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The Green500 List - November 2012

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Heterogeneous Systems Re-Claim Green500 List Dominance

SALT LAKE CITY, UT - November 14, 2012 - The latest Green500 List was released today (<http://www.green500.org/lists/green201211>) and the top spots on the list have been taken over by machines that combine commodity processors with coprocessors or graphics processing units (GPUs) to form heterogeneous high-performance computing systems.

With all eyes on the new TOP500 number one system, Oak Ridge National Labs' Titan, it was a system belonging to a neighbor at the University of Tennessee that debuted at the top of the November Green500 List. The National Institute for Computational Sciences' Beacon system has set the new energy efficiency bar at nearly two-and-a-half billion floating-point operations per second (gigaflops) per watt. Employing Intel's Sandy Bridge series of Xeon central processing units (CPUs) and four of Intel's Xeon Phi coprocessors per node Beacon achieved a peak 112,200 gigaflops of performance running the LINPACK benchmark while consuming only 44.89 kW of power.

The Intel Xeon Phi--"Knights Corner"-- is a 22nm multicore coprocessor featuring the world's first 3D Tri-Gate transistors. Like its GPU counterparts, the Intel Xeon Phi resides on a PCI Express board that plugs into a machine's expansion slots.

Rounding out the top five systems are three other machines using GPU accelerators combined with traditional AMD or Intel CPUs. "Metaphorically, think of CPU-GPU systems operating like the human brain, where the CPU could be viewed as the left brain and the GPU as the right brain," says Dr. Wu Feng, founder of the Green500 List. "Each side of the brain is suited to process different types of tasks." In second place is the SANAM system from the King Abdulaziz City for Science and Technology, an Intel CPU system that uses AMD's new FirePro S10000 GPU accelerators, and in third and fourth are the Titan and Todi systems by Cray that employ AMD Opteron CPUs and nVIDIA Tesla K20 GPU accelerators. In number five is the previous Green500 List number one system, IBM's Blue Gene/Q that uses PowerPC BQC CPUs. All of these systems are over two gigaflops per watt.

Overall, the performance of machines in the Green500 List has increased at a higher rate compared to power consumption. "That's why the machines' efficiencies are going up," says Feng. "We are more performance for the same amount of power." For machines based on commodity components--machines built with off-the-shelf components-- coprocessors and GPUs are attributing a great deal to the efficiency gains. So much so that they are keeping pace and in the latest list even outpacing purpose built systems like IBM's Blue Gene/Q. "Power consumption is still going up," says Wu, and that is still a concern.

The Green500 List has provided a ranking of the most energy-efficient supercomputers in the world since November 2007. For decades, the notion of "performance" has been synonymous with "speed" as measured in FLOPS. 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, the emphasis on speed as the ultimate metric has caused other metrics such as reliability, availability, and usability to be largely ignored. As a result, there has been an extraordinary increase in the total cost of ownership (TCO) of a supercomputer.

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