

Tianhe-2: Notes for UPSC Science and Technology

Tianhe-2 or TH-2 is a 33.86-petaflop supercomputer located in the National Supercomputer Center in Guangzhou. It was developed by a team of 1,300 scientists and engineers.

Tianhe-2 is likely to be a current affairs topic in the science and technology section of the UPSC Exam.

Overview of Tianhe-2

According to leading publications Tianhe-2 was the world's fastest supercomputer according From June 2013 to November 2015. The record was surpassed by another supercomputer in June 2016 by the Sunway Taihuight. There were plans by the Sun Yat-sen University to double Tianhe-2's computing capacity but a U.S Economic sanction put an end to it.

The brief specifications of the supercomputer are given in the table below:

Specifications of Tianhe-2	
Architecture	32,000 Intel Xeon E5-2692 12C with 2.200 GHz 48,000 Xeon Phi 31S1P
Power	17.6 MW (24 MW with cooling)
Memory	1,375 TiB (1,000 TiB CPU and 375 TiB
Speed	33.86 PFLOPS
Cost	2.4 billion Yuan (US\$390 million)

History of Tianhe-2

The development of Tianhe -2 was initiated by the Chinese government collaborating with the government of Guangdong province Guangzhou city. It was built by China's National University of Defense Technology in a joint-effort with a Chinese IT firm Inspur. Inspur constructed the printed circuit boards, installed and tested the system software.

The development of Tianhe-2 was sponsored by the 863 High Technology Program, initiated by the Chinese government, the government of Guangdong province, and the government of

Guangzhou city. It was built by China's National University of Defense Technology (NUDT) in collaboration with the Chinese IT firm Inspur. Inspur manufactured the printed circuit boards and helped with the installation and testing of the system software. The project was originally scheduled for completion in 2015, but was instead declared operational in June 2013. As of June 2013, the supercomputer had yet to become fully operational. It was expected to reach its full computing capabilities by the end of 2013.

In June 2013, Tianhe-2 topped the TOP500 list of fastest supercomputers in the world and was still listed as the fastest machine in the November 2015 list. The computer beat out second-place finisher Titan by nearly a 2-to-1 margin. Titan, which is housed at the U.S. Department of Energy's Oak Ridge National Laboratory, achieved 17.59 petaflops, while Tianhe-2 achieved 33.86 petaflops. Tianhe-2's performance returned the title of the world's fastest supercomputer to China after Tianhe-I's début in November 2010. In June 2013, China housed 66 of the top 500 supercomputers, second only to the United States' 252 systems.

Specifications of Tianhe-2

With 16,000 computer nodes, each comprising two Intel Ivy Bridge Xeon processors and three Xeon Phi coprocessor chips, it represented the world's largest installation of Ivy Bridge and Xeon Phi chips, counting a total of 3,120,000 cores. Each of the 16,000 nodes possessed 88 gigabytes of memory (64 used by the Ivy Bridge processors, and 8 gigabytes for each of the Xeon Phi processors). The total CPU plus coprocessor memory was 1,375 TiB (approximately 1.34 PiB). The system has a 12.4 PiB H2FS file system consisting of IO forwarding nodes providing a 1 TiB/s burst rate backed by a Lustre file system with 100 GiB/s sustained throughput.

During the testing phase, Tianhe-2 was laid out in a non-optimal confined space. When assembled at its final location, the system will have had a theoretical peak performance of 54.9 petaflops. At peak power consumption, the system itself would have drawn 17.6 megawatts of power. Including external cooling, the system drew an aggregate of 24 megawatts. The completed computer complex would have occupied 720 square meters of space.

Despite its advanced tech, the system is still found difficult to use by users unfamiliar with the supercomputer. Tech experts are of the opinion that programmers will take years or decades to write the necessary code.

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