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Special Issue: Supercomputer Developments in China

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Tianhe-2 Scores Sixth World TOP500 Win

China continues to take the world lead in supercomputer development technology, bringing "China Speed" under the global spotlight. At Super Computing Conference 2015 held in Austin, USA on November 17, the TOP500 Organization released the 46th Currently, Tianhe-2 is being applied in the fields of genetic analysis and sequencing, new drug development, meteorology & environment, numerical computations of large aircraft and high-speed train aerodynamics, structural design simulations of automobiles, ships and other large equipment, E-government and Smart City. For example, the Shanghai Institute of Materia Medica of the Chinese Academy of Sciences has carried out Ebola virus-oriented virtual drug screening on Tianhe-2 and screened in one day 4 million molecular compounds of known structures in the world. Tianhe-2 provides effective means for the fast screening of virtual drugs for unknown acute viruses. A cosmic neutrinos numerical simulation team headed by astronomy

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experts at Beijing Normal University have completed on Tianhe-2 high-resolution numerical simulations of cosmic neutrinos and dark matter with 3 trillion particles and revealed the long evolutionary process over the period of approximately 13.7 billion years from 16 million years after the universe expulsion. A joint research team involving Technical University of Munich have edition of the TOP500 List of Most Powerful Supercomputers in the world. Tianhe-2, a supercomputer system developed by China's National University of Defense Technology, topped the TOP500 list for the sixth consecutive time. This is the first supercomputer in the history to win the title six times in a row. It has set a new world record in the supercomputer field.

The TOP500 Organization is an authoritative organization that releases the performance rankings of supercomputers already installed worldwide. Rankings are made based on actually measured system speeds. The TOP500 list is released twice a year, and the top-placed supercomputer represents the highest level of supercomputers in the world.

Tianhe-2 is a major achievement from projects undertaken by National University of Defense Technology funded by China's National Program 863 and Major Special Science and Technology Project on Core Electric Components, High-End General-Purpose Chips and Basic Software Products. Successfully developed in June 2013, Tianhe-2 has a peak computing speed of 55.9 petaflops and an actual computing speed of 33.9 petaflops. It marks a series of innovations and breakthroughs in many fields, including heterogonous architecture, customered high-speed interconnecting networks, new parallel programming model frameworks, and is now the fastest supercomputer in the world.

After Tianhe-2 was put into use at National Supercomputer Center in Guangzhou in 2013, research institutions and users have worked closely and established 6 application service platforms for material science and engineering computing, biological computing and personalized healthcare, digital design and manufacturing of equipment, digital design of energy and related technologies, astronomy, earth sciences and environmental engineering, Smart City & Big Data, and cloud computing. Tianhe-2 has provided high-performance computing and cloud computing services to Customers almost 500 both at home and abroad.

Currently, Tianhe-2 is being applied in the fields of genetic analysis and sequencing, new drug development, meteorology & environment, numerical computations of large aircraft and high-speed train aerodynamics, structural design simulations of automobiles, ships and other large equipment, E-government and Smart City. For example, the Shanghai Institute of Materia Medica of the Chinese Academy of Sciences has carried out Ebola virus-oriented virtual drug screening on Tianhe-2 and screened in one day 4 million molecular compounds of known structures in the world. Tianhe-2 provides effective means for the fast screening of virtual drugs for unknown acute viruses. A cosmic neutrinos numerical simulation team headed by astronomy experts at Beijing Normal University have completed on Tianhe-2 high-resolution numerical simulations of cosmic neutrinos and dark matter with 3 trillion particles and revealed the long evolutionary process over the period of approximately 13.7 billion years from 16 million years after the universe expulsion. A joint research team involving Technical University of Munich have used Tianhe-2 to simulate the propagation of real seismic waves and reestablished the seismic wave propagation process of the 1992 Landers earthquake, offering a new research approach to seismic wave generation mechanisms and earthquake forecasting. Last year, the result was nominated for the Gordon Bell Prize, the highest academic award in the international high-performance computer application field.

In addition, Tianhe-2 has also been equipped with Guangzhou's E-government data management system, cloud storage system and other key business systems. The cloud supercomputer platform established by Tianhe-2 will also play an active role in pushing forward industrial upgrading and transformation in the Pearl River Delta region.

(Source: Science and Technology Daily,
November 18, 2015)

Chinese Supercomputer Legion Makes Historical Breakthroughs

On November 16 (US local time), the latest edition of the TOP500 List of Most Powerful Supercomputers in the world was released during the 46th Super Computing Conference. Sugon, a leading supercomputer company from China, overtook IBM to gain a place in the top 3 of the list with 49 supercomputers featured on the TOP500 list. This marks a historical breakthrough of Chinese companies in the global supercomputer field. In terms of computing speed, "Tianhe-2" retains its top position for the sixth time in a row, breaking the world record of five straight wins previously held by Japan's K Earth Simulator.

In the current edition of the TOP500 list, there are 109 Chinese supercomputers among the top 500, making a historical breakthrough by winning a 21.8% share. Speaking of the rapid increase in Chinese shares of the TOP500 list, Jack Dongarra, a leading compiler of the TOP500 list and professor of computer sciences at the University of Tennessee, Knoxville, pointed out that it is a result of the joint efforts by Sugon, Lenovo and several other Chinese companies. Among them, Sugon contributed most of China's supercomputer systems.

With 49 supercomputer systems on the TOP500 list, Sugon has now overtaken the traditional supercomputer giant IBM, which has 45 supercomputers on the list. This also puts Sugon, which accounts for 9.8% of the total listed supercomputers, just behind HP (31.2%) and Cray (13.8%). Before this, Sugon had topped China's TOP100 List of high-performance computers in terms of percentage for seven times in a row, with 34 supercomputers on that list.

While the remarkable achievement of Sugon is a surprise to many people, it has not come without a reason. Sugon HPCs not only have made solid progress in the domestic market but are also flourishing in overseas markets. Through specially established sales networks and testing centers in Europe and Southeast Asia, Sugon HPCs are now sold in regions as far away as Eastern Europe and Southeast Asia and have also carved out their market in North America. In addition, Sugon HPCs have been used in such diverse fields as Internet Big Data, engineering computer, industrial simulation, meteorology, oceanography, life sciences and petroleum exploration. Deepening into user demand, Sugon HPCs are getting more and more orders.

The latest edition of the TOP500 list represents an impressive collective showing of Sugon and other Chinese companies. In a sense, it also reflects the urgent demand of economic development for computing power in China.

(Source: Science and Technology Daily, November 18, 2015)

Sugon Caps China's TOP100 HPC List for Seven Straight Years

At HPC China 2015 held on November 11, the TOP100 List of High-Performance Computers was unveiled. Sugon once again tops the list, contributing 34% of the HPCs on the list. This is the seventh consecutive year for Sugon to claim the title.

The 34 Sugon HPCs on the list have been applied in government, energy, security and other vital national sectors, as well as in the Internet, data centers and other cutting-edge fields of science and technology. The inclusion of 3 Sugon HPCs on the TOP10 list has once again attested to Sugon's leading position in the HPC field. Meanwhile, Sugon is also the company with the largest numbers of new HPC systems and users on China's TOP100 HPC list. What is worth noting is that the prototype system of the "Earth Numerical Simulation Device" which Sugon released in September this year came 7th on the list.

In recent years, Sugon has been the first to put "HPC customization" into practice in China, challenging the problem of "high power consumption but low efficiency" existing in HPC. As a typical example of "customized" high-performance computers, the prototype system of the "Earth Numerical Simulation Device" performs far better than general-purpose computers in terms of improving efficiency and reducing power consumption. Its

performance and stability have won full recognition from users.

How to reduce power consumption while ensuring performance improvement is a major challenge facing the world high-performance computing industry. In a quest for "greener" high-performance computer rooms, liquid cooling technology has become a key field of competition for various high-performance computing enterprises. The TC4600E-LP liquid-cooled server, China's first mass-producible server which powers the prototype system of Sugon's "Earth Numerical Simulation Device" and has attracted much attention both at home and abroad, has once again become a highlight on this year's China HPC TOP10.

With the fast development of its HPC industry in recent years, China is now well on a par with developed countries in terms of hardware level. But, the country is still slow in developing HPC applications. How to popularize supercomputer applications will be the key to improving supercomputers in China and turning high-performance computing into social and economic value. In the future, HPC competitions will no longer be merely based on "size". "Application and service" will become more important. This will be a new criterion for measuring the comprehensive strength of a country and a company in the HPC field.

It is understood that Sugon will mainly start its HPC transformation applications and services from three aspects. Firstly, the company will develop dedicated as well as customized machines for high-performance computing. As demand for high-performance computing rises fast in meteorological, biological, energy, financial and Internet industries, there has also been a development trend from general-purpose computers to integrated customized application computers. The development of high-performance computers is entering a new normal. Secondly, Sugon will deepen the one-stop delivery of its high-performance computers. By pre-configuring testing and optimization, the company has reduced both the difficulty and risks of high-performance computer deployment to help users to shorten the time of pre-production to application. After a high-performance computer is delivered to the user site, it can enter a trial run state or even direct use after equipment connection and wiring. This can greatly improve application efficiency. Thirdly, Sugon will energetically develop and promote EasyOP, an online operation and maintenance platform. It will provide customers with HPC 7×24 asset lifecycle management services. The high-performance computing business involved is no longer merely products. Rather, it includes services at all levels of high-performance computing.

(Source: Science and Technology Daily, November 18, 2015)

INSPUR Releases Deep Learning Speech Recognition Acceleration Solution along with iFLYTEK and Altera

At Supercomputing Conference 2015 (SC15) held on November 17, in collaboration with the world's programmable logic chip giant Altera and China's largest intelligent speech technology provider iFLYTEK, unveiled a deep learning DNN speech recognition solution. Based on the AlteraArria 10 FPGA platform and targeting at deep learning, the solution features parallel design and optimization adopting the OpenCL development language. Meanwhile, the release also symbolizes that Inspur has become a world-leading HPC system vendor which possesses the heterogeneous computing application capacities of three types of HPCs, namely GPU, MIC and FPGA.

FPGA (Field — Programmable Gate Array) falls between dedicated chips, with programmability to a certain extent. It can concurrently carry out parallel data and task computing and thus offer greater efficiency in the processing of special applications. More importantly, FPGA also has a clear advantage in terms of performance/power consumption ratio, which is more than 10 times higher than that of CPUs and 3 times higher than that of GPUs. In addition, customizability is also an important

feature of FPGA.

iFLYTEK has the largest speech recognition system in China, which can achieve an accuracy rate of 98% in common scenarios and takes a commanding lead in the industry. To further improve the efficiency and performance of DNN algorithms, iFLYTEK plans to launch an FPGA platform in speech recognition businesses. If the performance meets the requirements, the company will build a FPGA speech recognition system with up to 10,000 users. Yu Zhenhua, Technology Director at iFLYTEK, said that software algorithms of the deep learning model need continuous minor adjustment and optimization and with the elapse of time, the efficiency of server accelerators with fixed functions will keep on falling and result in a waste of space and power. By comparison, FPGA allows more flexible customization but with less power consumption. This is also an important reason for iFLYTEK to migrate from DNN algorithms to the FPGA platform.

This has given birth to a collaboration project among Inspur, iFLYTEK and Altera. With Altera providing the Altera Arria 10 FPGA platform and iFLYTEK a DNN recognition algorithm, Inspur is responsible for completing the parallel design, migration and optimization of the DNN based on the FPGA platform and adopting OpenCL. Through joint efforts, the three sides eventually developed an OpenCL-based FPGA online speech recognition acceleration solution for deep learning.

Through the collaboration, the three companies have completed feasibility studies on FPGA-based HPC new heterogeneous acceleration models and technology. In the actual verification of DNN applications in deep learning, the solution is found to improve performance and save power consumption. It proves OpenCL's easy programmability.

(Source: Science and Technology Daily, November 18, 2015)

Chinese Supercomputer to Aid "Skyeye" to Explore Edges of Universe

As a leading high-performance computer company in China, Sugon will build "Skyeye 1", a supercomputer capable of a quadrillion computing operations per second, at Qiannan Supercomputing Center in southwest China's Guizhou province. The supercomputer will support China's ongoing single-aperture radio telescope, the largest in the world when completed, to detect information 10 billion light years away.

As one of China's nine major science and technology infrastructure facilities, the super telescope—Five hundred meters Aperture Spherical Radio Telescope("FAST"), also known as China's "Skyeye", has a single aperture of 500m and a receiving area as large as 30 soccer pitches. Expected to be completed between 2011 and 2016, FAST will extend China's space exploration power from the synchronous orbit of the moon to the outer edges of the solar system. This implies that FAST may well capture radio signals 10 billion light years away.

Given that FAST's massive data storage and processing both require the support of a powerful super computing system, the Institute of Computing Technology of the Chinese Academy of Sciences, the Skyeye Group and Sugon signed an agreement on strategic cooperation to co-build Qiannan Supercomputing Center, a supporting facility of the FAST Project, in an attempt to beef up the construction of the project.

Among FAST's important scientific objectives, the "pulsar surveys" and the "neutral hydrogen spectral line surveys" all demand "astronomical" data storage and high-efficiency precision computing. According to Zhang Peiheng, Director of High-Performance Computing Research Center at the Institute of Computing Technology of the Chinese Academy of Sciences, FAST's daily peak computing demand will be above 200 teraflops per second and its storage demand will be more than 10 petabyte when FAST is completed.

In the face of FAST's future data demand, "Skyeye 1" will have a computing capacity of over 1,000 teraflops per

second. This supercomputer will be supported by advanced distributed data storage technology and equipped with a 100Gb/s high-speed network. This means that Skyeye 1 will not only fully meet the needs of the project and but also possess the features of low power consumption, low cost, high density and fast delivery and provide the necessary facility for the high-speed transmission and analysis of massive data.

(Source: Science and Technology Daily, July 29, 2015)

Sugon Starts to Develop "100 Petaflops" Supercomputer Sugon 7000

Following the success of its 1 petaflops supercomputer Nebula, Sugon has now started working to develop Sugon 7000, a 100 petaflops supercomputer.

The Sugon 7000 is a new-generation supercomputer system designed by Sugon to meet future market demand. Independent technology will be adopted for the processors, high-speed communication network, large-scale storage system, system software and application software of the Sugon 7000 to ensure security control. The Sugon 7000 is not a general-porpoise computer. Rather, it is a mainframe tailored for certain applications. To thoroughly understand these applications, great difficulties must be overcome and a long time will be taken. As a leading high-performance computer company in China, Sugon has long attached great importance to the application of high-performance computers and is gradually transforming itself into a cloud computing service provider. After the transformation, Sugon will become an "information+data management" service provider and form an application ecosystem through its partners and establish a nationwide informatization and Big Data management service network. So far, Sugon has established pilot cloud computing centers in 10 cities across China, including Wuxi, Shenzhen and Chongqing. The initial results show that the pilot centers have greatly improved the cities' management capacities and played an important role in their everyday management.

(Source: Science and Technology Daily, July 13, 2015)