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L-CSC Emerges as the Most Energy-Efficient Supercomputer in the World

New Orleans, LA, USA; November 20, 2014 -- A new supercomputer, L-CSC from the GSI Helmholtz Center, emerged as the most energy-efficient (or greenest) supercomputer in the world, according to the 16th edition of the twice-yearly Green500 list. The L-CSC cluster was the first and only supercomputer on the list to surpass 5 gigaflops/watt (billions of operations per second per watt). Like so many of the most energy-efficient supercomputers in the world over the past few years, L-CSC is a heterogeneous supercomputer that is powered by GPU accelerators, namely AMD FirePro? S9150 GPUs. It marks the first time that a supercomputer using AMD GPUs has held the top spot.

In fact, the top three slots of the Green500 were powered by three different accelerators with number one, L-CSC, being powered by AMD FirePro? S9150 GPUs; number two, Suiren, powered by PEZY-SC many-core accelerators; and number three, TSUBAME-KFC, powered by NVIDIA K20x GPUs. Beyond these top three, the next 20 supercomputers were also accelerator-based.

L-CSC achieved the first position on the November 2014 Green500 List with an impressive 5.27 gigaflops per watt. This system used Intel Ivy Bridge CPUs, AMD FirePro GPUs, and an energy-efficient software design to achieve this feat. TSUBAME-KFC, which was number one over the previous two editions of the Green500, came in third in this edition of the Green500. TSUBAME-KFC was the first supercomputer to have broken the 4 gigaflops/watt barrier. Finally, Suiren, a supercomputer from the High Energy Accelerator Research Organization/KEK in Japan, occupied the second spot between L-CSC and TSUBAME-KFC at 4.95 gigaflops per watt. Like L-CSC and TSUBAME-KFC, Suiren used Intel Ivy Bridge CPUs, but coupled them with many-core accelerators from PEZY-SC. These many-core accelerators consist of 1,024 independent processor cores.

Assuming that L-CSC's energy efficiency could be scaled linearly to an exaflop supercomputing system, one that can perform one trillion floating-point operations per second, such a system would consume on the order of 190 megawatts (MW). Although this 190-megawatt power

envelope is still far from DARPA's optimistic target of a 67-megawatt power envelope, it is approximately 16 times better than the initial projection of a nearly 3000-megawatt power envelope from 2007 when the first official Green500 list was launched," says Wu Feng of the Green500.

About the Green500:

The Green500 has provided a ranking of the most energy-efficient supercomputers in the world since November 2007. For decades, the notion of supercomputer "performance" has been synonymous with "speed." This particular focus has led to the emergence of supercomputers that consume egregious amounts of electrical power and produce so much heat that extravagant cooling facilities must be constructed to ensure proper operation. In addition, when there is an emphasis on speed as the ultimate metric, it often comes at the expense of other performance metrics, such as energy efficiency, reliability, availability, and usability. As a result, there has been an extraordinary increase in the total cost of ownership (TCO) of a supercomputer. Consequently, the Green500 seeks to raise the awareness in energy efficiency of supercomputing and to drive it as a first-order design constraint on par with speed.

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