

Editorial for the fifth international conference on energy-aware high performance computing

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Tianhe-2 (MilkyWay-2)—installed at the National Super Computer Center in Guangzhou—ranks first in the November 2013s TOP500 list and achieves an impressive peak performance of 33.86 Petaflops on the Linpack benchmark using 3,120,000 cores. However, such an amount of performance comes with a price: the power input of about 17.8 MW would result in an annual electricity bill of more than 17 million Euros based on German price levels. At the same time, the U.S. Department of Energy publishes roadmaps in its Exascale Computing Initiative and puts 20 MW as a “practical power limit” for a future Exaflop computer by the end of this decade. Thus, we are more than a factor of 25 away from our performance goal but today’s technology already uses almost the entire acceptable power.

This situation calls for an intensified research in the field of energy efficiency technology, also called Green IT which has found its way into High Performance Computing. Only a few years ago, the community considered HPC as the Formula 1 of computing and ignored the fact of dramatically rising operational costs. However, as with these race cars,

we conceived means to reduce power consumption and at the same time increase the speed. HPC is also beginning to learn from the field of embedded systems where battery-powered hardware requires special mechanisms to reduce power consumption during phases of low performance demand.

In 2010 we started the EnA-HPC conference series in order to bring researchers, vendors, and HPC center administrators together. Its purpose is to foster discussions regarding the status and future of energy awareness in high performance computing.

Fields of interest cover all abstraction layers, from the lowest level of hardware technology, via operating system, compiler and application issues to facility technologies like air conditioning, sensor technology and heat reuse. A comprehensive effort at all these levels is necessary to yield the overall energy reduction required to enable Exaflop computers to be operational by the end of this decade—as predicted by the TOP500 list.

The articles of this fifth edition of our conference on Energy-Aware High Performance Computing cover several of the abstraction levels mentioned above and thus represent world-wide research efforts in high performance computing: energy efficiency measurements, hardware evaluation, application analysis, and energy-aware algorithm design. This variety guarantees a good coverage of crucial research questions. The ideas presented will trigger inspiring discussion during the event. We hope to contribute to a successful cooperation between vendors and users of HPC equipment and foster more research in the field of green HPC.

The organizers express their gratitude to all contributors to this journal. Their research efforts will render High Performance Computing economically and ecologically sustainable. We thank the program committee members as well as all reviewers for their efforts in selecting an attractive content for this journal and for the conference.

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