter Kogge and John Shalf will talk about system architecture; the past, present and future trends. We'll have case studies from Tokyo Institute of Technology, Leibniz Supercomputing Center and the National Renewable Energy Lab that will focus on both system architecture and the data center. Then, we'll have more tutorial type of information on ASHRAE, metrics and data center efficiency tips and techniques. Both the Conferences and Systems Teams will give more information on SC12.
- IDC report features EE HPC WG members Greg Rottman, ERDC and Nic Dube, HP. Energy-Efficient Strategies in HPC: HPC User Forum, September 2012, Dearborn, Michigan

Conferences Sub-group Update: ***Natalie Bates, LBNL***

- **Upcoming Conferences: (more details at** http://eehpcwg.lbl.gov/events-and-links)
    - Silicon Valley Leadership Group's Fifth Annual Data Center Efficiency Summit. October 24th. Sunnyvale California. http://svlg.org/

Some of our members are featured on the agenda.
Anna Maria Bailey will talk about modeling and DCIM.
Dennis Symanski will talk about wireless CRAC and CRAH controls.
Henry Coles will talk about case studies on cooling technologies.
Bill Tschudi will talk about Server Closet Efficiency.
Dale Sartor will moderate a session on case studies on energy efficiency from data center design.

- Supercomputing Conference SC12. November 10-16. Salt Lake City, Utah
  http://sc12.supercomputing.org/

  There are at least 35 technical sessions at SC12 with a specific focus on energy efficiency. Two of these are the EE HPC WG workshop scheduled for all day Sunday, November 11th ant the EE HPC WG Birds of Feather scheduled for Wednesday, November 14th at noon. The workshop will cover a full spectrum of energy efficiency topics for both the data center and HPC systems. The BoF will focus on the methodology used for measuring power/energy while running system workloads for architectural comparison, such as done with HPL by the Top500.

  Twelve of the sessions are exploring system hardware energy efficiency. Of these twelve, 6 of them focus on alternative processors like GPU, ARM and DSP and 4 others are focused on memory technologies. The other two describe liquid cooling architectures.

  There are two sessions that are more focused on the data center including Kim Cupps speaking about Sequoia Integration.

  There are five sessions that describe research on tuning applications for energy efficiency. Most of these are focused papers, but one of them is a BoF on Power and Energy Measurement Modeling. Four other sessions, again papers, describe research on various energy efficient job scheduling efforts.

  Individuals from PNL will be hosting another high level Bof on energy efficiency this year, similar to the one held last year. Kirk Cameron and Thomas Ludwig will both give high level talks on energy efficiency- although Thomas's talk highlights cost of HPC, with energy comprising a significant cost.

  Finally, the Top500, Green500, Graph500 and SPEC will all cover power as well as performance in their BoFs.

  More information about the SC12 technical program sessions focused on energy efficiency will be posted on the EE HPC WG website

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

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.

1. LIQUID COOLED COMMISSIONING GUIDELINE. 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.

2. DEMAND RESPONSE AND ELECTRIC GRID INTEGRATION. 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 desireable 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

EXISTING TEAMS:

1. DASHBOARD GUIDELINE. This team has completed writing a draft guideline that provides general recommendations to help select or tailor the energy elements (or parameters) of a Data Center infrastructure Management (DCIM) system's dashboard for a High Performance Computing (HPC) center. The team is looking for members who are interested in reviewing and providing feedback on this document.

2. Total PUE and HEAT RE-USE CASE STUDIES. The EE HPC WG is looking for members who are are willing and able to write case studies that would test metrics for Total PUE and Heat Re-use. Total PUE is the total energy into the data center divided by the computational components inside the IT equipment. It attempts to redress the concern that PUE does not account for the power distribution and cooling losses inside the IT equipment.

Compute System Sub-group Update: Craig Steffen/NCSA and *Natalie Bates, LBNL*

- **HPC System Metrics.** We are working on an improved power/energy measurement methodology that will be used by the Top500 and the Green500- and now possibly the Graph500 - for submissions on power/energy used while running a workload. In the case of the Top500 and

Green500, that workload is High Performance Linpack. The attempt is to achieve a methodology that will allow for an 'apples to apples' comparison of power/energy used by different systems.

We have responded to recommendations made by alpha testers of the methodology and are currently reviewing are in the process of reviewing as well as testing a beta version of the methodology. Changes made in the document include:

1. More explicitly defining and drawing a line in the sand for system boundary.
2. Requiring measurement (verses modeled estimates) of power losses over the power supply modules for dc power measurements.
3. Including a single reading of inlet and outlet temperature during the run.

This version will be tested in October/November and the results will be presented at SC'12.

Beta testers include the following vendors and geographies: Cray, HP, IBM, Bull and Sun and United States, Germany, Spain and Canada.

PARTICIPANTS

Name	Organization
Bates, Natalie	LBNL
Campbell, Matt	SDSC
Cocilova, Anita	LLNL
Di Salvo, Garr	ARUP
Dorella, Dario	Altair
Ellsworth, Mike	IBM
Goodhue, John	Mass Green HPC Center
Lam, Sunny	Intel
Lopez, Cacheiro Javier	Supercomputing Center of Galicia
Martinez, Dave	SNL
Netzer, Gilbert	KTH
Patterson, Michael	Intel
Peck, John-Luke	Intellectual Ventures
Rottman, Greg	Army Corps of Engineers
Sartor, Dale	LBNL
Sorell, Vali	Syska Hennessy Group
Taylor, Rob	UTC Aerospace Systems
Tschudi, Bill	LBNL
Zero, Jose	Intel