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Top Two Slots on Newest TOP500 List of Supercomputers Unchanged, but New Systems in Germany, Saudi Arabia are Shaking Things Up

HAMBURG, Germany—The 33rd edition of the TOP500 list of the world's most powerful supercomputers is still led by Roadrunner and Jaguar, but shows that two of the top 10 positions are now claimed by new systems in Germany. The latest listing, to be announced Tuesday, June 23, at the 2009 International Supercomputing Conference, also includes a brand-new player, an IBM BlueGene/P system at the King Abdullah University of Science and Technology (KAUST) in Saudi Arabia, ranked at No. 14.

The closely watched TOP500 list, issued twice a year, both confers bragging rights on research institutions and manufacturers and serves as a valuable tool for tracking trends in supercomputer performance and architectures. The latest list reflects changes from November 2008 to June 2009.

Holding onto the No. 1 spot with 1.105 petaflop/s (quadrillions of floating point operations per second) is the Roadrunner system at DOE's Los Alamos National Laboratory (LANL) which was built by IBM and in June 2008 became the first system ever to break the petaflop/s Linpack barrier. It still is one of the most energy efficient systems on the TOP500.

Maintaining its hold on second place is the Cray XT5 Jaguar system installed at the DOE's Oak Ridge National Laboratory. Jaguar reached 1.059 petaflop/s shortly after its installation but due to its heavy workload no further measurements were possible.

But in third place, a new contender has emerged-- a new IBM BlueGene/P system called JUGENE and installed at the Forschungszentrum Juelich (FZJ) in Germany. It achieved 825.5 teraflop/s (trillions of floating point operations per second) on the Linpack benchmarks and has a theoretical peak performance of just above 1 petaflop/s. FZJ is also home to the new No. 10 system. Called JUROPA, it is built from Bull Novascale and Sun SunBlade x6048 servers and achieved 274.8 Tflop/s.

The two systems in Germany are the only non-U.S.-based systems in the latest TOP10 list. There are only two other new entries in the TOP10. At No. 6 is a new Cray XT5 system called Kraken and installed at the National Institute for Computational Sciences at the University of Tennessee with a Linpack performance of 463.3 Tflop/s, making it the most powerful university-based system. The other new entry, at No. 9 with 415.7 Tflop/s, is a new IBM BlueGene/P system called Dawn installed at DOE's Lawrence Livermore National Laboratory.

Another notable system is the Chinese-built Dawning 5000A at the Shanghai Supercomputer Center at No 15. It is the largest system which can be operated with the Windows HPC 2008 operating system.

The U.S. is clearly the leading consumer of HPC systems with 291 of the 500 systems (unchanged from 291). The European share (145 systems – down from 151) is settling down after having risen for some time, but is still substantially larger than the Asian share (49 systems – up from 47).

Energy Efficiency and Other Trends

As energy efficiency becomes a more critical issue for supercomputing centers, the TOP500 list now provides data on energy use, expressed as the number of megaflop/s per watt. While the most energy efficient supercomputers are based on IBM QS22 Cell processor blades (up to 536 Mflop/watt), A

GRAPE-DR custom accelerator system (429 Mflop/watt) and IBM BlueGene/P systems (up to 372 Mflop/watt), the Intel quad-core blades are catching up fast, with the Nehalem-based system achieving up to 273 Mflops/watt and Harpertown-based systems up to 265 Mflop/watt.

While the average power consumption of a TOP10 system is 2.45 megawatts and is unchanged from six months ago, average power efficiency is 280 Mflops/watt –up from 228 Mflops/watt over the same period. Average power consumption of a TOP500 system is 386 kilowatts and average power efficiency is 150 Mflops/watt.

Here are other trends and highlights from the 33rd TOP500 List:

- Hewlett-Packard kept a narrow lead in market share by total systems from IBM, but IBM still stays ahead by overall installed performance.
- Cray's XT system series is very popular for big customers 10 systems in the TOP50 (20 percent).
- Quad-core processor-based systems have taken over the TOP500 quite rapidly and are found in 383 systems. 102 systems are using dual-core processors, and only four systems still use single core processors. Already four systems use IBMs advanced Sony PlayStation 3 processor with 9 cores and two systems at Cray are using the new six-core Shanghai AMD Opteron processors. The Linpack benchmark can utilize multi-core processors very well, which led to performance levels increasing above average across the whole list.
- The entry level to the list moved up to the 17.1 Tflop/s mark on the Linpack benchmark, compared to 12.64 Tflop/s six months ago.
- The last system on the newest list would have been listed at position 274 in the previous TOP500 just six months ago. This turnover rate is gain just above average after the TOP500 recorded the highest turnover in its history one year ago.
- Total combined performance of all 500 systems has grown to 22.6 Pflop/s, compared to 16.95 Pflop/s six months ago and 11.7 Pflop/s one year ago.
- A total of 399 systems (79.8 percent) are now using Intel processors. This is slightly up from six months ago (379 systems, 75.8 percent). Intel continues to provide the processors for the largest share of TOP500 systems.
- The IBM Power processors are the second most commonly used processor family with 55 systems (11 percent), down from 60.
- They are followed by the AMD Opteron family with 43 systems (8.6 percent), down from 59.

The TOP500 list is compiled by Hans Meuer of the University of Mannheim, Germany; Erich Strohmaier and Horst Simon of NERSC/Lawrence Berkeley National Laboratory; and Jack Dongarra of the University of Tennessee, Knoxville.

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