

**Energy Efficient High Performance Computing Working Group
02/12/18 Meeting Report**

INTRODUCTION

The Energy Efficient High Performance Computing Working Group (EE HPC WG) held a meeting on 2/12/19. This Working Group is composed of members representing major governmental 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, April 9th, 2019 9:00-10:00AM Pacific Time

Conferences Sub-group Update: *Torsten Wilde, Hewlett Packard Enterprise and Siddhartha Jana, Intel*

Torsten Wilde, HPE, presented.

SC18

InsideHPC published a video recording of the SC18 Panel we organized on "*If you can't measure it, you can't improve it*", *Software Improvements from Power/Energy Measurement Capabilities*
Link: <https://insidehpc.com/2019/01/dan-reed-panel-on-energy-efficient-computing-at-sc18/>

SC19

We actually have submitted the proposal for our 10th Annual Workshop and we hope that we get selected again. We definitely have a booth space again as we have for several years.

ISC19

There are several research areas that include energy and/or power management and efficiency. These include power and energy management and scheduling, energy efficient algorithms, power consumption, and energy measurement and modeling. Link: <https://www.isc-hpc.com/press-releases/the-entire-isc-2019-contributed-program-is-now-open.html>

There will be a joint BoF submission between the EE HPC WG, the Green500 the Top500.

ICPP19

Our workshop submission to the International Conference on Parallel Processing (ICPP) was accepted and will be held in Kyoto on August 5th. The title of the workshop is EE HPC SOP, for Energy Efficient HPC State of the Practice. It is intended to be a paper workshop, but focused

on state of the practice and not research. It is also centrally focused on practices and technologies that span both the infrastructure and HPC systems.

Link: <https://sites.google.com/view/eehpcsop2019/>

Argonne Leadership Computing Facility Development Series

The Argonne Leadership Computing Facility Development series will hold a tutorial on GeoPM, which is part of the PowerStack Initiative.

Other Conferences

The EE HPC WG website has a links and events page with many other conferences and workshops listed that have an HPC energy efficiency focus.

Events link: <https://eehpcwg.llnl.gov/events.html>

Conf link: <https://eehpcwg.llnl.gov/conf.html>

Infrastructure Sub-Group Update: David Grant, Oak Ridge National Laboratory and Dave Martinez, Sandia National Laboratory

Grid Integration

Grant Stewart, LANL, presented. The Electrical Grid Integration team has recently had a change in focus from one that was focused on contracts to one that is focused on power engineering. We have three deliverables under our belt and one that is pending. The team had most recently been focused on an analysis of contracts and relationships between supercomputing centers and electric service providers. Prior to that, the team was focused on Demand Response both in Europe and the United States.

More recently, the team is vectoring more towards the power engineering aspects of how super computer centers that are large and growing, with highly variable electric power demand, are impacting the grid environment where they exist. The team is also looking at how supercomputing centers that are planning to grow are thinking about and working with their electric service provider to make sure that they're a good neighbor in the grid setting. So we're underway with current activities doing surveys with a set of questions that get at this basic topic.

We have interviewed ORNL and NCAR and have developed a good set of information from those two sites. Next, we're working on LLNL and LANL. We're going to boil all that survey research down into insights and information and sum it up and present it at the 10th Annual European HPC Infrastructure Workshop as well as submit it to the EE HPC SOP Workshop. workshop and also to submit it.

We'd like to expand to a broader set of sites than the ones I've listed; maybe some European and Japanese sites. We're looking for diversity of sites. And we're also looking for help on our team for expertise on electrical power engineering and this idea of responsiveness to large power loads voltage swings.

Operational Data Analytics

Torsten Wilde, HPE, presented. The Operational Data Analytics Team did a short survey when we started the team to see which sites are interested in data analytics for improving operational efficiency and HPC system efficiency. From that response, we picked the most interested sites, developed a more detailed questionnaire to answer the question as to what is the state of the practice across the HPC community for operational data analytics.

Simultaneously, we also decided to write some detailed case studies highlighting the experiences and benefits gained from operational data analytics. There was a presentation at the EE HPC WG workshop at SC18 by LBNL/NERSC showing some of what they have done. From that, we came up with four case studies that we are writing up with NERSC. One describes the motivation behind building some of the advanced monitoring analytics capabilities. The second is on how much data is enough- the experience with what to collect and how to archive it and how to decide what to keep. The third one is inside and outside the box- or why aggregate data from the facility and the HPC system. It's really looking into how system like that might help facility to make decisions. Finally, the fourth one is on improvements made with the cooling system. This is a classical engineering analysis that highly benefited from operational data analytics.

Liquid Cooled Rack Specification

Dale Sartor, LBNL, presented. The Liquid Cooled Rack Specification Team was kicked off this year. There have been a couple of dozen participants in each meeting. We have a draft of a very preliminary specification that we're working on and we received a whole lot of comments. So that kind of indicates that we have our work cut out to work through that document and improve it over the next few months.

Systems Sub-group Update: Jim Laros, Sandia National Laboratory and John Shalf, Lawrence Berkeley National Laboratory

Energy and Power Aware Job Scheduling and Resource Management

Greg Koenig, KPMG, presented. Over a year or two period of time, this team had conducted a global survey of energy and power aware job scheduling and resource management techniques that are being carried out in supercomputing centers around the world. We had written a couple of papers that had gotten some traction in 2018 at both the High Performance Power Aware Computing (HPPAC) workshop and the Data Center Automation Analytics and Control (DAAC) Workshop that was part of SC18. As part of DAAC, we were selected as one of the papers that was invited to contribute a 12-page version of our paper to a special issue of the journal Cluster Computing that is focused on data center automation and analytics. We are currently working toward getting that 12-page version of our paper put together. It is due on March 7th.

So beyond that the team has been looking for what its next mission in life will be. We have been looking at the Power Stack effort, most prominently the policies that sit on top of the knobs that you can turn with the power stack. We've had a small sub team that has been talking about where we might take some sort of work on policies. It's not clear right now whether that work would happen in the context of the energy and power aware job scheduling and resource management team. I don't really see any reason why it couldn't, but it's not clear how that team will be shaped.

Procurement Considerations

Jason Hick, LANL, presented. The Procurement Considerations Team has been updating the Energy Efficient Procurement Considerations document that is posted on the EE HPC WG website. It was originated in 2013 with updates in 2014 and last year in 2017. We have reviewed a significant number of recent HPC procurements to help us with updating the document. That included kind of refining a lot of the requirements or adding new requirements to the document. Our immediate focus has been on restructuring the format of the document prior to finalizing revised or new requirements. We are hoping that this improves the document readability.

We have done this by organizing a small sub team. There are four of us that edit the document and produce drafts and then we have a review by the broader procurement team to get their expertise in fine-tuning what we've done as a small sub team. After we have approval from the large team on the format, we will work on the requirements. We have been spending some time with updating the liquid cooling section and would like to address the facility integration section.

Power API

Siddhartha Jana, Intel, presented. In November, the original Sandia NL Power API team was named a recipient of the R&D 100 Award winner and also received a special recognition.

There haven't been significant updates with the Power API over the past month. Generally, however, the Power API strives to come up with a portable APIs that enables multiple layers of the HPC software stack to interoperate with each other and for ease of deployment. It helps reduce cost because you do not have to implement different set of function calls for doing the same work when it comes to controlling and monitoring control knobs on the hardware and on the platform.

The specification and related documents for the PowerAPI are on-line. There are efforts underway to implement different plug-ins for the API specification to target different platforms and different layers of the software stack. More are welcome. You can clone the latest version of the source code and then add your contributions to it. There is a reference implementation, which is a community-wide effort with multiple stakeholders.

Current activities include soliciting feedback and recommendations. There are they are in the midst of collaborating with the HPC Power Stack Initiative. The goal there is really to be synergists that drive lessons learned From the HPC power stack into the specification to fine-tune the function called designs and the execution model next steps. Of course, the goal will be

to try to improve the specification to incorporate more HPC actors that play a role in the software stack. Help is needed and solicited.

System-level Benchmark Power Measurement Methodology

Torsten Wilde, HPE, presented. Not much has happened in the team recently, but we did make a submission for a Birds of a Feather for ISC2019 which is a International Supercomputing Conference to be held in Frankfurt, Germany.

PARTICIPANTS INCLUDED

Name	Organization
Natalie Bates	EE HPC WG
Siddhartha Jana	Intel
Torsten Wilde	HPE
Parks Fields	New Mexico Consortium
Dale Sartor	LBNL
Matthias Maiterth	LMU and Intel
Greg Koenig	KPMG
Brandon Hong	LLNL
Ashley Avallone	Sandia NL
Grant Stewart	LANL
Michael Ellsworth	IBM
Chris DePrater	LLNL
Jason Hick	LANL
Mike Stevell	LANL
Xingfu Wu	Argonne NL
Beth Kaspar	LANL