**TOP500 Supercomputers**

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The total computational power of the 500 most powerful computer systems in the world of 1993 through 2008 (In French).

The distribution of computational power by country according to the Top 500 list in November 2008.

The **TOP500** project ranks and details the 500 (non-distributed) most powerful known computer systems in the world. The project was started in 1993 and publishes an updated list of the supercomputers twice a year. The project aims to provide a reliable basis for tracking and detecting trends in high-performance computing and bases rankings on HPL, a portable implementation of the High-Performance LINPACK benchmark for distributed-memory computers.

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

The list is updated twice a year. The first of these updates always coincides with the International Supercomputer Conference in June, the second one is presented in November at the IEEE Super Computer Conference in the USA.

**Project history**

In the early 1990s, a new definition of supercomputer was needed to produce meaningful statistics. After experimenting with metrics based on processor count in 1992, the idea was born at the University of Mannheim to use a detailed listing of installed systems as the basis. Early 1993 Jack Dongarra was convinced to join the project with his Linpack benchmark. A first test version was produced in May 1993, partially based on data available on the Internet, including the following sources:

* Mannheim Supercomputer Statistics 1986-1992
* "List of the World's Most Powerful Computing Sites" maintained by Gunter Ahrendt
* David Kahaner, who had an immense amount of data.

The information from those sources was used for the first two lists. Since June 1993 the TOP500 is produced bi-annually based on site and vendor submissions only.

**The systems ranked #1 since 1993**

* Cray [Jaguar](http://en.wikipedia.org/wiki/Jaguar_(computer)) (since November 2009)
* IBM [Roadrunner](http://en.wikipedia.org/wiki/IBM_Roadrunner) (June 2008 – November 2009)
* IBM [Blue Gene](http://en.wikipedia.org/wiki/Blue_Gene)/L (November 2004 – June 2008)
* NEC [Earth Simulator](http://en.wikipedia.org/wiki/Earth_Simulator) (June 2002 – November 2004)
* IBM [ASCI White](http://en.wikipedia.org/wiki/ASCI_White) (November 2000 – June 2002)
* Intel [ASCI Red](http://en.wikipedia.org/wiki/ASCI_Red) (June 1997 – November 2000)
* Hitachi [CP-PACS](http://en.wikipedia.org/w/index.php?title=CP-PACS&action=edit&redlink=1) (November 1996 – June 1997)
* Hitachi [SR2201](http://en.wikipedia.org/w/index.php?title=SR2201&action=edit&redlink=1) (June 1996 – November 1996)
* Fujitsu [Numerical Wind Tunnel](http://en.wikipedia.org/w/index.php?title=Numerical_Wind_Tunnel&action=edit&redlink=1) (November 1994 – June 1996)
* Intel [Paragon XP/S](http://en.wikipedia.org/wiki/Intel_Paragon)140 (June 1994 – November 1994)
* Fujitsu [Numerical Wind Tunnel](http://en.wikipedia.org/w/index.php?title=Numerical_Wind_Tunnel&action=edit&redlink=1) (November 1993 – June 1994)
* TMC [CM-5](http://en.wikipedia.org/wiki/CM-5) (June 1993 – November 1993)

**List as of November 2009**

The following table gives the Top 10 positions of the 34th TOP500 List released during the SC09 conference, November 16, 2009 in Portland, Oregon.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rank** | **Rmax Rpeak (Tflops)** | **Name** | **Computer Processor cores** | **Maker** | **Site Country, Year** |
| **1** | 1759.00 2331.00 | *Jaguar* | **Cray XT5** 224162 (Opteron) | Cray | Oak Ridge National Laboratory   United States, 2008 |
| **2** | 1042.00 1375.78 | *Roadrunner* | **BladeCenter QS22/LS21** 122400 (Cell/Opteron) | IBM | Los Alamos National Laboratory   United States, 2008 |
| **3** | 831.70 1028.85 | *Kraken* | **Cray XT5** 98928 (Opteron) | Cray | National Institute for Computational Sciences   United States, 2008 |
| **4** | 825.50 1002.70 | *JUGENE* | **Blue Gene/P Solution** 294912 (Power) | IBM | Jülich Research Centre   Germany, 2009 |
| **5** | 563.10 1206.19 | *Tianhe-I* | **NUDT TH-1** 71680 (Xeon), InfiniBand | NUDT | National SuperComputer Center   China, 2009 |
| **6** | 544.30 673.26 | *Pleiades* | **SGI Altix ICE 8200EX** 56320 (Xeon), InfiniBand | SGI | NASA/Ames Research Center   United States, 2008 |
| **7** | 478.20 596.38 | *Blue Gene/L* | **eServer Blue Gene Solution** 212992 (Power) | IBM | Lawrence Livermore National Laboratory   United States, 2007 |
| **8** | 458.61 557.06 | *Intrepid*[4] | **Blue Gene/P Solution** 163840 (Power) | IBM | Argonne National Laboratory   United States, 2007 |
| **9** | 433.20 579.38 | *Ranger* | **Sun Constellation System** 62976 (Opteron), Infiniband | Sun | Texas Advanced Computing Center   United States, 2008 |
| **10** | 423.90 487.74 | *Red Sky* | **Sun Constellation System** 41616 (Xeon), InfiniBand | Sun | Sandia National Laboratories   United States, 2009 |

**Legend**

* **Rank** – Self-explanatory, most powerful computer on top.
* **Rmax** – The highest score measured using the LINPACK benchmark suite. This is the number which is used to rank the computers. Measured in trillions of floating point operations per second, i.e. Teraflops.
* **Rpeak** – This is the theoretical peak performance of the system. Measured in Tflops.
* **Name** – Some supercomputers are unique, at least on its location, and are therefore christened by its owner.
* **Computer** – The computing platform as it is marketed.
* **Processor cores** – The number of active processor cores actively used running Linpack. After this figure is the processor architecture of the cores named. If the interconnect between computing nodes is of interest, it's also included here.
* **Maker** – The manufacturer of the platform and hardware.
* **Site** – The name of the facility operating the supercomputer.
* **Country** – The country in which the computer is situated.
* **Year** – The year the supercomputer went online. Since then the computer might have been upgraded.

**External links**

* [Top500.org](http://www.top500.org/)
* [Netlib](http://www.netlib.org/benchmark/hpl/)
* [An Overview of High Performance Computing and Challenges for the Future](http://www.youtube.com/watch?v=zTIKUxO9kf4) - [Jack Dongarra](http://en.wikipedia.org/wiki/Jack_Dongarra) discusses the TOP500 benchmark, its history and its trends.
* [Green500](http://www.green500.org/) - Top500 supercomputers ranked by energy efficiency.

Retrieved from "<http://en.wikipedia.org/wiki/TOP500>"

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**Largest computers**

Throughout its history, LLNL has been a leader in computers and scientific computing. Even before the Livermore Lab opened its doors, E.O. Lawrence and Edward Teller recognized the importance of computing and the potential of computational simulation. Their purchase of one of the first UNIVAC computers, set the precedent for LLNL’s history of acquiring and exploiting the fastest and most capable supercomputers in the world. A succession of increasingly powerful and fast computers have been used at the Lab over the years:

* 1953 Remington-Rand [UNIVAC](http://en.wikipedia.org/wiki/UNIVAC) 1 (Universal Automatic Computer)
* 1954 [IBM 701](http://en.wikipedia.org/wiki/IBM_701)
* 1956 [IBM 704](http://en.wikipedia.org/wiki/IBM_704)
* 1958 [IBM 709](http://en.wikipedia.org/wiki/IBM_709)
* 1960 IBM 7090
* 1960 Remington-Rand [LARC](http://en.wikipedia.org/wiki/LARC) (Livermore Advanced Research Computer)
* 1961 [IBM 7030](http://en.wikipedia.org/wiki/IBM_7030) (Stretch)
* 1963 [IBM 7094](http://en.wikipedia.org/wiki/IBM_7094)
* 1963 [CDC 1604](http://en.wikipedia.org/wiki/CDC_1604)
* 1963 [CDC 3600](http://en.wikipedia.org/wiki/CDC_3600)
* 1964 [CDC 6600](http://en.wikipedia.org/wiki/CDC_6600)
* 1969 [CDC 7600](http://en.wikipedia.org/wiki/CDC_7600)
* 1974 [CDC STAR 100](http://en.wikipedia.org/w/index.php?title=CDC_STAR_100&action=edit&redlink=1)
* 1978 [Cray-1](http://en.wikipedia.org/wiki/Cray-1)
* 1984 [Cray X-MP](http://en.wikipedia.org/wiki/Cray_X-MP)
* 1985 [Cray-2](http://en.wikipedia.org/wiki/Cray-2)
* 1989 [Cray Y-MP](http://en.wikipedia.org/wiki/Cray_Y-MP)
* 1992 [BBN Butterfly](http://en.wikipedia.org/wiki/BBN_Butterfly)
* 1994 [Meiko CS-2](http://en.wikipedia.org/wiki/Meiko_CS-2)
* 1995 [Cray C90](http://en.wikipedia.org/wiki/Cray_C90)
* 1995 [Cray T3D](http://en.wikipedia.org/wiki/Cray_T3D)
* 1998 [IBM ASCI Blue Pacific](http://en.wikipedia.org/wiki/IBM_ASCI_Blue_Pacific)
* 2000 [IBM ASCI White](http://en.wikipedia.org/wiki/IBM_ASCI_White)
* 2004 Thunder
* 2005 [IBM Blue Gene/L](http://en.wikipedia.org/wiki/IBM_Blue_Gene/L)
* 2005 [ASC Purple](http://en.wikipedia.org/wiki/ASC_Purple)
* 2006 Zeus
* 2006 Rhea
* 2006 Atlas
* 2007 Minos

The November 2007 release of the 30th TOP500 list of the 500 most powerful computer systems in the world, has LLNL’s Blue Gene/L computer in first place for the seventh consecutive time. Five other LLNL computers are in the top 100. However, the November 2008 release of the TOP500 list places the Blue Gene/L supercomputer behind the Pleiades supercomputer in NASA/Ames Research Center, the Jaguar supercomputer in Oak Ridge National Laboratory, and the IBM Roadrunner supercomputer in Los Alamos National Laboratory. Currently, the Blue Gene/L computer can sustain 478.2 trillion operations per second, with a peak of 596.4 trillion operations per second.

On June 22, 2006, researchers at LLNL announced that they had devised a scientific software application that sustained 207.3 trillion operations per second. The record performance was made at LLNL on Blue Gene/L, the world's fastest supercomputer with 131,072 processors. The record was a milestone in the evolution of predictive science, a field in which researchers use supercomputers to answer questions about such subjects as: materials science simulations, global warming, and reactions to natural disasters.

LLNL has a long history of developing computing software and systems. Initially, there was no commercially available software, and computer manufacturers considered it the customer’s responsibility to develop their own. Users of the early computers had to write not only the codes to solve their technical problems, but also the routines to run the machines themselves. Today, LLNL computer scientists focus on creating the highly complex physics models, visualization codes, and other unique applications tailored to specific research requirements. A great deal of software also has been written by LLNL personnel to optimize the operation and management of the computer systems, including operating system extensions such as CHAOS (Linux Clustering) and resource management packages such as SLURM. The Peloton procurements in late 2006 (Atlas and other computers) were the first in which a commercial resource management package, Moab, was used to manage the clusters.