CSCS
Centro Svizzero di Calcolo Scientifico
Swiss National Supercomputing Centre

ETH zürich

FACT SHEET

Piz Daint, the first supercomputer with sustained petaflops-scale performance in Switzerland

The supercomputer "Piz Daint", named after a striking mountain that dominates the Val Müstair, exceeds petaflops sustained performance in scientific production runs. This enables researchers to study more detailed models with higher efficiency and accuracy.

The Cray XC30 supercomputer, in operation at CSCS since April 2013, has gone through a major upgrade. During the month of October 2013, the supercomputer based on Intel® Xeon® E5 processors, has more than doubled in system size from 12 to 28 cabinets and has been upgraded to a hybrid architecture featuring NVIDIA® Tesla® K20X graphical processing units (GPUs). With a total of 5'272 hybrid compute nodes as well as a powerful high-bandwidth, low-latency network, it is now possible for real simulations to sustain petaflops (10^{15} floating point operations per seconds) performance. With a peak performance of 7.79 petaflops, Piz Daint has been listed during the Supercomputing Conference 2013 in Denver, USA, the fastest supercomputer in Europe.

First of its kind

In the extension, one of two conventional processor (CPU) located on a compute node was replaced by a GPU, which stem from the computer game and graphics industry. Compared to a conventional CPU, the GPU has reduced functionalities that are optimized for numerical calculations. In simple terms, this enables the GPU to compute much faster, while saving energy. Furthermore, the new supercomputer gets much of its overall performance and efficiency from a novel interconnecting network between compute nodes that has been by computer manufacturer Cray. It is the first of its kind, and has been designed to help researchers solve more detailed, higher-resolution models – and this all while consuming less power.

CSCS Director Thomas Schulthess is convinced that given the ever growing demands of computer models, energy consumption in supercomputing can only contain with a radical change in computer architecture. The new Piz Daint will enable researchers and scientists to study more detailed, higher-resolution models in less time. The benefit of the new system should go primarily to climate scientists, geoscientists, chemists, as well as materials and nano-scientist with their complex computations, but also to physicists and biologists who run ever more compute-intensive applications at CSCS.

Energy efficiency as important goal

Compared to its predecessor, the Cray XE6 "Monte Rosa", Piz Daint provides up to 20 times more compute performance while using only up to two and half times as much electrical power. Initial tests revealed that a climate simulation on Piz Daint runs over three times faster and reaching the solution with seven times less energy consumed as compared to Monte Rosa, which runs with conventional CPUs. This improvement is possible only thanks to the hybrid architecture.

Piz Daint will be fully integrated into the CSCS user program in April 2014, with the start of the new allocation period.

With the upgrade of Piz Daint, CSCS has successfully implemented the final step of the Swiss High Performance Computing and Networking (HPCN) initiative coordinated by ETH Board. The HPCN-strategy started in 2009 with the goal of providing the Swiss research community with a petaflop-scale supercomputer.

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Piz Daint Specifications

Number of Compute Nodes	5'272
Theoretical Peak Floating-point Performance per node	166.4 Gigaflops (Intel®Xeon® E5-2670); 1'311 Gigaflops (NVIDIA® Tesla® K20X)
Theoretical Peak Performance	7.787 Petaflops
Memory Capacity per node	32 GB (DDR3-1600); 6 GB non-ECC GDDR5
Memory Bandwidth per node	51.2 GB/s DDR3 ; 250.0 GB/s non-ECC GDDR5
Total System Memory	169 TB DDR3; 32 TB non-ECC GDDR5
Interconnect Configuration	Aries routing and communications ASIC, and Dragonfly network topology
Peak Network Bisection Bandwidth	33 TB/s
System Storage Capacity	2.5 PB
Parallel File System Peak Performance	138 GB/s

HPC Systems at CSCS

Name	Supplier / Model	Installation / Upgrade	User	Peak Performance (TFlops)
Piz Daint	Cray XC30	2012 / 2013	User Lab	7'787
Blue Brain 4	IBM BG/Q	2013	EPF Lausanne	839
Monte Rosa	Cray XE6	2009 / 2011	User Lab	402
Tödi	Cray XK7	2011 / 2012	R&D	393
Mönch	Cluster	2013	ETH Zurich	102
Albis / Lema	Cray XE6	2012	MeteoSwiss	50
Phoenix	Cluster	2010 / 2011 / 2012	CHIPP (LHC Grid)	22
Pilatus	Cluster	2012	User Lab	15
Rothorn	SGI UV 1000	2011	User Lab	3
Matterhorn	Cray Urika	2011	User Lab	NA

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