Prometheus from Cyfronet AGH is the 71st supercomputer in the world

Once again the Polish supercomputer Prometheus took a very high position in the list of 500 fastest supercomputers in the world. The most recent edition of TOP500 has been published on June 19th at the ISC'17 conference in Frankfurt, Germany.

Prometheus - the fastest Polish supercomputer

Prometheus, a new supercomputer with its 2.4 Pflops of theoretical performance has been listed at 71st position. This top-efficient supercomputer located in Poland has been built by Hewlett-Packard according to requirements and partial design provided by Cyfronet. To date, Prometheus is one of the biggest installations of this type in the world and also the first one in Europe, based on the latest technology of direct liquid cooling.

Prometheus consists of more than 2,200 servers based on HP Apollo 8000 platform, combined with super-fast InfiniBand network with 56 Gbit/s capacity. Its energy saving and high-performance Intel Haswell latest-generation processors offer more than 53,000 cores. These are accompanied by 279 TB RAM in total, and by two storage file systems of 10 PB total capacity, and 180 GB/s access speed. Prometheus has been also equipped with 144 Nvidia Tesla GPGPUs.

To illustrate Prometheus' speed, one would have to harness the power of more than 50,000 first-class PCs, in their strongest configuration, additionally connected to super-fast network and managed by special software, to catch up with its abilities - says prof. Wiatr, Director of ACC Cyfronet AGH. Thanks to the innovative technology of direct liquid cooling, Prometheus is also one of the most energy-efficient computers in its class in the world. Its PUE factor is comparable with some of the largest data centres in the world, such as Google or Facebook. Furthermore, liquid cooling allows for extremely high installation density, therefore Prometheus, weighing of more than 40 tons, covers 18m² area and is placed on 20 racks only. To achieve the same computing power in case of Zeus (Prometheus' predecessor), it would have to take about 160 racks. Baribal, the predecessor of Zeus, with computing power of 1,5 Tflops was placed on 8 racks. To achieve the computing power of Prometheus it would take as many as 12 000 Baribal's racks - points Cyfronet's Director.

Prometheus has been installed in a high-tech computing room, exclusively adapted for its operation. The supercomputer's proper functioning is additionally supported by the accompanying infrastructure, including such systems as guaranteed power supply with an additional generator, modern air-conditioning and gas extinguishing. Prometheus can serve for:

- data results analysis,
- numerical simulations,
- advanced visualisations provision,
- (big) data processing,
- cloud computing and many other services.

Zeus together with Prometheus

For less demanding computing tasks, supercomputer Zeus still offers its computing power. The heterogeneous architecture of this supercomputer consisting of four dedicated hardware partitions provides 25,468 computing cores and 204 GPGPUs with total theoretical computational power of 374 Tflops. This is accompanied by 60TB of RAM and 2.3PB of disk storage. Zeus is built of over 1,300 individual blade servers, interconnected via high-speed 40Gb/s InfiniBand network.

In total, in 2016 the two most powerful supercomputers in ACK Cyfronet AGH – Zeus and Prometheus, executed 7 748 677 jobs with a total duration of 24 653 years of CPU time.
Scientific calculations from different fields

Access to the Prometheus and Zeus resources is done via the PLGrid infrastructure – Polish nationwide computing infrastructure for scientific research in silico (performed with the help of computers). Dedicated computing environments, so-called domain grids, and specialised IT platforms enable conduction of increasingly complex research problems. The research portfolio carried out with the help of Zeus and, recently, Prometheus is quite rich. It includes: prediction of 3D protein structures, study of semiconductor nanostructures and catalytically activity molecules as well as effective biosensors. Computations are used to study the behaviour of galaxies in a wide range of electromagnetic spectrum, for nuclear magnetic resonance modelling for the purposes of structural analysis of molecular systems, antidots in quantum world, for structural characteristics of human telomeres and complexity of the financial markets. Scientific computations do not include simulations only. Computing power is utilised by Polish scientists also within international projects, including experiments like CTA, LOFAR, EPOS, Large Hadron Collider in CERN and the recently discovered gravitational waves.

Supercomputers enable to significantly reduce time of computations that using a single computer would often take many years (in specific cases more than 150, 700 or even 1000 years). Here they may be usually performed within a few days. Cyfronet users can benefit from professional support tools – starting from full documentation, through training, to individual consultations with experts. Information concerning the use of the Prometheus and Zeus resources by scientists is available on www.cyfronet.krakow.pl. It is worth to register in the PLGrid portal and use many available services.

Supercomputers from Poland on TOP500 list

The June 2017 edition of TOP500 spots also other supercomputers installed in Polish computing centres and research institutes. The full list of Polish supercomputers on TOP500 is as follows:

- 71 – Prometheus, ACC Cyfronet AGH,
- 131 – Hetman, PSNC, Polish Academy od Sciences, Poznan,
- 135 – Tryton, TASK, Technical University Gdańsk,
- 161 – Okeanos, ICM, University of Warsaw,
- 275 – Bem, WCNS, Technical University Wroclaw,
- 490 – ICM, University of Warsaw.

Fastest in the world

For the third time, Sunway TaihuLight – the supercomputer from China – took the first position on TOP500, with more than 125,4 Pflops of computational power (theoretical). The list is dominated by supercomputers from USA (169 units, 34 %) and China (160 units, 32%). The fastest European supercomputer was ranked in 3rd position.