Contact: Erich Strohmaier, EStrohmaier@lbl.gov, 510-495-2517

China Grabs Supercomputing Leadership Spot in Latest Ranking of World's Top 500 Supercomputers

MANNHEIM, Germany; BERKELEY, Calif.; and KNOXVILLE, Tenn.—The 36th edition of the closely watched TOP500 list of the world's most powerful supercomputers confirms the rumored takeover of the top spot by the Chinese Tianhe-1A system at the National Supercomputer Center in Tianjin, achieving a performance level of 2.57 petaflop/s (quadrillions of calculations per second).

News of the Chinese system's performance emerged in late October. As a result, the former number one system — the Cray XT5 "Jaguar" system at the U.S. Department of Energy's (DOE) Oak Ridge Leadership Computing Facility in Tennessee — is now ranked in second place. Jaguar achieved 1.75 petaflop/s running Linpack, the TOP500 benchmark application.

Third place is now held by a Chinese system called Nebulae, which was also knocked down one spot from the June 2010 TOP500 list with the appearance of Tianhe-1A. Located at the National Supercomputing Centre in Shenzhen, Nebulae performed at 1.27 petaflop/s.

Tsubame 2.0 at the Tokyo Institute of Technology is number four; having achieved a performance of 1.19 petaflop/s. Tsubame is the only Japanese machine in the TOP10.

At number five is Hopper, a Cray XE6 system at DOE's National Energy Research Scientific Computing (NERSC) Center in California. Hopper just broke the petaflop/s barrier with 1.05 petaflop/s, making it the second most powerful system in the U.S. and only the third U.S. machine to achive petaflop/s performance.

Of the Top 10 systems, seven achieved performance at or above 1 petaflop/s. Five of the systems in the Top 10 are new to the list. Of the Top 10, five are in the United States and the others are in China, Japan, France, and Germany. The most powerful system in Europe is a Bull system at the French CEA (Commissariat à l'énergie atomique et aux énergies alternatives or Atomic and Alternative Energies Commission), ranked at number six.

The full TOP500 list and accompanying analysis will be discussed at a special Nov. 17 session at the SC10 Conference on High Performance Computing, Networking, Storage and Analysis being held Nov. 13-19 in New Orleans, La.

Accelerating Performance

The two Chinese systems and Tsubame 2.0 are all using NVIDIA GPUs (graphics processing units) to accelerate computation. In all, 28 systems on the TOP500 use GPUs as accelerators, with 16 using the Cell processor, ten of them using NVIDIA chips and two using ATI Radeon chips.

China is also accelerating its move into high performance computing and now has 42 systems on the TOP500 list, moving past Japan, France, Germany and the UK to become the number two country behind the U.S.

Geographical Shifts

Although the U.S. remains the leading consumer of HPC systems with 275 of the 500 systems, this number is down from 282 in June 2010. The European share – 124 systems, down from 144 — is still substantially larger than the Asian share (84 systems — up from 57). Dominant countries in Asia are China with 42 systems (up from 24), Japan with 26 systems (up from 18), and India with four systems (down from five).

In Europe, Germany and France caught up with the UK, which dropped from the No. 1 European nation from 38 six months ago to 24 on the newest list. Germany and France passed the UK and now have 26 and 25 systems each, although France is down from 29 and Germany is up 24 systems compared to six months ago.

Other Highlights from the Latest List

- Cray Inc., the U.S. firm which was long synonymous with supercomputing, has regained the number two spot in terms of market share measured in performance, moving ahead of HP, but still trailing IBM. Cray's XT and XE systems remain very popular for big research customers, four of which are in the Top 10.
- HP is still ahead of Cray measured in the number of systems, and both are trailing IBM.
- Intel dominates the high-end processor market, with 79.6 percent (398) of all systems using Intel processors, although this is slightly down from six months ago (406 systems, 81.2 percent).
- Intel is now followed by the AMD Opteron family with 57 systems (11.4 percent), up from 47. The share of IBM Power processors is slowly declining with now 40 systems (8.0 percent), down from 42.
- Quad-core processors are used in 73 percent (365) of the systems, while 19 percent (95 systems) are already using processors with six or more cores.

In Just Six Months

- The entry level to the list moved up to 31.1 teraflop/s (trillions of calculations per second) on the Linpack benchmark, compared to 24.7 Tflop/s six months ago.

- The last-ranked system on the newest list was listed at position 305 in the previous TOP500 just six months ago. This turnover rate is about average after the rather low replacement rate six months ago.
- Total combined performance of all 500 systems has grown to 44.2 Pflop/s, compared to 32.4 Pflop/s six months ago and 27.6 PFlop/s one year ago.

Some Final Notes on Power Consumption

Just as the TOP500 List has emerged as a standardized indicator of performance and architecture trends since it was created 18 years ago, the list now tracks actual power consumption of supercomputers in a consistent fashion. Although power consumption is increasing, the computing efficiency of the systems is also improving. Here are some power consumption notes from the newest list.

- Only 25 systems on the list are confirmed to use more than 1 megawatt (MW) of power.
- IBM's prototype of the new BlueGene/Q system set a new record in power efficiency with a value of 1,680 Mflops/watt, more than twice that of the next best system.
- Average power consumption of a TOP500 system is 447 kilowatts (KW) and average power efficiency is 195 Mflops/watt (up from 150 Mflops/watt one year ago).
- Average power consumption of a TOP10 system is slowly raising with now 3.2 MW (up from 2.89 MW six month ago) and average power efficiency is 268 Mflops/watt, down from 300 Mflops/watt six month ago.

About the TOP500 List

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.