

Energy Efficient High Performance Computing Working Group 10/13/15 Meeting Report

INTRODUCTION

The EE HPC WG held a meeting on 10/13/15. 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 8th, 9:00-10:00AM Pacific Time

Introductions and Announcements: *Natalie Bates, EE HPC WG*

The EE HPC WG membership continues to grow and is now at 575 members, up almost 100 people from last October.

The Liquid Cooling Controls team hosted a webinar last week. Perspectives and case studies were presented from Sandia, LRZ, NCSA and the Stennis Space Center. It was well attended with ~40 people. David will provide more information about the webinar in the Infrastructure Update.

There aren't any additional webinars scheduled, but the HPC Power Management workshop held last month in Annapolis had very interesting presentations from EE HPC WG members Craig Barclay, Jim Rogers, Jim Laros, Thomas Durbin, Ram Nagappan, Chung-Hsing Hsu, Greg Koenig, Wu Feng and Natalie Bates. Many of these presentations could make for an effective webinar.

I will tell you about what we are planning for SC15. I hope to see y'all in Austin!

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

SC15 will be held in Austin, Texas in mid-November.

The 6th Annual EE HPC WG SC15 Workshop will be held on Monday, November 16th from 9:00 to 5:30.

In August, we reported that Satoshi Matsuoka from the Tokyo Institute of Technology will open the workshop and will also moderate the first workshop session with three speakers from Japanese Supercomputing Centers.

Since August, we've finalized some other exciting aspects of the workshop.

Justin Rattner will deliver the keynote address. He is the former Intel Senior Fellow, Chief Technology Officer (CTO) and Vice President of Intel Corporation. Justin's vision and leadership in the late 80s and early 90s led to the first teraflop supercomputer and helped shape the technology direction and innovation that drove an exciting era of parallel supercomputing. We're very fortunate to have Justin as the keynote.

He has been the keynote speaker for Supercomputing as well as the International Supercomputing Conference in recent years. He is uniquely qualified to talk about perspectives on HPC system architecture and energy efficiency.

The workshop will also host a session with a panel of representatives from the Oil and Gas Industry. Donny Cooper from Total is helping to organize this session and it will include representatives from BP, Hess, Exxon Mobile and CGG. The purpose of this session is to learn more about the oil and gas industry supercomputer centers and to explore if there are opportunities to work together in the future.

The remaining sessions in the workshop are still being finalized and more news will be communicated to the EE HPC WG as things develop.

On Tuesday from 5:30 to 7PM, we will be hosting a Birds of Feather called “Dynamic Liquid Cooling, Telemetry and Controls; Opportunity for Improved TCO?”

On Wednesday from 5:30 to 7PM, the EE HPC WG has a joint Birds of Feather with the Green500. Erich Strohmaier from the Top500 will also be there.

Thursday the EE HPC WG is running two different sessions. At 12:15, there will be a Birds of Feather on “Identifying a Few, High-Leverage Energy Efficiency Metrics” and in the afternoon at 2PM, the Power Measurement Methodology Team will be presenting a paper on “Node Power Variability: Implications for System Power Measurement Methodologies”.

Other Conferences:

The EE HPC WG website lists many upcoming Conferences and Workshops that have an HPC Energy Efficiency Focus.

Infrastructure Sub-Group Update: *David Grant, ORNL*

LIQUID COOLING COMMISSIONING TEAM:

The Liquid Cooling Commissioning Team has prepared material to be included in the EE HPC WG Procurement Considerations document. This is a subset of the Team’s document, “Systematic Approach for Universal Commissioning Plan for Liquid-cooled Systems”.

LIQUID COOLING CONTROLS TEAM:

The Liquid Cooling Control’s Team presented a webinar last week with perspectives and case studies from HPC Centers on dynamic controls for liquid controls. This was a follow-on to an earlier webinar where system integrators - HP, Cray, IBM, Lenovo and RSC – talked about their vision and roadmap for HPC liquid cooling controls.

Today’s practice for liquid cooling is to use CDUs with constant flow-rate and temperature. Tomorrow’s products could be designed for variable flow-rate and temperature based on actual heat removal requirements, but there would have to be more and finer grained telemetry and controls. How much savings can be gained in energy savings compared to the incremental capital and operational costs? This webinar explored case studies from major HPC centers that have implemented and/or are considering dynamic controls for liquid cooling.

Marriann Silveira, Lawrence Livermore National Laboratory, opened the webinar with a statement of motivation and goals.

Tom Durbin, National Center for Supercomputing Applications, described controls that utilize variable frequency drives to minimize energy use in chilled water pumps.

David Martinez, Sandia National Laboratory, described components and controls working in unison to prevent wasted energy and improve reliability.

Greg Rottman, U.S. Army Engineer Research and Development Center (retired) and Charles Rush, Hermetic Rush Services, presented a case study of Stennis Space Center's energy efficient chiller and water tower control system.

Torsten Wilde, Leibniz Supercomputing Center, showed work in progress on using models and simulations of the LRZ hot water cooling infrastructure.

Presentations and audio recordings for both webinars are posted on EE HPC WG website.
<https://eehpcwg.llnl.gov/pages/webinar.htm>

The team has created a list of data elements deemed important for dynamic liquid cooling controls from both the IT systems and the data center building. This work is exploratory, as there are few implementations of dynamic integrated liquid cooling controls. We are now collecting information on use cases to test and expand upon the initial list of data elements. We are also looking for more examples of dynamic liquid cooling controls.

As was said earlier, we are also organizing a BoF "Dynamic Liquid Cooling, Telemetry and Controls; Opportunity for Improved TCO?" Tuesday, 5:30-7:00PM. The BoF will have panelists Nic Dube from HP, Dave Martinez from SandiaNL, Thomas Durbin from NCSA, Wade Doll from Cray and Chris Marroquin from IBM. Panelists will be asked to prepare a short presentation to answer a few questions:

- Can we reduce operational expenditures and improve energy efficiency by optimizing liquid cooling systems with more dynamic controls?
- Where are liquid cooling controls best implemented- in the HPC system or in the building or both?

What telemetry is required for optimized dynamic liquid cooling? Your thoughts and experiences?

Presentations will be followed by Q&A from both the moderator and the floor.

TUE TEAM:

There isn't any news from the TUE Team.

ENERGY REUSE EFFECTIVENESS:

The Energy Re-use Effectiveness Team in collaboration with The Green Grid has developed a standard metric for measuring the contribution of re-using heat generated by HPC systems for other useful purposes.

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 Bates.

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

SYSTEM WORKLOAD POWER MEASUREMENT METHODOLOGY:

After collecting several years of real world data from various supercomputer centers around the world, this team has raised the bar with a second version of a methodology for measuring system power while running a workload. This second version requires that a greater fraction of the system is instrumented and measured, that the measurement covers the entire time that the workload is running and that the interconnect as well as compute subsystem is measured. As I mentioned in August, the Version 2 methodology is posted on the Green500 website. The Green500 and Top500 have approved version 2 and will implement it effective November 19th, 2015. It is still under review and pending approval from The Green Grid.

There will be an announcement and more details about the implementation of this V2 methodology at the Top500 and Green500 SC15 Birds of Feather sessions.

HPC AND GRID INTEGRATION:

This team is looking at the interaction between supercomputing centers and their electricity service providers, currently comparing the US and Europe. We are focused on grid integration, where interaction is mutual and dynamic. The consumers of electricity are engaging real-time in responding to the needs of their electricity providers. Survey data and analysis suggests that the United States electricity services market may be slightly further ahead than that in Europe when it comes to grid integration. That said, the Europeans may be more responsive to electricity service contractual requirements and have more experience with power as well as energy management strategies.

METRICS and DASHBOARDS:

Metrics are key to driving improvements and the EE HPC WG Dashboard Team is collaborating with a few other groups to see if there might be an opportunity to identify a few high-leverage energy efficiency metrics. These groups include the Energy Efficient HPC Working Group (EEHPC WG), ORNL's HPC Power Management Workshop, the US DOE Federal Energy Management Program (FEMP), and Germany's Simulation and Optimization of Energy circuits in data centers (SIMOPEK) Initiative.

The EEHPCWG hosted a BoF at SC14 to discuss how the HPC community can agree on system metrics and workloads to move from analysis towards optimization. The outcome was that there is no single silver bullet to resolve the challenge. The experts did agree that a good metric is simple, easy to measure, actionable, and links strongly with clear goals. Besides the compute load, new metrics need to include storage and network as well.

FEMP published Guidelines for Data Center Energy Information Systems which discussed in detail possible measuring requirements and possible energy efficiency indicators for various stakeholders.

SIMOPEK published a new metric, called Data center Workload Power Efficiency, which connects an HPC systems Performance/Watt metric with the data center infrastructure overheads.

Therefore, it seems timely to engage the broader HPC community in the discussion, how HPC data center energy efficiency needs to be measured and how application energy efficiency can be connected with the traditionally separated data center infrastructure space. On Thursday November 19th, at 12:15, there will be an SC15 Birds of Feather on “Identifying a Few, High-Leverage Energy Efficiency Metrics.”

PARTICIPANTS INCLUDED

Name	Organization
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