

## **Growing Greenness in the Grassroots Green500**

June 30, 2011 – The latest release of The Green500 List points to a rapidly increasing pace of greenness on the Green500 List. Of the ten greenest supercomputers in the world, two trends towards greener supercomputing have emerged: (1) aggregating many low-power processors a la IBM BlueGene/Q and the K Computer by Fujitsu at the RIKEN Advanced Institute for Computational Science and (2) using energy-efficient accelerators, typically from the gaming/graphics market, e.g., AMD Radeon GPU, NVIDIA Tesla Fermi GPU, Cell, and Intel Knights Corner, to complement the commodity CPUs from Intel and AMD.

The Green500 has ranked the energy efficiency of the world's 500 fastest supercomputers since its debut in 2007, serving as a complement to the well-known supercomputer industry marker TOP500. Green500 founder Wu Feng notes that “The Green500 seeks to raise awareness in the energy efficiency of supercomputing, and in turn, drive energy efficiency as a first-order design constraint – one that is on par with performance or speed.” To measure this energy efficiency, the Green500 uses a metric defined as ‘millions of floating-point operations per second’ (MFLOPS) divided by ‘watts’ (W) or MFLOPS/W.

### **Aggregating Many Low-Power Processors**

As in the previous edition of the list, an IBM Blue Gene/Q prototype supercomputer tops this edition of the Green500. However, the Blue Gene/Q prototype that tops this list is different from the one that topped the last edition of the list in that it delivers significantly better performance but with the same number of processor cores and only a marginal increase in power consumption. The end result is a 2097 MFLOPS/W rating, the first supercomputer to surpass the 2000 MFLOPS/W bar. The fastest supercomputer in the world, the K supercomputer from RIKEN in Japan, also aggregates many low-power processors and is one of the greenest supercomputers in the world, coming in at #6 on the Green500.

### **Using Energy-Efficient Accelerators to Complement Commodity Processors (CPUs)**

The greenest accelerator-based supercomputer in the world is the DEGIMA Cluster, a self-built supercomputer from Nagasaki University in Japan. The DEGIMA Cluster is accelerated by AMD/ATI Radeon graphics processing units (GPUs) on a thrifty supercomputing budget of NZ\$600,000 or approximately US\$500,000. Six other accelerator-based machines round out the ten greenest

supercomputers in the world – three with GPU accelerators (one more from AMD/ATI and two from NVIDIA) and three with Cell-based accelerators from IBM.

“Over the past six months, the average efficiency of measured systems on the Green500 has increased from 230 MFLOPS/W to 256 MFLOPS/W, an improvement of 11%,” Feng said. The improvement in efficiency of accelerator-based systems on the Green500 has been even more dramatic, improving 23% from 573 MFLOPS/W to 707 MFLOPS/W. 70% of the 20 greenest supercomputers are now accelerator-based.”

### **The Green500**

In addition to IBM Blue Gene/Q claiming the title of “Greenest Supercomputer in the World” for this edition of the Green500, the Green500 recognizes the DEGIMA Cluster from Nagasaki University in Japan as the “Greenest Self-Built Supercomputer in the World” and TSUBAME2.0 from the Tokyo Institute of Technology as the “Greenest Production Supercomputer in the World.”

The Green500 List is released twice a year, in June and in November. For additional information, please visit <http://www.green500.org/>.