



CSCS

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PRESS RELEASE

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New Hybrid Computer Architecture at CSCS Delivers Promising Results

The Swiss National Supercomputing Center's (CSCS) new Cray XC30 supercomputer from computer manufacturer Cray is making its debut at CSCS in Lugano. Cray and CSCS are collaborating to equip this system with NVIDIA GPUs, and preliminary results show it is performing at up to seven times more energy-efficiency than current systems. CSCS aims to reduce operating costs, and offer scientists new research possibilities.

The supercomputer "Piz Daint", which has been in operation at CSCS since April, is presently being extended with graphic processing units (GPUs). In this extension, one of the two conventional processors (CPU) on a compute node is being replaced by an NVIDIA® Tesla® GPU. Compared to conventional CPUs, the GPUs are optimized for numerical calculations, and deliver significantly higher performance and energy efficiency. Furthermore, the new supercomputer gets much of its overall performance and efficiency from a novel inter-connecting network between compute nodes designed by Cray and successfully tested at CSCS since end of 2012.

The new hybrid system installed at CSCS is worldwide the first of its kind. It was designed to help researchers solve more detailed, higher-resolution models – and this all while consuming less power.

Energy efficiency as important goal

"Given the ever growing demand for computer simulations, we can only contain energy consumption in supercomputing with a radical change in computer architecture," says Prof. Thomas Schulthess, Director of CSCS, with conviction. The benefit of this new system should go primarily to climate scientists, geoscientists, chemists, as well as materials and nano-scientists with their complex computations, but also physicists and biologists who run ever more compute-intensive applications at CSCS.

Initial tests conducted by CSCS that will be presented today at the "International Computing for the Atmospheric Sciences Symposium" (iCAS2013) in Annecy (France), reveal that a climate simulation on "Piz Daint" runs over three times faster. In comparison to the other CSCS' computers, the new system is also consuming up to seven times less energy during the simulations. In all, CSCS researchers compared four supercomputer systems, using full simulations codes from chemistry, materials and nanoscience, as well as regional climate simulations over the alpine region. The tests were first run with the original codes on all four machines, and then with newly implemented codes that had been designed especially for efficiency and to run on CPUs as well as graphic processors.

Borrowed from the game industry

Thomas Schulthess has long seen an opportunity to build energy-efficient, high-performance computing systems with GPU processors, which stem from the computer game and graphics

industry. In the last three years, under the [HP2C](#) Initiative launched within the scope of the national high-performance computing and networking strategy ([HPCN Strategy](#)) in Switzerland, researchers have developed algorithms that run on both CPU and GPU processors. According to Schulthess, the evaluations reveal that both GPU processors and improved algorithms influence energy efficiency and performance. In the meantime, Schulthess collaborated with supercomputer manufacturer Cray to include GPUs in its new generation of computer systems. “Piz Daint” is the result of this effort.

“We are very pleased with the huge performance and energy efficiency potential of the Cray XC30 systems that this collaboration is demonstrating,” said Dr. Ulla Thiel, Cray vice president, Europe. “CSCS is the first customer to order an Intel based Cray XC30 with NVIDIA GPUs, which will transform ‘Piz Daint’ into Switzerland’s first hybrid petascale supercomputing system. CSCS has a long tradition of providing its researchers and scientists with highly innovative, advanced supercomputing technologies, and this is yet another example of its leadership position within the HPC community worldwide.”

“In order to continually reach higher levels of performance to drive scientific discovery, supercomputers will need to minimize energy consumption in every way possible,” said Sumit Gupta, general manager of the Tesla Accelerated Computing Business Unit at NVIDIA. “GPU-accelerated hybrid systems represent the best path forward in this respect, and ‘Piz Daint’ raises the bar for the level of energy-efficient performance that will be expected from next-generation systems.”

The extension of “Piz Daint” will be completed by the end of this year and the machine will then be prepared for users. The real trial will come next spring, when users will be able to use “Piz Daint” for their simulations – either to get faster time to solution or to improve model resolution and fidelity.

Further information:

- HPCN-Strategy
<http://www.ethrat.ch/en/node/2802>
- HP2C-Initiative
http://www.cscs.ch/fileadmin/Documents/media/fact_sheets/20120828_Fact_Sheet_HP2C_English.pdf

Photos:

- http://www.cscs.ch/newsroom/media/photos/piz_daint/index.html

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About CSCS, the Swiss National Supercomputing Center

Founded in 1991, CSCS develops and provides the key supercomputing capabilities required to solve important problems to science and/or society. The center enables world-class research with a scientific user lab that is available to domestic and international researchers through a transparent, peer-reviewed allocation process. CSCS's resources are open to academia, and are available as well to users from industry and the business sector. The center is operated by ETH Zurich and is located in Lugano.